NUTRITION THROUGH LIFE CYCLE

M.Sc., FOODS AND NUTRITIONAL SCIENCE,
Second Year, Paper – I

Specialization-I: Clinical Nutrition and Dietetics

Study Material Prepared by:

R. K. Tiwari

Director
Dr. Sumanth Kumar Kunda
M.F.Sc., Ph.D.
Associate Professor
Department of Zoology and Aquaculture

Centre for Distance Education
Acharya Nagarjuna University
Nagarjuna Nagar - 522 510

Ph: 0863-2293299, 2293356, 08645-211023, Cell:98482 85518
0863-2346259 (Study Material)
Website : www.anucde.ac.in or www.anucde.info
e-mail : info@ anucde.ac.in

Edition : 2020

No. of Copies : 43

Published by

Dr. Sumanth Kumar Kunda
M.F.Sc., Ph.D.
Director
Centre for Distance Education
Acharya Nagarjuna University

Printed at :
M/s.Romith Technologies
Guntur

FOREWORD

Acharya Nagarjuna University, since its establishment in 1976, has been moving ahead in the path of academic excellence, offering a variety of courses and research contributions. The University achieved recognition as one of the eminent universities in the country by gaining A grade from the NAAC 2016. At present Acharya Nagarjuna University is offering educational opportunities at the UG, PG levels to students of 447 affiliated colleges spread over the two districts of Guntur and Prakasam.

The University had started the Centre for Distance Education in 2003-04 with the aim to bring Higher education within the reach of all. The Centre has been extending services to those who cannot join in colleges, cannot afford the exorbitant fees as regular students, and to housewives desirous of pursuing higher studies to study B.A., B.Com, and B.Sc., Courses at the Degree level and M.A., M.Com., M.Sc, M.B.A. and LL.M. courses at the PG level.

For better understanding by students, self-instruction materials have been prepared by eminent and experienced teachers. The lessons have been prepared with care and expertise. However constructive ideas and scholarly suggestions are welcome from students and teachers. Such ideas will be incorporated for the greater efficacy of the distance mode of education. For clarification of doubts and feedback, Weekly classes and contact classes are arranged at UG and PG levels respectively.

I wish the students who pursue higher education through Centre for Distance Education will not only be personally benefited by improving their qualifications but also strive for nation's growth by being a member in Knowledge society I hope that in the years to come, the Centre for Distance Education will grow in strength by introducing new courses, catering to the needs of people. I congratulate all the Directors, Academic coordinators, Editors, Lesson - Writers, and Academic Counsellors and Non-teaching staff of the Centre who have been extending their services in these endeavours.

Prof. Raja Sekhar P.
Vice - Chancellor (FAC)
Acharya Nagarjuna University

SYLLABUS

M.Sc (Course Code-139)

Paper - I: NUTRITION THROUGH LIFE CYCLE

UNIT- I

- Agriculture production, population pressure, food availability, meal pattern, Interrelation of socio-cultural and economic aspects and their impact on Nutritional well being in the individual, family, country and National contexts,

UNIT- II

- Pregnancy: Out come effect on plan of Nutrition of the mother on the factorial growth hazard (physical and mental risks).
- Lactation: Current concepts, composition of colostrums breast milk, growth and development of infants feed on breast milk and trends in breast feeding.
- Infancy: Growth and development of infant existing practices and suitable and method of introducing supplementary foods to bear the child. Weanling diarrhoea, feeding effects etc. Advantages and disadvantages to the mother and child.

UNIT - III

- Pre-school child: Nutritional demands, effects of under Nutrition and infections and dangers of malnutrition on the growth and development of the child. Maintenance and importance of the growth charts, supplementary foods.
- School child: Importance and necessity of school feeding/school lunch programs with special reference to Andhra Pradesh.
- The pre-adolescent and adolescent: Effect of poor Nutrition on the growth support and feature adult hood.

UNIT - IV

- The Middle aged: Psychological effects leading degenerative /Biochemical changes, participating diseases–dietary modifications.

UNIT - V

- Geriatric Nutrition: Changes in body composition, changes in physiological requirements.
- Nutritional needs for Industrial workers, sports Nutrition.

CONTENTS

Units		Page No.
I	: Agriculture Production and Food Security	1
II	: Pregnancy, Lactation and Infancy	113
III	: Pre-School, School and Adolescent Child	161
IV	: The Middle Aged	221
V	: Geriatric Nutrition	242

NOTES

UNIT—I

AGRICULTURE PRODUCTION AND FOOD SECURITY

OBJECTIVES

After going through this unit, students will be able to:

- explain the basic concepts pertaining to the agriculture production and food availability;
- discuss the interrelation between population pressure and per-capita food availability;
- state the socio-cultural and economic aspects of food production and consumption;
- understand the impact of food availability on individual, family and country.

STRUCTURE

1.1 Introduction
1.2 Agriculture Production
1.3 Hunger Hotspots in Asia and the Pacific
1.4 Threats to Sustainable Agriculture
1.5 Population Pressure
– Population and Consumption
– Population: The Demand Side
– Production: The Supply Side
1.6 Food Availability
– Food Accessibility
– World Food Security Situation Today
1.7 Food Insecurity
1.8 Meal Pattern
– Development in the Availability of Dietary Energy
– Availability and Changes in Consumption of Dietary Fat
– Availability and Consumption of Fruits and Vegetables
1.9 Interrelation of Socio-Cultural and Economic Aspects and their Impact on Nutritional Well Being in the Individual, Family and National Contexts
1.10 Summary
1.11 Glossary
1.12 Review Questions
1.13 Further Readings

NOTES

1.1 INTRODUCTION

Agriculture has played a key role in the development of human civilization. Until the Industrial Revolution, the vast majority of the human population laboured in agriculture. Development of agricultural techniques has steadily increased agricultural productivity, and the widespread diffusion of these techniques during a time period is often called an agricultural revolution. A remarkable shift in agricultural practices has occurred over the past century in response to new technologies.

The productivity of a region's agriculture is important for many reasons. Aside from providing more food, increasing the productivity of farms affects the region's prospects for growth and competitiveness on the agricultural market, income distribution and savings, and labour migration. An increase in a region's agricultural productivity implies a more efficient distribution of scarce resources. As farmers adopt new techniques and differences in productivity arise, the more productive farmers benefit from an increase in their welfare while farmers who are not productive enough will exit the market to seek success elsewhere.

Agriculture is fundamental to achieving nutrition goals. It produces the food, energy, and nutrients essential for human health and well-being. Gains in food production have played a key role in feeding growing and malnourished populations. Yet they have not translated into a hunger-free world nor prevented the development of further nutritional challenges. Micronutrient deficiencies (for example, of vitamin A, iron, iodine, and zinc) are now recognized as being even more limiting for human growth, development, health, and productivity than energy deficits. Hunger among the poor also increasingly manifests itself through excessive consumption of energy-rich but nutrient-poor foods. The result is a double burden of undernutrition (deficiencies of energy, micronutrients, or both) and "overnutrition" (poor diet quality leading to obesity and other dietrelated chronic illnesses).

Availability of food largely depends on the agricultural productivity. Food insecurity has been described as "a condition in which people lack basic food intake to provide them with the energy and nutrients for fully productive lives." The stages of food insecurity range from food secure situations to full-scale famine. "Famine and hunger are both rooted in food insecurity. Food insecurity can be categorized as either chronic or transitory. Chronic food insecurity translates into a high degree of vulnerability to famine and hunger; ensuring food security presupposes elimination of that vulnerability. Chronic hunger is not famine. It is similar to undernourishment and is related to poverty, existing mainly in poor countries."

1.2 AGRICULTURE PRODUCTION

NOTES

Agricultural production is the major activity of any part of the world and it consists of two large subsectors, animal production and crop production. Animal production includes establishments that raise livestock, such as beef cattle, poultry, sheep, and hogs; farms that employ animals to produce products, such as dairies, egg farms, and apiaries (bee farms that produce honey); and animal specialty farms, such as horse farms and aquaculture (fish farms). Crop production includes the growing of grains, such as wheat, corn, and barley; field crops, such as cotton and tobacco; vegetables and melons; fruits and nuts; and horticultural specialties, such as flowers and ornamental plants. Of course, many farms have both crops and livestock, such as those that grow their own animal feed, or have diverse enterprises.

The nature of agricultural work varies, depending on the crops grown, animals being raised and the size of the farm. Although much of the work is now highly mechanized, large numbers of people still are needed to plant and harvest some crops on the larger farms. During the planting, growing, and harvesting seasons, farmers and the workers they employ are busy for long hours, plowing, disking, harrowing, seeding, fertilizing, and harvesting. Vegetables generally are still harvested manually by groups of migrant farmworkers, although new machines have been developed to replace manual labour for some fruit crops. Vegetable growers on large farms of approximately 100 acres or more usually practice "monoculture," large-scale cultivation of one crop on each division of land. Fieldwork on large grain farms—consisting of hundreds, sometimes thousands, of acres—often is done using massive tractors controlled by global positioning system (GPS) technology, and other modern agricultural equipment.

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. While individual products are usually measured by weight, their varying densities make measuring overall agricultural output difficult. Therefore, output is usually measured as the market value of final output, which excludes intermediate products. This output value may be compared to many different types of inputs such as labour and land (yield). These are called partial measures of productivity. Agricultural productivity may also be measured by what is termed total factor productivity (TFP). This method of calculating agricultural productivity compares an index of agricultural inputs to an index of outputs. This measure of agricultural productivity was established to remedy the shortcomings of the partial measures of productivity; notably that it is often hard to identify the factors cause them to change. Changes in TFP are usually attributed to technological improvements.

Increases in agricultural productivity lead also to agricultural growth and can help to alleviate poverty in poor and developing countries, where agriculture often employs the greatest portion of the population. As farms become more productive, the wages earned by those who work in agriculture increase. At the same time, food prices decrease and food supplies become more stable. Labourers therefore have more money to spend on food as well as other products. This also leads to agricultural growth. People see that there is a greater opportunity earn their living by farming and are attracted to agriculture either as owners of farms themselves or as labourers.

However, it is not only the people employed in agriculture who benefit from increases in agricultural productivity. Those employed in other sectors also enjoy lower food prices and a more stable food supply. At the same time, they may see their wages rise as well.

Agricultural productivity is becoming increasingly important as the world population continues to grow. India, one of the world's most populous countries, has taken steps in the past decades to increase its land productivity. Forty years ago, North India produced only wheat, but with the advent of the earlier maturing high-yielding wheats and rices, the wheat could be harvested in time to plant rice. This wheat/rice combination is now widely used throughout the Punjab, Haryana, and parts of Uttar Pradesh. The wheat yield of three tons and rice yield of two tons combine for five tons of grain per hectare, helping to feed India's 1.1 billion people.

Agricultural Productivity and Sustainable Development

Increases in agricultural productivity are often linked with questions about sustainability and sustainable development. Changes in agricultural practices necessarily bring changes in demands on resources. This means that as regions implement measures to increase the productivity of their farm land, they must also find ways to ensure that future generations will also have the resources they will need to live and thrive.

Sustainable production practices involve a variety of approaches. Specific strategies must take into account topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals. Despite the site-specific and individual nature of sustainable agriculture, several general principles can be applied to help growers select appropriate management practices:

- Selection of species and varieties that are well suited to the site and to conditions on the farm;
- Diversification of crops (including livestock) and cultural practices to enhance the biological and economic stability of the farm;

NOTES

- Management of the soil to enhance and protect soil quality;
- Efficient and humane use of inputs; and
- Consideration of farmers' goals and lifestyle choices.

Productive Farms

Nevertheless, for many farmers (especially in non-industrial countries) agricultural productivity may mean much more. A productive farm is one that provides most of the resources necessary for the farmer's family to live, such as food, fuel, fiber, healing plants, etc. It is a farm which ensures food security as well as a way to sustain the well-being of a community. This implies that a productive farm is also one which is able to ensure proper management of natural resources, such as biodiversity, soil, water, etc. For most farmers, a productive farm would also produce more goods than required for the community in order to allow trade.

Diversity in agricultural production is one key to productivity, as it enables risk management and preserves potentials for adaptation and change. Monoculture is an example of such a nondiverse production system. In a monocultural system a farmer may produce only crops, but no livestock, or only livestock and no crop.

The benefits of raising livestock, among others, are that it provides multiple goods, such as food, wool, hides, and transportation. It also has an important value in term of social relationships (such as gifts in weddings). In case of famine, when crops are not sufficient to ensure food safety, livestock can be used as food. Livestock may also provide manure, which can be used to fertilize cultivated soils, which increases soil productivity. On the other hand, in an agricultural system based only on raising livestock, food has to be bought to other farmers, and wastes produced cannot be easily disposed of.

Production has many functions, and diversity is the foundation of such production. To ignore the complex functions provided by a farm is thought by many to turn agricultural production into a commodity.

Land Resources

Less than one half of the world's land area is suitable for agriculture, including grazing; total arable (crop) land, in use and potential, is estimated to comprise about *3000 million ha*. However, nearly all of the world's productive land, flat and with water, is already exploited. Most of the unexploited land is either too steep, too wet, too dry, or too cold for agriculture.

There are difficulties in finding new land that could be exploited for agricultural production. Expansion of cropland would have to come at the expense

NOTES

of forest and rangeland, much of which is essential in its present uses. In Asia, for example, nearly 80% of potentially arable land is now under cultivation. In the 1970s, there was a net annual gain in world cropland of nearly 0.7%. The rate of gain has slowed and, in 1990, the net annual gain was about 0.35% yr, largely as a result of deforestation. As much as 70—80% of ongoing deforestation, both tropical and temperate, is associated with the spread of agriculture.

For these reasons we estimate that the world's arable land could be expanded at most by *500 million ha,* or a net expansion of roughly one-third. However the productivity of this new land would be much below present levels in land now being cropped.

At the present time humans either use, coopt or destroy 40% of the estimated 100 billion tons of organic matter produced annually by the terrestrial ecosystem.

Quality and Degradation: The loss of productive soil has occurred as long as crops have been cultivated. Land degradation has now become a major threat to the sustainability of world food supply. This loss arises from soil erosion, salinization, waterlogging, and urbanization with its associated highway and road construction. Nutrient depletion, overcultivation, overgrazing, acidification, and soil compaction contribute as well. Many of these proces es are caused or are aggravated by poor agricultural management practices. Taken together or in various combinations, these factors decrease the productivity of the soil and substantially reduce annual crop yields, and, more important, will reduce crop productivity for the longterm.

Almost all arable land that is currently in crop production, especially marginal land, is highly susceptible to degradation. We estimate that about one quarter of this land should not be in production. This is depressing food production, as well as requiring increased fossil energy inputs of fertilizers, pesticides, and irrigation in an effort to offset degradation.

Soil erosion, a problem throughout the world, is the single most serious cause of degradation of arable land, owing to its adverse effect on crop productivity. The major cause is poor agricultural practices that leave the soil without vegetative cover to protect it against water and wind erosion.

Soil loss by erosion is extremely serious because it takes from 200 to 1000 years, averaging about 500 years, to form 2.5 cm (1 inch) of topsoil under normal agricultural conditions. Throughout the world current soil losses range from about *20 to 300 t ha yr,* with substantial amounts of nitrogen and other vital nutrients also lost. Topsoil is being lost at 16 to 300 times faster than it can be replaced.

Worldwide soil erosion has caused farmers to abandon about *430 million ha* of arable land during the last 40 years, an area equivalent to about one-third of

NOTES

all present cropland. Each year at least *10 million ha* are lost to land degradation that includes the spread of urbanization. For example, Tolba reported that the rate of soil loss in Africa has increased 20-fold during the past 30 years.

The estimated rate of world soil erosion in excess of new soil production is 23 billion t yr, or about 0.7% loss of the world's soil inventory each year. The continuing application of fertilizers has so far masked much of the deterioration and loss of productivity from this process, so that world cropland yield is remaining roughly constant. This appears likely to continue in the next decades. Continued erosion at the current rate will result in the loss of over 30% of the global soil inventory by the year 2050, a truly severe damage and loss, obviously unsustainable over the long run.

Erosion reduces the availability of water, as well as nutrients to growing plants and diminishes organic matter and soil biota. Reduction of the water available to growing plants is the most harmful effect of erosion.

Soil degradation is affecting 15% of the earth's cropland area. In developing countries, the degradation of soil is growing worse owing to increased burning of crop residues and dung for fuel. This reduces soil nutrients and quickly intensifies soil erosion.

Water: Resources and Irrigation

Supply and Use: Water is the major limiting factor for world agricultural production. Crops require and transpire massive amounts of water. For example, a corn crop that produces about *7000 kg ha* of grain will take up and transpire about 4.2 million L ha of water during its growing season. To supply this much water to the crop, assuming no use of irrigation, not only must 10 million liters (1000 mm) of rain fall per ha, but it must be reasonably evenly distributed during the year and especially during the growing season.

Irrigation: irrigation is vital to global food production: About 16% of the world's cropland is under irrigation. This area contributes about one-third of crop production, yielding about 2 1/2 times as much per ha as nonirrigated land. In arid lands crops must be irrigated and this requires large quantities of water and energy. For example, the production of 1 kg of the following food and fiber products requires: 1400 liters of irrigation water for corn; 4700 liters for rice, and 17000 liters for cotton. About 70% of the fresh water used by humans is expended for irrigation.

Much of the world's irrigated land is being damaged by salinization and waterlogging from improper irrigation techniques. It is sufficiently severe over 10% of the area to suppress crop yields. This damage, together with reduced irrigation development and population growth, has led, since 1978, to declining

world irrigated area per capita. Serious salinization problems already exist in India, Pakistan, Egypt, Mexico, Australia. and the United States. Because salt levels are naturally high in these regions, the problem of salt build-up is particularly severe. Recent research puts the current loss of world farmland due to salinization alone at *1.5 million ha yr* or almost 1 % yr, a loss presently being more than made up by expansion of irrigation. If the damage continues, nearly 30% of the world's presently irrigated acreage will be lost by 2025 and nearly 50% lost by 2050, losses increasingly difficult to make up.

Another damaging side effect of irrigation is the pollution of river and stream waters by the addition of salts.

Water Shortages: Pressures from growing populations have strained water resources in many areas of the world. Worldwide, 214 river or lake basins, containing 40% of the world's population, now compete for water.

In many areas of the world, irrigation water is drawn from "fossil" aquifers, underground water resources, at rates much in excess of the natural recharge rates. The average recharge rate for the world's aquifers is 0.007% yr. As the aquifers' water levels decline, they become too costly to pump or they become exhausted, forcing abandonment of the irrigated land.

Africa and several countries in the Middle East, especially Israel and Jordan, as well as other countries, are depleting fossil groundwater resources. China has severe agricultural problems. In China, ground water levels are falling as much as 1 m yr in major wheat and corn growing regions of the north China Plain. Tianjin, China, reports a drop in ground water levels of 4.4 m yr, while in southern India, groundwater levels are falling 2.5 to 3 m yr; in the Gujarat aquifer depletion has induced salt contamination.

The prospect for future expansion of irrigation to increase food supplies, worldwide and in the US, is not encouraging because per capita irrigated land has declined about 6% since 1978. Greatly expanded irrigation is a difficult, and probably unsustainable solution to the need for expansion of agriculture output because of the rapidly accelerating costs of irrigation.

Greenhouse Effects

The continuing emission of a number of gases into the atmosphere from human activities, including chlorofluorocarbons (CFCs), methane, and, most important, carbon dioxide, is now thought likely to alter the global climate in the years ahead, a consequence arising from the greenhouse effect. Worldwide changes in rainfall distribution are expected, including drying of some continental interiors as well as possible increases in climatic variability.

NOTES

Increased variability in temperature and rainfall can, in many circumstances, be damaging to agricultural productivity. There are expected to be CO2-induced effects on productivity and growth of plants, including crops and weeds, and collateral effects on plant pathogens and insect pests. There may be decline or loss of ecosystems that are unable to accommodate a rapid climate change. The major impact will be caused by changes in rainfall and water availability to crops. Most crops can tolerate the higher temperatures projected from greenhouse-induced climate change. The detailed consequences are difficult to predict, in part because the expected global average temperature rise and changes in weather patterns have substantial uncertainties. The temperature rise expected from a doubling of the atmospheric CO_2 level—which, in the absence of carbon emission controls, will occur a decade or so before the year 2100—is "unlikely to lie outside the range 1.5- to 4.5-C". If the rise were only 2-C (a degree of warming not experienced in the last 8000 years), there could still be pronounced adverse effects.

The 1988 US experience is enlightening. It was the hottest year on record to that time which, accompanied by a mid-continent drought, resulted in a 30% decrease in grain yield, dropping US production below consumption for the first time in some 300 years. Similarly, Canadian production dropped about 37%.

Laboratory studies under favourable conditions indicate that enhanced CO_2 levels can improve growth rates and water utilization of crops significantly. Under field conditions, the estimated increase in yields are projected to be only one-quarter to one-third of that observed in the controlled greenhouse conditions without taking into consideration other deleterious consequences of climate change that also may be present and yields may, in fact not improve at all.

Ozone Depletion

Ground-level ultraviolet enhancement arising from O_3 loss in the upper atmosphere from the anthropogenic emission of chlorofluorocarbons can affect natural systems' productivity, alter pest balances, as well as affect the health of humans and surface and marine animals. The current ozone loss, as well as its seasonal variation, over equatorial and mid-latitude regions is not yet well known but is expected to increase, perhaps greatly. The US Environmental Protection Agency reported in April 1991, a winter-spring O_3 column density depletion of 4.5-5% in mid-latitudes. More recently, there is evidence of a slow but steady ozone depletion over most of the globe; between 40- and 50-N the decline is as great as 8% per decade. Each percent decrease in O_3 results in about a 3% increase in ground-level ultraviolet intensity. Even if the O_3 depleting chemical releases were halted now, O_3 depletion would continue to increase for decades, with effects lasting a century or more.

NOTES

Increased ozone levels may already have decreased phytoplankton yields in the Antarctic ocean. Plant responses to ultraviolet radiation include reduced leaf size, stunted growth, poor seed quality, and increased susceptibility to weeds, disease, and pests. Of some 200 plant species studied, two thirds show sensitivity to ozone damage. A 25% O_3 depletion is expected to reduce yields of soybean, one of civilization's staple crops, 20%. Red Hard disease infection rates in wheat increased from 9% to 20% when experimental ozone loss increased from 8% to 16% above ambient levels. Clearly, the potential exists for a significant decrease in crop yields in the period to 2050 from enhanced surface ultraviolet levels.

Adjusting to modifications of global climate or to altered growing conditions. caused by greenhouse gases or from enhanced ultraviolet, might stress management of agricultural systems greatly, especially if wholly new crops, and new procedures had to be developed for large areas of the world. Important uncertainties in the magnitudes of the effects expected may persist for a decade or so.

Food Security and Economic Growth Require New Strategies for Agricultural Development

Food security, poverty reduction and economic development are interrelated and depend critically on improvements in agriculture. They require strategies that focus on increasing food productivity and incomes among small-scale farmers and access to income and employment for rural poor people who lack access to land.

Most poor and food insecure people live in rural areas and depend primarily on agriculture for their livelihoods. On average, agriculture provides 64 percent of employment and represents 34 percent of gross domestic product (GDP) in the poorest countries. Although the vast majority of people affected by the rise in food prices live in the poorest countries of sub-Saharan Africa and South Asia, hunger and food insecurity are present among poor, rural and indigenous people in all developing regions.

Historically, agricultural growth has been the way out of poverty for developed countries. More recently, this has been true in China and India where agricultureled economic growth has reduced poverty. The World Development Report (WDR) states that "GDP growth generated in agriculture is at least twice as effective in reducing poverty as growth generated by other sectors."

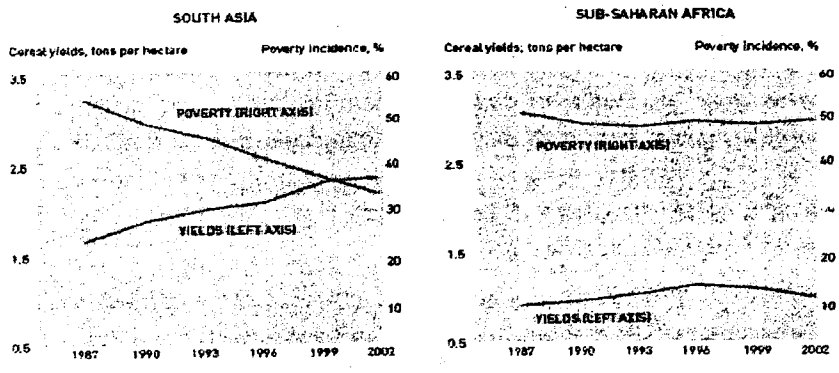
Small-scale women farmers represent the majority of rural poor populations in developing countries. For greatest impact, agricultural development strategies must target these populations.

Improving Food Production in Subsistence Agriculture

Improving food production among poor people is vital to ensure both subsistence and ability to purchase food (and other products). A large proportion of rural households in developing countries rely primarily on their own food production. Poor roads and infrastructure, limited transport, and low incomes severely limit people's ability to buy food from outside markets. On a national scale, low foreign exchange earnings limit many developing countries' ability to import food as well.

Subsistence agriculture is the main source of food and income in many rural communities throughout the world, especially sub-Saharan Africa. In Malawi, staple crops comprise 60 percent of agricultural production; in Zambia and Kenya, it is 70 percent. That said, more than half of rural households in sub-Saharan Africa also are net food buyers. Millions of low-income small-scale farmers in Latin America and the Caribbean also live in isolated rural areas and depend on their own production for food.

There is substantial scope to improve food production and productivity among poor and food insecure populations throughout the developing countries—a strategy that simultaneously can increase food security and reduce poverty. Yields of staple food crops in the low-income countries of Africa, for instance, are among the lowest in the world. Poor yields undermine food availability for personal consumption, especially in primarily subsistence households, as well as people's ability to purchase food because their related earnings are low. As shown in *Fig. 1*, low yields track poverty in sub-Saharan Africa and higher yields correlate with reductions in poverty in South Asia.



Source: The World Bank. (2007) World Development Report 2008: Agriculture for Development.

FIG. 1 :— STAPLE YIELDS AND POVERTY IN SUB-SAHARAN AFRICA AND SOUTH ASIA

NOTES

Strategies and investments to improve food production among small-scale farmers, such as increasing crop yields, are needed to ensure food security and economic growth. These strategies also must account for women who in many regions are vital to small-scale—and increasingly cash crop—agriculture. This is especially true in sub-Saharan Africa where "women play a pivotal role in agriculture," being responsible for nearly all food production, 60 percent of marketing, and at least half the tasks involved in storing food and raising animals. In Latin America, smallholder agriculture also increasingly is comprised of women.

Commercial and High-value Agriculture Crucial to Long-term Economic Growth

While improvements to subsistence agriculture are crucial to ensure food security for millions of people in rural areas, investments in agriculture that raise incomes and overall economic growth are essential for longer-term food security and improved well-being. One such strategy is for rural poor people to move beyond subsistence agriculture into commercial and high-value agriculture and become more diversified producers who are competitive in wider regional and global agricultural markets.

Commercial agriculture can include both staple crops and high-value products. High-value agriculture involves a wide range of products including vegetables, fruits, shrimp, nuts, dairy, poultry and non-food products such as cut flowers. The list continues to grow as new uses or added values are found for traditional products.

The impetus for growth in commercial and high-value agriculture comes from multiple and overlapping changes related to rising demand for food, policy reforms, and the availability of new technologies and infrastructure. These changes are occurring within domestic markets in both developed and developing countries and in global markets. Higher incomes and changing tastes have boosted demand in the domestic urban markets of many developing countries for both "traditional crops," such as leafy vegetables and cassava in local and regional markets in sub-Saharan Africa, and for higher value products such as meats, fruits and vegetables in Africa and other developing regions.

High-value agricultural products are mostly grown and marketed through value chains of large international and local companies, with small-scale farmers playing relatively small but growing roles. Such high-value products often are sold well beyond production areas to national, regional and global markets.

Trade liberalization and improvements in transportation have opened up demand for year-round produce in industrialized countries. Supermarkets increasingly dominate the retail food trade in both developed and developing

NOTES

countries. They account for 80 percent of all retail food in the United Kingdom, between 50 percent and 60 percent in South Africa, and 20 percent in urban Kenya. Global retailers have vast sales; the top 30 companies account for nearly one-third of global grocery sales. The world's largest retailer, Wal-Mart, also is the world's largest grocer.

By 2000, high-value and specialized agricultural products made up two-thirds of total agricultural trade, and many developing countries benefited from increased exports. For instance, leguminous vegetable imports from outside Western Europe increased by 133 percent in the European Union between 1989 and 1997, the bulk of it coming from Africa. These exports contributed significantly to higher foreign exchange earnings and rural incomes (Table 1). Cut flower exports earned $110 million for Kenya in 2001. Of this, $80 million returned to the rural economy as wages or other types of payments for goods produced. By 2002, horticultural exports were the second-highest contributor to Kenya's export earnings. In Uganda, export earnings from cut flowers added $22 million to the economy in 2002, and over $2 million to the rural economy. In 1999, fresh vegetable exports earned $1.2 million for Guatemala.

TABLE 1: HIGH-VALUE AGRICULTURE EXPORT EARNINGS FOR SELECTED COUNTRIES

Country	*Product*	*Year*	*Export Value U.S.$ (millions)*
Kenya	floriculture	2001	110.00
	vegetables	2001	270.00
Uganda	floriculture	1999-2000	22.00
	vanilla	1998	0.75
Colombia	floriculture	2000	580.00
Ecuador	floriculture	1996	195.00
Zimbabwe	deciduous, tropical and citrus fruits	1990	1.75
	sweet corn, asparagus and French beans	1990	5.5
Chile	grapes	2000	1,122.00
	fruit and vegetables		676.00
Brazil	fruit and vegetables	1999	1691.00
South Africa	deciduous and vine fruits	1999	0.69

Source: Dolan C and Sorby K. (2003) Gender and Employment in HVA Industries. Agriculture and Rural Development Working Paper 7

Volumes and returns increase with growing demand, providing greater incentives and higher incomes for agricultural producers, input suppliers, marketers, distributors and other agents along value chains in domestic and global markets. A three-country study in Guatemala, Indonesia and Kenya found that participation in modern supply chains can increase farmer income by 10 percent to 100 percent. McCulloch and Ota (2002) found smallholders in export horticulture were significantly better off than non-horticulture smallholders, even after correcting for household characteristics such as age, family size, education and land ownership. Farmers benefited directly from higher income and indirectly from credit and extension services.

Although returns in commercial and high-value agriculture can be high, small-scale farmers are typically at a disadvantage in responding to these incentives for several reasons. Buyers demand large quantities that small-scale farmers may not be equipped to deliver because they do not have access to the required resources, inputs and technologies. They may not be able to meet standards for product quality such as health, sanitation, environment, safe use of chemicals, and food and worker safety. Standards in export markets are set high by governments and by particular industries in response to market demand. Small-scale women farmers may lack information about these standards. And even those who have the information may be unable to meet standards because they require substantial investments in equipment or other resources.

The challenge for development planners and program designers, therefore, is to tailor development interventions to enable small-scale women farmers to tap these lucrative and growing markets for food and agricultural products.

1.3 HUNGER HOTSPOTS IN ASIA AND THE PACIFIC

In Asia and the Pacific, people who are food insecure are largely hidden. Occasionally, food shortages will hit the national headlines. But outside immediate emergencies, food has a much lower public profile. This is largely because achieving 'food security' means not just ensuring that sufficient food is produced, but also that everyone has access to it – and failures of access to food, particularly for the most marginal communities, are largely hidden from the public view.

Monitoring Progress

The simplest way of monitoring food security is to look at outcomes to count how many people are hungry. For this, there are two principal measures. The first addresses consumption, typically by estimating the proportion of the population whose food intake falls below the minimum dietary energy requirement of 1,800 calories per day (the minimum standard often used by

FAO). On this basis, in 2005-2006, on average some 16 percent of the region's population, 542 million people, were going hungry and in 2007, as a result of sudden price rises, that number is thought to have increased to 582 million. The greatest problems are in South and South-West Asia where 21 percent of the population are undernourished. The country with the most acute problems is Afghanistan where the proportion is more than one third. But, levels of undernourishment are also high between 20 and 34 percent in a number of other countries, including (in descending order of the proportion undernourished) Tajikistan, the Democratic People's Republic of Korea, Mongolia, Bangladesh, Cambodia, Pakistan, Armenia, Sri Lanka, India and the Solomon Islands.

Children Underweight

The second principal way of monitoring food security is by weighing a sample of children to arrive at the proportion who are underweight for their age. Again, the problems are most severe in South and South-West Asia where on average 42 percent of children are underweight with the highest figures in Bangladesh, at 47 percent, and India, at 46 percent. However, even in South-East Asia, the majority of countries in the subregion have more than one quarter of their children undernourished. For children, the consequences are potentially fatal because poorly nourished children have low resistance to infection and disease. Across Asia and the Pacific, around 3.8 million children die each year before reaching the age of five, and around half these deaths, over 1.9 million, are from causes related to malnutrition, poor hygiene and lack of access to safe water and adequate sanitation. This is the equivalent of 10 jumbo jets, full of children, crashing every day and killing all on board.

The Global Hunger Index

Another way of tracking food insecurity is through the 'global hunger index', which is based on a simple average of three indicators: the percentage of the population undernourished; the percentage of under-five children underweight; and the under-five mortality rate. Of the Asia-Pacific countries listed in this index, Afghanistan again has the worst score, over 40 percent, as a consequence of high levels on all three indicators, with Tajikistan second at 26 percent, with a high score primarily on undernourishment.

These indicators help build up a picture of malnutrition across the region by country. However, since most food insecure people are usually found in specific provinces or states, it is usually better to consider data at the sub-national level. In Indonesia, for example, rates of child undernutrition range across provinces from 15 to 42 percent; in India across states they range from 36 to 60 percent. In addition to mapping in-country food insecurity by region or state, it is also possible

to identify food-insecure subgroups. One is rural children who are twice as likely to be undernourished as those living in urban areas. Another is women: in some countries there is a persistent gender bias, as a result of maldistribution within households, which causes women to be at greater risk of undernourishment than men. Other vulnerable groups include migrant workers, tribal peoples as well as people living with HIV and AIDS.

Households that come under pressure, as a result of rising prices or falling food supplies, have a range of coping responses. Typically, they react first by eating less food, or cheaper food. But, if high prices persist, the poorest households will be driven to borrowing money or selling some of their assets. Just as poverty makes people food insecure, so food insecurity increases the risk of falling into poverty.

The Roots of Food Insecurity and Price Shocks

Although the principal cause of food insecurity is poverty, there are also many other contributing factors, linked to the balance of supply and demand. This study traces the Asia-Pacific experience starting with food production.

Since the mid-1960s, Asia and the Pacific has benefited from a remarkable boost in agricultural output as a result of the Green Revolution, using new varieties of rice and wheat, along with the application of fertilizer and irrigation. The result was a striking increase in cereal yields.

To some extent, especially in its initial stages, the Green Revolution benefited the rural poor. This was partly because the new technology could also be used on small farms, and because the new farming systems, which often involved double or triple cropping, proved to be quite labour intensive thus generating more work for the landless. Nevertheless, the Green Revolution displaced many smaller farmers, particularly women, as production was consolidated into larger and more integrated farming systems.

Increasing Demand

While the supply of food was increasing in Asia and the Pacific, so was the demand. This was not just because rising populations resulted in more mouths to feed, but also because higher incomes enabled consumers to buy more and better food.

The poorest people typically have to buy the cheapest available carbohydrates. But, with more money, they can buy more fruits and vegetables, along with meat, dairy goods, and eggs. As a result, much of the region has been changing from a traditional diet based on carbohydrates and vegetables to one richer in fat and protein.

NOTES

Security Through Trade

While some countries grow most of the food that they need, most rely to some extent on international trade. In the Asia-Pacific region, 25 countries are net food importers. Some of these have, at times, aimed for national food self sufficiency. However, a more realistic objective is 'food self-reliance' which means being able to earn sufficient foreign exchange from other exports, such as manufactured goods, so as to be able to import food. Countries following this strategy will, however, need to be concerned about the terms of trade. As food prices rise, food self-reliant countries will need to export more manufactured and other goods to be able to import sufficient food.

Food Policies of the Developed Countries

The international trade in food is also profoundly affected by the policies of the developed countries which have generally protected and subsidized their local farmers encouraging over-production. This may have supported local agriculture, but it harmed farmers around the world when the flood of subsidized crops into international markets resulted in surges of imports into developing countries. The consequences can be severe. Fiji, for example, in 1986 was 75 per cent self-sufficient in rice but, due to deregulation and the influx of cheaper imports, that proportion is now down to 15 percent.

Market-Based Food Insecurity

Even when food is available, from local production or imports, people may not have physical access to the food. People may not have economic access to food they may not have the cash to buy food. For large numbers of people, the primary source of food security is their income either from producing non-food goods or from selling their labour. Under these circumstances, much depends on the national terms of trade on the balance between the prices of food and those of other goods. The problem of food insecurity, like that of poverty, is thus frequently traceable to macroeconomic conditions and market failures. Farming communities and others can also suffer from food insecurity because of the actions of exploitative intermediaries, including landowners, moneylenders and traders. One of the most severe problems is the shortage of affordable credit. In some cases, farmers can pay interest rates of 25 percent per 100 days. Desperate for cash, small and marginal farmers, for example, are forced to sell their crops immediately after the harvest to middlemen or their creditors, only to have to repurchase some of this food later, at a higher price.

Food Absorption and Utilization

Even when food is available in the household, some family members may not be able to take advantage of it hampered by inadequate water supplies and

poor standards of sanitation which reduce the quality of their food or make it hazardous. Without reliable water supplies or basic sanitation, children especially are constantly exposed to infections and diseases that not only threaten their lives directly, but also prevent their absorption of many essential nutrients. Both children and adults need safe food. For babies, this is best assured by exclusive breast feeding for the first six months of their lives. Older children and adults also have to be concerned about the ever-present dangers of food contamination which can arise, for example, through the use of chemical products in food production, as well as from failures in the ways in which food is transported, stored and served.

The 2008 Food Price Crisis

The downward trend in food prices of the 1980s and 1990s reversed in the early 2000s, after world stocks of wheat, maize and rice dropped to 30 year lows. The drop in stocks, which resulted from production lagging significantly behind consumption, caused food prices to rise sharply. The price increase accelerated from 9 percent in 2006 to 23 percent in 2007 and 51 percent between January–June 2007 and January–June 2008.

The Impact of High Oil Prices

Another major factor in the food price rises was the steep hikes in oil prices. Food prices are increasingly linked with those for oil and gas, partly because natural gas is the principal input for fertilizers. But agriculture itself has also consumed more fuel, as it has become more energy intensive. In addition, some land has been taken for the production of biofuels.

Decelerating Productivity

While the demand for grain has been rising, productivity has failed to keep pace. This is largely the consequence of a neglect of investment in agriculture. Moreover, when prices were low, farmers had few incentives to step up production. Extreme climatic events also played their part in disrupting agriculture and food output. One of the main contributing factors to the 2007–2009 increases, for example, was six years of drought in Australia.

Speculation

While speculation is not a driver of commodity prices, it can nevertheless accelerate and amplify price movements driven by fundamental supply and demand factors. Given how steeply food prices increased and how fast they fell in 2008, it is likely that the growing presence of financial investors in commodity markets made prices over-react to new market information and deviate from fundamentals.

NOTES

Respite

With the onset of a global recession, prices started to fall again and, by early 2009, were back in real terms at around 2006 levels. This is a temporary respite. Once the industrial economies recover from the recession, both oil and food prices will start to rise again partly because of resurgent demand, but also because the world faces threats to sustainable agriculture.

1.4 THREATS TO SUSTAINABLE AGRICULTURE

In future, farmers will find things steadily more difficult faced with environmental degradation, climate change, and a series of other threats. Unless they can produce food not just efficiently, but also in ways that respect the environment, the food security outlook will be bleak. Sustainable agriculture integrates the goals of environmental health, economic profitability, and social and economic equity. The overriding principle is to meet current food needs without compromising the rights of future generations.

Expanding Deserts

One of the most critical threats to sustainable agriculture is land degradation. Vast areas of cropland, grassland, woodland and forest in Asia and the Pacific have already been lost, and many more are threatened. In many countries, including China, the implications of land degradation are grave as deserts expand across the territory. Over the next 50 years, crop output in north-eastern China could fall by as much as 40 percent.

Much of the land degradation results from overintensive cultivation. In order to meet their basic food needs, smallholders and the rural poor have been pushed into using ecologically fragile areas, forced to crop intensively on steep slopes that are vulnerable to erosion. Land degradation has also resulted from excessive use of mineral fertilizers and over-intensive livestock-keeping.

Shrinking Forests

Forests provide critical ecosystem services to the agricultural sector, including pollination and watershed protection, and support to fisheries. Millions of poor people and small-scale enterprises across the region depend on forests for food, fibre, fodder and other materials, but are finding this increasingly hard as the natural forests shrink. Some of the deforestation is a consequence of high prices for other fuels, driving the poorest people to take more wood from forests. But, in many cases, trees are falling as a result of a rapacious timber industry. At particular risk are mangrove forests. The Asia-Pacific region has around half the world's total area of mangroves. These are under severe strain as a result of the extraction of timber and coastal development, including for the production of environmentally damaging, export-oriented cultivation of shrimps.

Competing for Water

The region's main staple food, rice, requires two or three times more water for cultivation than other cereals. As a result, across Asia and the Pacific, agriculture is still the principal user of water, accounting for around 70 per cent of total withdrawals. Producing each calorie of food requires approximately one litre of water. On that basis, to provide each consumer with 1,800 calories per day, Asia and the Pacific would by 2050 need an additional 2.4 billion cubic metres of water per day.

Some of this overuse reflects government policy. Many governments have subsidized the construction of inefficient irrigation systems, along with fuel and electricity supplies. This has weakened price signals, tempting farmers to withdraw too much water from rivers, over-pump groundwater and generally waste freshwater resources. In addition, intensive agriculture and industrial effluents are creating high levels of pollution.

All water users domestic, industrial and agricultural have together been withdrawing more water than the renewable capacity of the natural hydrological cycle. Many countries are already facing water stress, and heightened competition for this precious resource is leading to water conflicts, which are emerging as new threats to social stability.

Displaced by Biofuels

Food also has to compete with biofuels for land. Some countries have been subsidizing the production of biofuels as a way of bolstering fuel security. Biofuels have, however, become increasingly controversial. Many people are concerned about their environmental impact, pointing out that their production will increase carbon dioxide emissions. Expanding the area devoted to biofuels could also accelerate the switch to industrial agriculture, at the expense of small farmers growing food crops, or of people living from forests. There are also major worries about food security. If crops are grown for biofuels, they displace those that could have been used for food, causing shortages and driving up food prices.

In Asia and the Pacific, biofuels may not yet have had a large impact on domestic food markets especially since the major staple is rice whose production has not been affected. But this situation could change, particularly if countries like China produce more corn for biofuels.

Genetically Modified Crops

Critics argue that genetically modified (GM) crops threaten human health and the environment and will allow large corporations to tighten their grip over agricultural production and thus widen socio-economic disparities. Currently,

GM crops are used to a fairly limited extent, so it is difficult to assess their impact. At present, most GM crops are grown as high-priced animal feedstock to supply rich nations with meat, rather than to meet the immediate food security needs of local households. The benefits of GM crops are far from certain. There is, for example, little consistent evidence of higher yields. Moreover, little is known about the risks, since there has been relatively little biosafety research on their health, environmental and socio-economic effects.

Climate Change

Food security is also being threatened by climate change which will have many complex effects bringing advantages in some places, but disadvantages in others. Higher concentrations of atmospheric carbon dioxide could, for example, increase photosynthesis in several crops, such as wheat and rice, thereby boosting yields. However, this potential gain could easily be outstripped by the effects of higher temperatures and more variable rainfall. In addition, there are likely to be more extreme weather conditions: more intense and frequent floods, droughts and storms will create significant uncertainties for agricultural production. One major impact will arise from the melting of the Himalayan glaciers.

Governments Step In

Surges in food prices in recent years have shaken many countries, propelling governments to take immediate action from blocking food exports to introducing special measures for social protection. Some of these responses have been counterproductive, but others show greater promise for strengthening food security, both in the short and longer terms.

Agriculture that Lasts

The main priorities in food-producing countries should be to promote sustainable agriculture so as to optimize food production, boost the incomes of farmers and maintain vibrant rural economies. This would constitute a shift in emphasis. In the past, many countries have been less concerned about sustainability placing greater reliance on new technology. But they did not achieve food security for all, since many of the benefits were reaped by the richer farmers, and long-term sustainability was threatened by the overuse of fertilizers and other inputs.

In practice, the barriers facing agriculture are not just technical, but also social and political. Many countries still face severe structural constraints, such as inequitable or inefficient land ownership. Agriculture, like many other forms of development, is further constrained by low levels of human capacity. Farmers often lack the education, training or the necessary health standards to make the

best use of available resources and have found it more difficult to get extension services. While some farmers now have cell phone access to market prices, many still neither have access to such information nor to markets. They have also been held back by government policy, which until recently at least, has tended to tax agriculture at the expense of urban consumers.

Trade Policies

National food availability is also strongly affected by government policy on trade. Indeed, when global food prices start to skyrocket, one of the first responses from exporting countries may be to restrict exports or impose quotas or export taxes. This may help domestic consumers, but it will harm domestic producers and may encourage smuggling. It will also hurt consumers in importing countries. The overall effect of trade restrictions is thus to undermine national, regional and global food security.

Trade measures can also be taken by foodimporting countries. When world food prices have been low, some countries have aimed for food self-sufficiency by combining efforts to boost local production with restrictions on cereal imports. On the other hand, when international prices are high, the importing countries will want to reduce tariffs; however, since these are already low, this is unlikely to make much difference to retail prices.

Fiscal Policy

In addition to adjusting trade policies, governments have influenced prices through fiscal measures. One option is to reduce domestic taxes, such as value added tax, on basic food commodities. Many countries have also introduced price controls and consumer subsidies. While benefiting consumers these measures do, however, reduce government revenue and increase government expenditure.

Stocks and Reserves

Most governments in Asia and the Pacific hold national stocks of rice or other staple foods. These can serve as buffers at times of volatile prices, since purchases from farmers to build the stocks can ensure that they receive minimum prices. At times of shortage, this food can then be released to consumers. However, building and managing national food stocks can be complex and expensive.

Food Transfers

Food from reserves and elsewhere can be released into national food markets. Typically, this has been through 'food-for-work' programmes, such as building roads, which are 'self targeting' on the assumption that only the poorest would be prepared to do this work for the type of food on offer. Other types of

conditional programmes include 'food-for-education' whereby food may be distributed through schools to encourage attendance.

Food aid has helped achieve many humanitarian and development goals, but it has also been criticized for damaging local markets, fostering dependency, and for being susceptible to corruption.

Cash Transfers

An alternative form of support to food-insecure communities is to offer lump sum payments to vulnerable groups. These too are usually conditional such as the Primary Education Scholarship Programme in Bangladesh and the Rural Employment Guarantee Scheme in India. Many programmes target women on the grounds that, compared with men, they are more likely to allocate incremental food or cash to their families, especially their children. But the conditions applied also represent extra demands on overworked mothers.

Insurance Systems

A further way to offer greater security to farmers is through insurance mechanisms. One of the most promising options is weather insurance based on a local index, say, of rainfall shortage or days of hailstorm or snow or frost.

Activist Administrations

The looming threats to food production will require Governments in Asia and the Pacific to take active measures to protect their poorest people.

Resilient Communities

Communities that are food insecure face different kinds of shocks. To protect themselves, they have established many systems of mutual support, through cooperatives, for example, or microcredit schemes to deal with financial risks. They can also take measures to improve food security through more resilient forms of agriculture.

Everything Together

Farmers who rely on one on two crops can be at considerable risk if these fail, or market prices fall. In response, many farmers have evolved complex integrated farming systems. In Kazakhstan, for example, some farmers have developed a form of two-track agriculture combining livestock and food production that tides them over during the severe winter months. In China, farmers have developed integrated agriculture centred on fish ponds, combined with cultivating silkworms, along with raising chickens, ducks and other animals a system that uses almost all waste as nutrient resources. Farmers in Japan have similarly made use of complex ecosystems, for example, by rearing ducks in rice fields.

Building Banks

Farmers can provide a degree of security for themselves by using common resources, such as grain or seed banks. This type of mutual support is promoted, for example, by the Self-employed Women's Association, a trade union based in Gujarat in India, which has used banks for grain, seeds, fodder and tools to help build food security. In some cases, grain banks have been combined with other activities to build the equivalent of public distribution systems.

Sharing Water

Asia has many community-based water delivery systems, which serve one third or more of the total irrigated area. Generally, these have been developed in mountainous or hilly territory, based on the diversion of small and medium streams, especially in the Himalayan regions, China, the Lao People's Democratic Republic, Japan, the Philippines and Thailand. In the Ilocos provinces of the northern Philippines, for example, irrigation systems are run by small societies which have run successfully for centuries. In Indonesia, rice farmers in Bali have irrigation systems coordinated through temples and that use common planting cycles based on a ritual calendar.

Common Property Resources

The poorest households often rely for food security on common resources lands, forests, wildlife, fisheries and waterways which they use as primary or secondary sources of food and fodder. As well as offering extra quantities of food, these can also add to the nutritional quality of their diets.

Food Storage and Protection

One of the best ways of boosting food security is to reduce the amount of food that is lost during storage and transmission. Poor communities in rural areas, however, lacking in modern methods of storage, have had to devise some of their own. In the Himalayan regions of India, for example, foodgrains like maize, wheat and rice are stored in special bamboo containers that inhibit the entry of insects and larvae. For protecting crops, people also use indigenous materials, such as leaves from the neem tree.

Community-based responses generally rely on informal but well-informed contracts of mutual support. But they may exclude certain groups women, for example, religious and ethnic minorities, persons with disabilities, and those at the bottom of the pyramid. They are also hampered by limited resources, both human and financial, and so cannot usually address covariate risks particularly in the wake of disasters. In these circumstances, they work best in combination with official safety nets.

AN AGENDA FOR FOOD SECURITY

NOTES

Food security depends on interlinked short, medium and long-term measures.

Short-Term Measure: Improving Access to Food

For large numbers of people in Asia-Pacific, food security depends as much on income as on food availability. People who have sufficient money will always have enough economic access to food. Government action to promote the longterm availability of food on a sustainable basis must be complemented by measures to ensure economic and social, and physical access to food, especially with regard to the poor and vulnerable communities of the Asia-Pacific region.

Economic and Social Access

Certain groups must have the protection of the State for food security on an equitable basis. Thus, it will be important to identify groups in need of special attention (such as small and marginal farmers, women and children in poor households, people living with HIV and AIDS, ethnic minorities, older persons, people who have been internally displaced and people with disabilities) and to provide special schemes for their food security.

Social Protection against Shocks

Whole communities may experience food insecurity associated with 'covariate' shocks. In many cases, people face food insecurity because of 'idiosyncratic' shocks of various kinds that force them to sell their only productive assets. To prevent downward spiralling due to such shocks, governments need to consider strengthening systems of social protection. These will include new forms of insurance, as well as more traditional forms of transfer, such as food or cash for work. Women and girl children face multiple food insecurities, resulting from the multiple inequalities that they face. Governments need to eliminate gender-based food insecurities through social, economic and legislative measures.

Social protection for food production – The most effective strategy for ensuring that the poorest people have food supplies in hand is to aim for sustainable increases of agricultural productivity on their land holdings. A key component of such a strategy is sustainable home (or kitchen) gardening of indigenous food plants, in which women play a central role, integrated with health and nutrition education. This strategy will reduce long-term dependence on budgetary resources and emergency actions. Other schemes targeting smallholders and the rural poor and that ensure minimum levels of income from agricultural activities can significantly boost smallholder food production. This would include a combination of insurance schemes, such as for micro-insurance, weather index insurance and

community-based health insurance. It would also include robust common property resource management systems with joint stakeholder responsibility for management, and enactment and enforcement of legislation recognizing and protecting people's usufructuary rights to these resources; productivity-related schemes, such as government-supported microcredit and community banks of agricultural inputs, working capital, facilities, services, tools and draught animals; and strengthening the governance, accountability and administration of social protection schemes.

Physical Access: Transport and Logistics

Governments also need to be concerned about the way food is transported, stored, marketed and distributed. For perishable foods, it will be important to define and implement operational standards for packaging, handling, storage and transport, bearing in mind the need to incorporate high-efficiency technologies. To enhance access to food, current logistics, storage and marketing institutions and practices need to be streamlined, with improvements in the corresponding infrastructure and services. Especially important in areas prone to disasters are improvements to transport and logistics infrastructure and decentralized food storage facilities for emergency food distribution.

Improving Choice and Utilization of Food

Measures are needed to enable people to make informed choices about the food that is available to them and to have access to health-promoting food and nutrition education. Measures are also needed to ensure the physical capacity to absorb and utilize the nutritious value of food that is consumed. For this, public health measures for health promotion and environmental hygiene will significantly reduce vulnerability to water-borne and other diseases that prevent food absorption.

Medium-Term Measure: Sustainable Agriculture

The Governments of the region stand at a crossroads: business as usual, continuing with shortterm profits for the few through chemically cultivated, irrigation and energy-intensive monoculture, with the burden of long-term costs shouldered by the many; or, a new, long-term commitment to ecologically balanced, socially just and economically equitable agriculture to ensure food security for all.

Revitalizing small-scale sustainable food production – Long-term food security in the Asia-Pacific region requires active State support for the participation of small farmers in a new green food revolution that gives high priority to revitalizing small-scale food production based on ecologically viable systems. A shift to such systems will provide the poor with in situ sources of food security and livelihood.

Future agricultural development will need to focus more on conservation farming, ensuring that the soils retain vital nutrients and that farmers and others protect biodiversity. A significant part of smallholder food production should increasingly be biodiverse, as insurance against various kinds of shocks to which agriculture is perpetually vulnerable, and based on integrated agro-ecosystems for greater resilience and productivity. Phasing out of agro-chemicals and inorganic fertilizer, complemented by cash incentives for biofertilizers as part of targeted government policy towards rejuvenating and converting national cultivable land for sustainable food production. Smallholder farming should increasingly be based on multiple, multilayer and mixed cropping for providing insurance against various kinds of shocks to which agriculture is perpetually vulnerable.

Rain-fed agriculture – While it will be necessary to develop sustainable irrigation systems, it will be even more important to reap greater benefits from rain-fed agriculture.

Better water management – Farmers will need to make smarter use of both soil moisture storage (green water) and irrigation. But governments will also need to give greater attention to watershed and river basin development and management. Governments shall need to achieve more optimal and equitable use of water resources. Governments may also consider offering incentives for upstream watershed management and by providing tax breaks to encourage water storage and harvesting. Furthermore, governments could consider introducing a differential, incremental pricing mechanism for higher per capita/per hectare levels of consumption of surface or ground water in excess of a minimum allotment for irrigation of food crops, especially those grown by small and marginal farmers.

Village knowledge and technology centres – To strengthen sustainable agriculture for food security, governments can help establish ICTnetworked knowledge centres, including at the village level. With good external ICT connections, preferably through the internet, community radio or cell phones, these can disseminate timely knowledge on experiences and options concerning seed and plant varieties, soil conservation and rejuvenation techniques, improvements in technology, attendant long and short-term risks, costs and benefits, levels of regulation, as well as market trends and price fluctuations.

Long-Term Measure: Adaptation to Climate Change

Climate change holds the potential to radically alter agro-eco systems in the coming decades. Adaptation to climate change should include strengthening regional and national mechanisms for scientific assessment, forecasting and information sharing, while building national and local capacities for greater ecological literacy, monitoring agro-eco systems and for assessing and managing risks. The concept of building the resilience of communities to tackle the impact

NOTES

of climate change in the context of changes in socioeconomic and environmental conditions has to be rapidly developed and widely promoted. Measures include rehabilitating degraded grasslands, as well as improving crop and grazing land use and management.

Indian Agriculture Production Status

The direct contribution of the agriculture sector to national economy is reflected by its share in total GDP, its foreign exchange earnings, and its role in supplying savings and labour to other sectors. Agriculture and allied sectors like forestry and fishing accounted for 18.5 percent of total Indian Gross Domestic Product (GDP) in 2005-06 (at 1999-2000 constant prices) and employed about 58 percent of the country's workforce (CSO, 2007). It accounted for 10.95 percent of India's exports in 2005-06 (GoI, 2007) and about 46 percent of India's geographical area is used for agricultural activity.

There has been a structural transformation in the Indian economy during the past few decades. The composition of Gross Domestic Product at 1993-94 constant prices reveals that the share of agriculture including forestry and fishing has declined as growth in industrial and services sectors far outpaced agricultural sector. The share of mining, manufacturing, electricity and construction sector has increased from 21.6 percent in 1970-71 to 27 percent in 2004-05 and services sector has increased significantly from 32 percent to 52.4 percent during the same period. Despite a steady decline of its share in the GDP, agriculture is still an important sector and plays a significant role in the overall socio-economic development of the country. Therefore, fostering rapid, sustained and broad-based growth in agriculture remains key priority for the government.

Consistent with the trends of economic development at national level, role of agricultural sector in the state economies is also changing rapidly. The share of agriculture in Gross State Domestic Product (GSDP) has declined significantly during the last two decades. In some States, such as Bihar, Punjab, Uttar Pradesh, Haryana, Rajasthan, and Orissa, the sector today contributes more than one-quarter of GSDP, while in some states, such as Gujarat, Kerala, Karnataka, Tamil Nadu and Maharashtra, the sector contributes less than 20 percent to GSDP. However, contribution of agriculture to GSDP has declined in almost all States between 1993-94 and 2004-05. The decline was the highest in Karnataka (16%), followed by Haryana (14.2%), and Kerala (13.7%). In Karnataka, decline was mainly due to significant increase in the share of service sector (from 37.9% in 1993-94 to 54.7% in 2004-05) mainly driven by informational technology (IT) industry. Similar is the case with Haryana the decline is due to faster development of services sector in cities around the national capital, Delhi.

Despite declining share of agriculture in the economy, majority of workforce continue to depend on agricultural sector for employment and in rural areas dependence on agriculture is more as nearly 75 percent of rural population is employed in agricultural sector. However, there is disguised employment in the sector due to limited opportunities for rural non-farm employment. This disguised employment leads to lower labor and resources productivity in the sector relative to other sectors of the economy. The low labour productivity leads to higher rates of poverty in rural areas.

Agriculture in India is constitutionally the responsibility of the states rather than the central government. The central government's role is in formulating policy and providing financial resources for agriculture to the states.

Deceleration in Agricultural Growth

India's GDP grew at an annual rate of 5.8 percent from 1995-96 to 2004-05 at 1993-94 constant prices, but agricultural growth declined to about 2 percent, resulting from stagnation/decline in productivity during the last decade. It is evident from the figure that India's agricultural sector has grown more than targeted growth rate during the 6th, 7th and 8th Five Year Plans but fell short of targeted growth during the 9th and 10th Plan. During the 10th Plan, agricultural GDP grew at an annual rate of mere 2.1 percent against the targeted growth rate of 4 percent. Indian agriculture is at a crossroads.

With about 70 percent population living in rural areas and about 58 percent of its workforce engaged in agriculture, India needs positive change in agricultural sector. Therefore, in the 11th Five Year Plan, the National Development Council has adopted a 14 point resolution dividing responsibilities equally between the Central and the state governments with an aim to achieve four percent agricultural growth by the end of 11th plan. The agricultural sector has been allocated additional Rs. 25,000 crore from the Central government in the next four years.

One of the important reasons for deceleration in agricultural growth has been declining levels of investment in agriculture and allied sectors and irrigation. Share of agriculture and irrigation in total plan expenditure has declined from 37.3 percent in First Five Year Plan to 10.6 percent in 10th Five Year Plan. In the 6th Plan additional head of rural development was introduced and its share in total plan expenditure has increased over the years from 6.4 percent in 6th Plan to 9.5 percent in 9th plan and then slightly declined to nearly 8 percent in 10th plan.

A key reason for declining public investment in agriculture has been ever increasing agricultural subsidies such as fertilizers, power, irrigation, food, etc. Total agricultural subsidies have increased at an annual compound growth rate

of about 12 percent between 1993-94 and 2002-03 (Rs. 14,069 crore in 1993-94 to about Rs. 36,514 crore). The share of fertilizer subsidies in total agricultural subsidies is about 36 percent (GOI, 2007). The amount of subsidy on fertilizers has increased from Rs. 4389 crore in 1990-91 to about Rs. 22,452 crore in 2006-07 (at an annual compound growth rate of 10.6%). Food subsidies have also witnessed a significant increase during the 1990s and 2000s, rising from Rs. 2450 crore in 1990-91 to Rs. 25,181 crore in 2003-04 and then marginally declined to Rs. 24,200 crore in 2006-07. The amount of food and agricultural subsidies is greater than public investment in agriculture and allied sector, irrigation and rural development combined. In addition there has been deterioration of institutions/organizations providing inputs and services such as credit, seeds, technology, extension, to agricultural sector.

Land Fragmentation

The agrarian structure in India has undergone significant structural transformation since the 1970s. Recent data shows that the share of marginal and small farmers (farmers owning from 0.1 to less than 2 ha) increased from 69.7 percent in 1970-71 to approximately 82 percent in 2000-01. The share of small and marginal farmers in total area operated also increased from about 21 percent in 1970-71 to about 39 percent in 2000-01. The average farm size has declined from 2.3 ha in 1970-71 to 1.41 ha in 1995-96 and 1.32 ha in 2000-01.

The average size of land holdings in India is very small and is subject to fragmentation, due to imposition of ceiling on land owned, population increase, inheritance laws which have stipulated an equal division of property among sons, lack of off-farm occupations, etc. Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labour. Moreover, there are several tenancy restrictions in many states. These restrictions range from a complete ban in some States to complete freedom of leasing in some States. There is growing consensus about the need to have a re-look at current tenancy legislations, which sometimes restrict participation of private sector in agriculture. However, under the Indian Constitution, land administration falls under the State governments, hence large variations across states.

Cropping Pattern Shifts and Stagnant Productivity Levels

Foodgrains continue to occupy important place in the Indian agriculture, commercial crops such as fruits and vegetables, fibres and condiments and spices, etc. have gained significant share in crop portfolio during the last decade. The share of foodgrains in total cropped area has declined from about 77 percent in 1970-72 to about 65.6 in 2000-02. The area under rice has remained almost constant at about 23 percent of total cropped area while area under wheat has

increased from 11.5 percent to 14 percent during the same period. However area under coarse cereals has declined significantly from about 27 percent in 1970-72 to 16 percent in 2000-02. The area under pulses has also declined from 13.3 percent to nearly 12 percent during the period. The area under other crops mainly under fruits and vegetables, fibres and condiments and spices has increased during the last decade.

The rate of growth in agriculture has become stagnant and productivity growth has also become stagnant. In case of production, pulses experienced a significant negative growth rate during the 1980s and 1990s and this decline was due to decline in both area and productivity. There was significant shift in area from pulses to superior cereals like wheat and rice and also non-foodgrain crops mainly fruits and vegetables. Growth rates of production for most of crops were significantly lower during the period 1991-92 to 2004-05 compared with 1970s and 1980s. Decline in production growth was due to lower growth in productivity levels of most foodgrain crops.

The above results clearly show that performance of agriculture particularly in case of wheat, coarse cereals, pulses and oilseeds has decelerated during the last decade, which is a cause of concern. Therefore, improving agricultural performance and sustaining it over longer term remains the key priority for the government.

STUDENT ACTIVITY

1. Discuss the interrelation of agriculture productivity and sustainable development.

2. Write a short essay on Indian agricuture production.

1.5 POPULATION PRESSURE

Population Pressure, strain imposed on natural resources by the growth and density of human overpopulation, especially as this relates to damaging levels and methods of consumption and unsustainable uses of the land, sea, and air.

The world population more than doubled in the latter half of the 20th century and reached almost 6.8 billion by 2009. While the annual rate of growth slowed in the 21st century, from around 2 percent in the 1970s to 1.2 percent in 2009, this is on a much larger population base. As a result, the biggest ever generation of young people in history is coming into the world each year. This, and the growing levels of consumption in rich countries as well as in newly developing countries such as China, India, and Mexico, is placing more and more demands on the environmental underpinnings of our planet. The fact that population is growing fastest in some of the poorest countries on Earth means that they face huge problems of urban and rural degradation, with limited means of improvement.

Projections to 2050

United Nations reports, such as World Population Prospects state:

- World population is currently growing by approximately 74 million people per year. If current fertility rates continued, in 2050 the total world population would be 11 billion, with 169 million people added each year. However, global fertility rates have been falling for decades, and the updated United Nations figures project that the world population will reach 9.2 billion around 2050. This is the medium variant figure which assumes a decrease in average fertility from the present level of 2.5 down to 2.05
- Almost all growth will take place in the less developed regions, where today's 5.3 billion population of underdeveloped countries is expected to increase to 7.8 billion in 2050. By contrast, the population of the more developed regions will remain mostly unchanged, at 1.2 billion. An exception is the United States population, which is expected to increase 44% from 305 million in 2008 to 439 million in 2050.
- In 2000-2005, the average world fertility was 2.65 children per woman, about half the level in 1950-1955 (5 children per woman). In the medium variant, global fertility is projected to decline further to 2.05 children per woman.
- During 2005-2050, nine countries are expected to account for half of the world's projected population increase: India, Pakistan, Nigeria, Democratic Republic of the Congo, Bangladesh, Uganda, United States of America,

NOTES

Ethiopia, and China, listed according to the size of their contribution to population growth. China would be higher still in this list were it not for its One Child Policy.

- Global life expectancy at birth, which is estimated to have risen from 46 years in 1950-1955 to 65 years in 2000-2005, is expected to keep rising to reach 75 years in 2045-2050. In the more developed regions, the projected increase is from 75 years today to 82 years by mid-century. Among the least developed countries, where life expectancy today is just under 50 years, it is expected to be 66 years in 2045-2050.
- The population of 51 countries or areas, including Germany, Italy, Japan and most of the successor States of the former Soviet Union, is expected to be lower in 2050 than in 2005.
- During 2005-2050, the net number of international migrants to more developed regions is projected to be 98 million. Because deaths are projected to exceed births in the more developed regions by 73 million during 2005-2050, population growth in those regions will largely be due to international migration.
- In 2000-2005, net migration in 28 countries either prevented population decline or doubled at least the contribution of natural increase (births minus deaths) to population growth. These countries include Austria, Canada, Croatia, Denmark, Germany, Italy, Portugal, Qatar, Singapore, Spain, Sweden, United Arab Emirates and United Kingdom.
- Birth rates are now falling in a small percentage of developing countries, while the actual populations in many developed countries would fall without immigration.
- By 2050 (Medium variant), India will have 1.6 billion people, China 1.4 billion, United States 400 million, Pakistan 309 million, Indonesia 280 million,Nigeria 259 million, Bangladesh 256 million, Brazil 254 million, Democratic Republic of the Congo 187 million, Ethiopia 183 million, Philippines 141 million, Mexico 132 million, Egypt 121 million, Vietnam 120 million, Russia 108 million, Japan 103 million, Iran 100 million, Turkey 99 million, Uganda 93 million, Tanzania 85 million, and Kenya 85 million.

Population and Poverty

The interactions of poverty with population are complex and often controversial, because the two problems often influence each other. One reason for this is that they are often two-way. For example, rapid growth of population may well make it more difficult for governments to provide education, health, housing, and employment opportunities for all who need them. However, at the

NOTES

same time, a failure by governments to invest in the social sector and to create a positive climate for fair and equitable economic development can perpetuate the conditions under which couples continue to have large families. The situation is made critical by the fact that 95 percent of the annual increase in world population takes place in developing countries, which are generally least able to provide for them. For example, the numbers in the world's poorest 48 countries could triple by 2050, according to UN estimates.

Numerous studies have shown that where women have access to education, and especially secondary education, they are more likely to marry later and have fewer children. The same is true in relation to health care. Where women have access to good health services, including those related to reproduction and birth control, they are less likely to have unwanted pregnancies and more likely to have healthy children—thus reducing the incentive to have more babies in case some of them die. The same may be said for other aspects of human development. Where couples do not have to rely on their children for security in old age, and where women have job opportunities and status other than through childbearing, they are more likely to opt for a smaller family.

Population and development are thus two sides of the same coin. Slowing population growth in countries where it is growing unsustainably is an important policy aim, but its achievement requires both direct action to provide women and men with the means to plan their families and indirect action to create the right conditions under which they are empowered to do so. That was very much the theme of the United Nations International Conference on Population and Development, held in Cairo in September 1994. It has been reaffirmed, more generally, as a component of the Millennium Development Goals.

Population and Consumption

The connections between population, consumption, and the environment are equally complex. Two important factors that affect the impact of people on the world around them are technology and affluence. Technology can be more or less disruptive in producing the goods that people consume, and affluence is a useful measure of how much people are likely to consume. One theory states that, whatever the levels of consumption, involving whatever technology, population will multiply the use of resources and of space as well as the output of waste. It also stresses the impact on the environment of population growth in affluent societies, such as those in North America, where consumption levels, using sometimes wasteful technologies, are extremely high. In 2004 the United States, with approximately 4.5 percent of the world's population, was responsible for around 22 percent of the world's carbon dioxide emissions, which are fuelling global warming. Yet, according to United Nations' projections, the United States

NOTES

is expected to increase its 2004 population of 294 million to 420 million by the year 2050.

The amount spent on global goods and services increased considerably from the latter half of the 20th century. Such consumption helps to meet basic needs and create jobs; however, this unprecedented consumer appetite undermines the natural systems and resources, which makes it even harder for the world's poor to meet their basic needs.

From this perspective, some commentators have pointed out that the additional 126 million Americans will have a much greater impact on resources and create much more pollution than the larger projected population increase of a country such as Bangladesh, which is expected to more than double its 1994 population of 141 million over the same period—but where each additional person consumes relatively little and wastes less. According to one estimate, a newborn American child will have 30 times more impact on the Earth's environment in his or her lifetime than a child born in India.

Taken together, although the developed nations make up less than a quarter of the Earth's population, they consume three quarters of raw materials and energy and create a similar proportion of the solid wastes. Outside North America, developed country population growth rates are generally low, with many countries in Europe at or below replacement levels of fertility, or heading for an absolute decline.

Population Growth and Food Needs

In many developing countries rapid population growth makes it difficult for agricultural production to keep pace with the rising demand for food. Most developing countries already are cultivating virtually all arable land and are bringing ever more marginal land under cultivation.

"Unfortunately, population growth continues to out-strip food availability in many countries," reported Jacques Diouf, director-general of the United Nations Food and Agriculture Organization (FAO), at the 1996 World Food Summit in Rome. For example, between 1985 and 1995, food production lagged behind population growth in 64 of 105 developing countries studied by FAO. Among regions, Africa fared the worst. Food production per person fell in 31 of 46 African countries.

Concerns about lagging agricultural production and rapid population growth, as well as inadequate food distribution systems, have focused international attention on the concept of food security. FAO defines food security as a "state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and active life". By this definition about two billion people—

one person in every three—lack food security. Either they cannot grow enough food themselves, or they cannot afford to purchase enough in the domestic marketplace. As a result, they suffer from micronutrient and protein energy deficiencies in their diets.

Although the global economy probably produces enough food to feed the nearly 6 billion people in the world and even more, if it were distributed equitably, this food is not readily available to many millions of people. Natural resources, population, and agricultural production technologies are distributed unevenly around the world. Some countries produce more food than they need for domestic use, while others do not produce enough to assure access to adequate diets for all of their people. Thus better distribution of food is an essential component of any world strategy to improve food security.

While the way most people live and work has little impact on food distribution policies, people in their everyday lives do make a great difference in the demand for and supply of food, both as consumers and producers. While changes in food distribution policies are decided in national capitals and at international negotiations, communities and individuals can do much themselves to influence the demand for and supply of food. Therefore programs and policies that enable people to improve agricultural productivity, manage natural resources, and plan their families are essential to improving food security.

Population: The Demand Side

Population growth, along with changes in people's living standards and dietary preferences, largely determine changes in the demand for food. Throughout history societies have raced to keep the food supply equal to or ahead of population growth. The race has not always been won, as the history of widespread malnutrition and famines attests.

Currently, world population is growing by over 80 million people a year—that is, by one billion people every 12 to 13 years. Such change is unprecedented. It was not until about 1800 that the world's total population reached 1 billion. It took approximately another century to reach 2 billion. In the past 50 years more people have been added to the world's population than during the previous 4 million years.

The world's population is expected to reach 6 billion in 1999. According to UN projections, by 2025 the world would contain over 8 billion people, of whom some 6.8 billion would live in developing countries.

Since the 1960s the rate of population growth has slowed. In what demographers have termed a reproductive revolution, fertility in developing countries has declined as contraceptive use has risen. Family planning programs

NOTES

have helped millions of couples avoid unintended pregnancies and thus have contributed importantly to reducing fertility rates. Because of family planning programs in the past, the world now contains 400 million fewer people than it would otherwise.

World population is growing by 1.5% per year today compared with 2% per year in the 1960s. In some developing countries, however, primarily in sub-Saharan Africa, population is still growing at 2% to 3.5% per year, rates at which populations would double in 20 to 35 years. Even growth rates of 2% or less create a powerful momentum for future population increase, particularly as they are applied to ever larger numbers of people.

Changing diets. As living standards have risen in many parts of the world, more people have chosen to eat meat and dairy products regularly rather than to continue living almost entirely on grains such as rice, corn (maize), and wheat. As people consume meat and dairy products instead of consuming grain directly, more grain must be produced to maintain the same caloric value. When used to feed livestock, grain provides humans less than half as much food energy as when consumed by people directly.

Reflecting changing diets as well as population increases, the world's consumption of meat has nearly quadrupled in the second half of this century—from an estimated 44 million metric tons in 1950 to about 200 million metric tons in 1995. Today nearly 40% of the world's grain production goes to feed livestock. This trend makes it more difficult to feed the world's poor, who often cannot afford to eat meat at all.

Food Production: The Supply Side

For most of the past 50 years food production has outpaced rising demand. World population has doubled since World War II, but food production has tripled. In the developing world the calories available per person increased from an average of 1,925 calories in 1961 to 2,540 in 1992. World food production has expanded since the early 1960s due mainly to the Green Revolution—adoption of crop rotation, the mass production and use of petroleum-based fertilizers and chemical pesticides, expanded irrigation, and the introduction of genetically superior, disease-resistant cultivars (cultivated crops).

The trend may now be changing for the worse, however. Since about 1990 global grain production has risen only slightly and, despite slower rates of population growth, grain supplies per capita have fallen. In the worst case, Africa now produces nearly 30% less food per person than it did in 1967. The reasons for the change in the trend include not only rapid population growth on the demand side, but also higher population densities in traditional agricultural areas,

NOTES

fragmentation of small farmsteads, poor land management, and inappropriate agricultural and economic policies, all of which suppress supply.

With one-third of world population lacking food security now, FAO estimates that world food production would have to double to provide food security for the 8 billion people projected for 2025. By 2050, when world population is projected to be over 9 billion, the situation would be even more challenging. At current levels of consumption, without allowing for additional imports of food, Africa would have to increase food production by 300% to provide minimally adequate diets for the 2 billion people projected in 2050; Latin America would have to increase food production by 80% to feed a projected 810 million people; and Asia's food production would have to grow by 70% to feed the 5.4 billion people projected. Even North America would have to increase food production by 30% to feed a projected 384 million people in 2050.

Rapid population growth not only pushes up demand for food but may also be starting to diminish supply as well. As people try to obtain higher yields from heavily used natural resources, soil loss worsens, fresh water becomes scarcer, and pollution increases. As a result the developing world's capacity to expand food production may well be shrinking, not expanding.

Food Distribution

Food security could be improved for millions of people if food from countries with a surplus were better distributed to countries where there are food deficits—that is, countries that do not produce enough food to meet domestic needs. The international trade system, however, works against the ability of poor countries to meet their food needs with imports.

Most rich countries produce enough food for themselves and for export as well. Affluent manufacturing countries that are not self-sufficient in food production can afford to import as much food as they need, and more. Also, developed countries protect their agricultural sectors with various economic incentives and trade barriers—including price supports for key commodities, such as wheat and corn, and tariffs to shield domestic growers from cheaper imports.

In contrast, the poorest countries, particularly those with food deficits, usually export only one or two raw commodities, such as rubber or cacao. When prices of export commodities decline on the world market, or when prices of vital imported supplies rise, they are hit hard. During the 1980s raw commodities exported by developing countries lost 40% of their value in relation to the manufactured goods that these countries imported. Between 1982 and 1992 the real value of cacao fell by 60%, cotton by 40%, and natural rubber by 45%. In

NOTES

1991 – just one year – Africa lost an estimated US$5.6 billion because of declines in commodity prices. Recently, however, some raw commodity prices have risen, providing relief to developing-country trade balances.

Declining commodity prices usually are good for consumers in wealthy countries, but in poor countries small-scale farmers suffer. In the 1970s and 1980s, for example, while real farm incomes increased substantially in most developed countries, real income from agriculture dropped for the average farmer in the developing world. To maintain their purchasing power, these poor farmers often try to bring more marginal land into production, even though this land yields less per hectare. Farmers may be pushed off their land altogether to make room for export driven agriculture, as governments try to make up the short-fall in international trade revenues.

National governments and international organizations can help to improve food distribution systems and can adopt new policies that make food more available and affordable. Over the long run, FAO argues, increased regional trade and cooperation are important to raising living standards in poor countries and to providing more affordable food. In addition, better world markets for developing-country agricultural produce could help provide more jobs in these nations, raise incomes, reduce hunger, and minimize pressures from subsistence farming on the resource base.

At the same time, however, FAO contends that international trade alone "cannot solve the problems of poverty and access to food which are the keys to food security". Given current population growth trends and land degradation patterns, FAO has warned that "future nutritional requirements challenge....both food production and environmental capabilities".

1.6 FOOD AVAILABILITY

The food available for human use reflects what is left from available supply after deducting exports, industrial uses, farm inputs, and end of year inventories. Human food use is not directly measured or statistically estimated. Instead it is a residual component after subtracting out other uses from the available total supply. The availability of food for human use represents disappearance of food into the marketing system, and it is often referred to as food disappearance. Food disappearance measures food supplies for consumption through all outlets— home and away from home. Per capita food use, or consumption, is calculated by dividing the total annual food disappearance by the total population.

Estimates of consumption (disappearance) are prepared at two levels for most commodities: the primary weight and the retail equivalent weight. The basic measurement is at the primary distribution level. Some foods, such as eggs

and produce, are measured at the farm gate. However, most processed commodities are measured at the processing or manufacturing plant. Once the primary level of distribution has been selected, quantities of all other components in the balance sheet for that commodity are converted to the primary-weight basis, using appropriate conversion factors.

Food is available when there are adequate quantities of good quality foodstuffs so as to provide the nourishing elements and calories necessary. Total availability combines both foods available from production and from imports. At the national level, food balance consists of two parts:

- Usage
- Resource, also called Net Domestic Availability

Food security depends on four key factors:

- Food availability;
- Access to sufficient food;
- Stability of food stocks;
- Utilisation of food, which is related to cultural practices.

At the household level the 'resource' part of the food balance changes so that:

- Domestic production means food produced and/or acquired by means of physical efforts by household members. This can be from crop production, animal production, fishing, or hunting and gathering of NTFPs that are then consumed by household members.
- Food can be acquired by means of exchange in the form of barter or market exchange. Some food items acquired by household members are in surplus and are traded for other ones that are in shortage or not available at all, or exchanged for cash. Cash income can also be generated from economic activities like working as a labourer for other farms, small commerce, service activities (transport), processing, and making handicrafts.
- The surplus of food produced or acquired may be processed for preservation so that it can be stocked for consumption during periods of shortage. For example, a household can stock dried rice for a year. The amount of rice at the beginning of the period minus the amount of rice at the end equals the variation of the stock. This is the amount of rice consumed during that period.

In the 'usage' part, the NDA is composed of products for food use (human and animal) and non-food use (processing at household level). To evaluate food availability, the per-capita annual food availability (PCAFA) ratio is used: the ratio

between the net domestic availability and the total resident population. Food availability can also be expressed in per-capita daily food availability by dividing the PCAFA by the number of days in a year.

NOTES

Food Accessibility

Accessibility is an important element because, even though food is in sufficient quantity, all individuals and families need to have access to food both physically and economically. All stages of the food chain supply system have some influence on physical accessibility, particularly transportation, storage, transformation and marketing of these food commodities. As for the economic accessibility, or purchasing power, household income is considered the most important factor affecting people's accessibility to healthy and nourishing foods. People are food secure when they are secure that they will be able to have access to the food they need to lead healthy lives at all times. Food security is jointly determined by availability of food and access to food. Availability of food does not guarantee access to food, but access to food is, of course, contingent on there being food available.

Access to food by households and individuals is usually, but not always, conditioned by income; the poor often lack adequate means to secure their access to food in sufficient quantities. When assessing the state of food security and planning policies and strategies to assure food security, both availability of food and access to food must be considered.

World Food Security Situation Today

The world is not food secure. Over 700 million people are undernourished, unable to grow or buy the food they need to lead healthy lives, and more than 180 million children under five years of age are underweight. South Asia is home to half of the world's hungry people and underweight children, but their numbers have been growing rapidly in recent years in Sub-Saharan Africa. Hunger is a consequence of poverty. Over 1.1 billion people worldwide live in households that earn a dollar a day or less per person. They are absolutely poor. In addition, there are many hundreds of millions of people who live at the borderline of poverty and food insecurity: any sudden shock such as loss of employment or a natural disaster could tip them into food insecurity. These vulnerable people must not be forgotten when assessing the state of world food security.

Considerable progress has been made in reducing the number of underfed people, especially in Asia. The number of underfed people has been reduced by over 150 million, from an estimated 941 million people in 1969-71 to 786 million in 1988-90. But for almost one-fifth of the developing world's population to be chronically hungry negates any assertion that the world is now food secure.

NOTES

In the next quarter century, the world's population is expected to grow by 2.3 billion to reach more than 8 billion in 2020. Almost 100 million people more than 10 times Sweden's total population today are likely to be added every year, mostly in the developing world. The close links between population and food security require that we confront several urgent issues:— will there be enough food available to meet the needs of an increased world population; will all people have access to the food they need to lead healthy, active lives; and where will the increased food production come from given increasing technological and economic constraints to large-scale conversion of potentially cultivable land?

If available food were evenly distributed and fully consumed (not wasted), then about 2,700 calories should be available per person per day and nobody should have to go hungry. But available food is neither evenly distributed nor fully consumed among or within countries, households, and individuals. At the beginning of this decade, there were 25 developing countries unable to assure sufficient food energy (2,200 calories per person per day) for their populations, even if available food energy were evenly distributed within each country.

Food production growth in recent decades has been impressive. In the developing world, production of major staples such as rice, maize, and wheat has increased impressively as a result of the green revolution. In many developed countries, surplus production is being recorded year after year, partly due to large subsidies. Food production increased by 24 percent worldwide, and by 39 percent in developing countries, during the most recent decade, the 1980s. Particularly large increases were observed in China and the Far East, 54 and 46 percent, respectively. Even in Africa, where concerns regarding the future food situation are greatest, food production increased 33 percent.

However, food production growth is much less impressive when compared to population growth. During the 1980s, per capita food production for the world increased by only 5 percent, while in the developing countries it increased by 13 percent. Food production performance varied widely across developing regions: while per capita food production increased by an astonishing 35 percent in China, in Africa and the Near East less food was produced per person at the end of the 1980s than at the beginning. Population growth outstripped food production growth in two-thirds of the developing countries. Thus, the bright global food production trends are, after accounting for population growth, somewhat less bright in their implications for food security.

Yield increases have driven food production increases in recent decades. About 92 percent of the increased cereal production in developing countries during 1961-91 resulted from increases in yields; area expansion accounted for only 8 percent. Yields of major staples such as rice, maize, and wheat have climbed steadily upward in developing countries since the 1960s. Yield increases have

NOTES

been notably high in Asia: between 1961 and 1991, maize yields almost tripled from 1.2 tons to 3.4 tons per hectare; wheat yields increased five-fold from 0.5 tons to 2.5 tons per hectare; and rice yields doubled from 1.7 tons to 3.6 tons per hectare. In Africa, however, yield performances have been poor and variable and it is not surprising to find that about half of the increased cereal production since 1961 came about by bringing new land into cultivation. While cultivated area is still increasing in most developing countries, it is doing so at a low and declining rate. The option of area expansion is rapidly disappearing, and even Africa will have to rely mostly on increased yields to expand food production.

Given the importance of yield growth to future production increases, it is disturbing to observe that yield growth rates for major cereals have begun to stagnate in some areas. For instance, in Asia, which is a major rice producer, the annual rate of increase in rice yields has declined from about 3 percent between the mid-1970s and early 1980s to less than 2 percent in the late 1980s; since 1989, yields have stagnated at around 3.6 tons per hectare. A similar situation is observed for wheat: annual yield growth rates have slowed down from 6.2 percent in the early 1960s to 2.7 percent in the 1980s; since 1989, yields have remained around 2.5 tons per hectare. A slowdown in yield growth rates could have important implications for future world food security.

In sum, global food availability has not led to universal food security there are marked national, regional, household, and individual differences in access to food.

Factors Influencing Future World Food Security

Food security depends on both the supply of and demand for food. Among the major driving forces expected to influence future food consumption are population growth, urbanization, and income growth. The importance of these forces varies by region: the overwhelming driving force is expected to be population growth and urbanization in Sub-Saharan Africa; income and population growth in South Asia and Latin America; and income growth and changing lifestyles in East Asia.

Absolute population increases in the next quarter century will be highest in Asia, 1.6 billion, but the relative increase will be greatest in Africa, where the population will more than double from 0.6 billion to 1.4 billion. Population growth of this magnitude will severely constrain efforts to increase income and improve welfare while at the same time greatly increase the need for food. Sub-Saharan Africa is particularly unlikely to be able to cope with the projected large population growth without significant increases in poverty and decreases in living standards unless a massive influx of aid from the rest of the world occurs.

NOTES

The 40 percent increase in world population between now and 2020 will require a more than 40 percent increase in world food production to meet not only the needs of the population increase between now and 2020 but also to improve the food security of the more than 700 million people who are food insecure and hungry today as well as to satisfy growing demands for livestock products and other diversified products brought about by rising incomes, urbanization, and changing lifestyles. Factors in addition to population growth are pushing up demand for grain: while future demand for grain for direct consumption is expected to grow at a rate only slightly above population growth, future demand for feedgrain is expected population growth.

Urbanization is an important demographic trend; already about 42 percent of the world's population lives in urban areas; within a few years about half of the world will be urbanized. Urban population growth is particularly high in East Asia and Sub-Saharan Africa. Rapid urban growth places severe pressures on food marketing systems (especially transportation, storage, processing, grading, and market information); on rural areas to produce more food to feed urban populations that have little access to land to grow their own food; and on agricultural systems to produce more livestock products, diversified foods, and foods that are convenient and easy to prepare.

Income growth, through conditioning access to food, is another major force influencing future food consumption. During the 1980s, economic growth was disappointing in most countries with several regions, notably Sub-Saharan Africa and Middle East and North Africa, experiencing real declines in per capita incomes. Prospects for the 1990s appear better: high rates of growth are expected to continue in Asia while elsewhere growth is expected to substantially improve, even in Sub-Saharan Africa where the growth rate is projected to turn positive. Future economic growth will depend on successful completion of structural adjustment and economic reforms currently underway in many developing countries as well as on trade liberalization and the removal of trade distortions.

Among the major forces expected to influence food production in coming years are investment in agriculture, considerations related to the environment and natural resource base, and government policy. Agricultural growth and development must be vigorously pursued to meet growing food needs, alleviate poverty through employment creation and income generation in rural areas, and stimulate overall economic growth. Agricultural growth is the most efficient and effective means of promoting general economic growth and, hence, of improving food security of the poorest people in low-income developing countries. Various investments are needed to facilitate agricultural and rural growth, such as agricultural research and technology to generate yield-increasing production technology and improved crop varieties, improved rural infrastructure to facilitate access to markets, modern inputs, credit, and technical assistance.

NOTES

Natural resource management and environmental considerations are also expected to influence food production. About 2 billion hectares of land worldwide 17 percent of vegetated soils have been degraded by human induced actions since 1945. Much of the degradation in the developing world overgrazing, deforestation, and over-exploitation for fuel-wood results from poverty and from lack of opportunities to intensify agriculture. As population, poverty, and food demands continue to grow, failure to develop and implement appropriate technology in production and marketing could lead to either more food insecurity and hunger, for which the current generation of poor people will pay, or to further degradation of natural resource base, for which future generations will pay. Trade offs between meeting future food demands and maintaining production capacity can be avoided and sustainability in food production can be assured only if investment in appropriate research and technology is accelerated, relevant externalities are internalized into production and consumption decisions or effectively dealt with by government policy, and poverty is significantly reduced or eradicated. Agricultural intensification production of more food on land already under cultivation is key to simultaneously alleviate poverty, meet current and future food needs, and avoid degradation of natural resources.

Government policy is the third driving force. Policies that remove distortions in input and output markets and asset ownership, improve the productivity of human resources, and enhance access by the poor to productive resources such as land and capital are urgently needed to improve incomes and food security and to reduce unit costs of food production. This calls for policies that expand investment in rural infrastructure, primary health care, education, agricultural research, improved production technology, technical assistance, and credit, among others.

Prospects for Future World Food Security

Views vary widely on what the future world food situation could look like. Some predict rapidly increasing food scarcity and real prices in coming years. Others argue that regardless of what the world does today, resources will be incapable of supporting the needs of future generations. Yet others contend that there are no serious problems ahead. Projections by the International Food Policy Research Institute suggest that developed countries as a group will continue to produce more cereals than they consume. Production is projected to increase from 870 million tons in 1988 to 1,167 million tons in 2010, and consumption from 793 million tons to 984 million tons. Developed countries are projected to more than double their net cereal exports from 78 million tons to 183 million tons over this period. Annual growth rates for per capita maize production are expected to exceed 1 percent, while those for wheat, rice, and other coarse grains are expected to range between 0.5 and 1.0 percent.

Developing countries are likely to increase their cereal production from 813 million tons in 1988 to 1,221 million tons in 2010. Despite production increases of more than 400 million tons, they are expected to consume more than they produce. The gap between their cereal production and consumption is projected to widen over time, and net imports will become increasingly important. The share of total cereals consumed that originate from net imports is projected to rise from 9 percent in 1988 to 13 percent in 2010. Wheat will constitute over 55 percent of net cereal imports in 2010, but coarse grain imports are projected to triple in volume during 1988-2010 and their share of net cereal imports to increase from 28 percent to 42 percent over the period. Between 1988 and 2010, cereal production in developing countries will increase 50 percent while consumption will increase 58 percent. Developing countries will account for almost 60 percent of the increase in cereal production but for over 70 percent of the increase in cereal consumption.

Among developing regions, South Asia is expected to switch from a minor net exporter of cereals in the late 1980s to a net importer by 2010: growth in net cereal imports is driven primarily by wheat imports, which are projected to increase from about 3 million tons in 1988 to 20 million tons in 2010. Sub-Saharan Africa is expected to increase net cereal imports from 11 million tons to 26 million tons, while Asia as a whole is expected to increase net cereal imports from 17 million tons to 70 million tons over the same period.

The better-off developing countries, such as many East Asian countries, will be able to meet the gap between production and demand through commercial imports. Net imports are a reflection of the gap between production and demand. The gap between production and need will be even wider, as many of the poor are priced out of the market and are unable to exercise their demand for needed food. Poorer countries will lack sufficient foreign exchange to import food in needed quantities. Much of Sub-Saharan Africa and parts of South Asia will require special assistance to avert widespread hunger and malnutrition. It is unlikely that they will have the necessary foreign exchange to import large amounts of food. Neither is it likely that enough food aid will be forthcoming to make up the gap between supply and need.

Projections for future food supply and consumption are extremely sensitive to assumptions made about future yield increases. The projections reported here are based on the assumption that yields will continue to rise at the rate of the mid to late-1980s. Slower yield growth rates in Asia such as those experienced during the last few years would have a major impact on food availability and prices. On the other hand, increasing yield growth rates in Africa could save many millions from starvation.

Where are food prices headed? They have been on a downward trend for several years now, partly reflecting food production growth and partly reflecting lack of purchasing power among a large share of the population.

NOTES

While it is difficult to predict where food prices are headed, there is no reason to expect significant increases in the next few years, if yield growth rates of the mid to late 1980s resume. The recently concluded GATT agreement could place upward pressure on international food prices, but agricultural subsides in the European Union and the United States are being reduced at a rate and speed far below what was visualized at the outset of the Uruguay Round more than eight years ago, so that the effect will be much less than the 15-20 percent price increase projected under total liberalization. Initial assessments of the combined effects of the GATT agreement and recent reforms of the Common Agricultural Policy of the European Union indicate that world market food prices will be about 5 percent higher by 2000 than they would have been in the absence of the reforms.

However, such upward pressure on prices is unlikely to be seen because Eastern Europe and the former Soviet Union will increase agricultural production considerably faster than demand during the same period, placing downward pressure on world food prices. Food shortages in Sub-Saharan Africa are unlikely to significantly influence international demands and prices due to lack of foreign exchange, unless increasing amounts of food aid compete with commercial trade. These falling price trends do not preclude periodic price increases.

Poverty in the developing world is not expected to diminish much in the near future. The total number of poor people is expected to remain around 1.1 billion in 2000, but regional shifts in the distribution of poverty are anticipated. Sub-Saharan Africa will increasingly become a new locus of poverty: the number of poor is expected to increase by 40 percent, from 216 million to 304 million, and the region's share of the developing world's poor is expected to increase from 19 percent to 27 percent. Projections by the UN ACC/SCN (1992) suggest that the number of underweight pre-school children in Sub-Saharan Africa is likely to increase during the 1990s. The situation in South Asia remains precarious, with almost half of the pre-school children still projected to be underweight in 2000. However, the picture is not completely bleak across the developing world. In East Asia, for instance, the number of poor is projected to decline from 169 million to 73 million during the 1990s.

In sum, the outlook for developed countries is favourable: they will continue to produce more cereals than they need, driving down world prices. However, even at lower prices, the outlook for developing countries, particularly for some groupings such as Sub-Saharan Africa, is not favourable. Although total consumption of cereals in developing countries as a group is projected to increase

NOTES

58 percent between 1988 and 2010, per capita consumption of cereals is projected to increase only 10 percent. Thus, it is quite likely that many people will continue to remain food insecure.

Concluding Remark

Today, the challenge is to both grow more food and assure that the food is accessible by all people at all times. Even though enough food is available to feed the world, that does not help the many people who cannot get access to it. We must focus on both better distribution of available food and increased production of food to meet the needs of the evergrowing population and to generate the incomes needed by the poor to convert their food needs into effective demand, recognizing that available food will not be evenly distributed. Agricultural development is key for both producing more food and ensuring better access to food via employment creation and income growth. Most of the world's food insecure people are based in rural areas and even if they do not grow their own food they are dependent on rural employment and income generated by agricultural activities.

To achieve a sustainable balance between world food production and food needs in the coming years, it is essential to (1) stimulate economic growth in those regions, especially Sub-Saharan Africa, where growth slowed in recent years; (2) adopt effective policies to reduce population growth and migration to urban areas; (3) commit resources to development of infrastructure, agricultural research and technology, and provision of modern inputs, credit, and technical assistance to farmers; (4) complete economic reforms; and (5) develop measures to manage natural resources and prevent environmental degradation.

Whether the world is more food secure in coming years depends on us and on actions we take or do not take - now to assure that all people have access to the food they need to lead healthy lives.

1.7 FOOD INSECURITY

In its simplest form, food security has been defined as "access by all people at all times to the food needed for a healthy life". As a concern mainly with the provision of sufficient food in terms of energy, food security discussions can be traced back to the food crisis in 1972-74. Since then the concept has changed, aspects of nutritional adequacy, access and entitlement to food have received increasing attention, and food security assessment and operational considerations in addressing food-insecurity, have thereby have become more complex.

At least three different dimensions need to be considered in any discussion on distribution of food insecurity. These are the aspects of hunger to be included, the level of aggregation to be used, and the time period or security concept to consider.

NOTES

Several aspects of hunger are implied in the definition of food security given above. These include famine, energydeficiency (or undernutrition both chronic and seasonal), micro nutrient deficiency and nutrient depleting illnesses. Freedom from all of them are necessary for a healthy life.

Under nutrition is measured either by shortcomings in food supply vs food needs or by actual body measurements anthropometry. The definition of 'energy deficient' or 'under nourished' which is used in terms of food needs is "people with a food energy consumption, average over a year, which is inadequate to support light activity and maintain body weight." The 'cut off point' is set at 1.54 of BMR (Basal Metabolic Rate). Body measurements or anthropometry looks at growth in terms of weight/height, height for age or weight for age compared to a reference population. Anthropometric information is most commonly available for children <5 years. Weight for age below -2 s.d. is a common 'cut off point' for child malnutrition. Micro nutrient deficiencies result from deficiencies of specfic minerals or vitamins in a diet which may be sufficient in energy. Globally iron deficiency anaemia, vitamin A deficiency and iodine deficiency are most widespread. Nutrient depleting illnesses are those which interfere with the absorption of nutrients in the body or with food intake. Major such illnesses include diarrhoeas, measles and malaria. Included in this group of depleting factors are also a number of parasites.

Food security questions are monitored and addressed at global, regional, national, household and individual levels. Naturally this requires a number of different indicators, varying with the definition used, the level of aggregation, and the purpose for monitoring. The common set of indicators at national level focuses on food supply (*e.g.*, agricultural production data, food balance sheets, market information) and dietary energy supply per capita. Another common category relates to outcome, including health information (micro nutrient deficiencies and nutrition related diseases) and nutrition status information, household budget and consumption data. Less frequently different indicators on loss management strategies, distress management or household perceptions are used. Examples on such indicators which may be included in early warning systems are changes in market prices, distress sales of livestock, out migration, and local peoples own perceptions of changes in their food security situation. The third dimension, implicit in many discussions of food insecurity, is time. Here the conceptual understandings vary but commonly distinctions are made between transitory or seasonal food insecurity and questions of chronic food insecurity are addressed. In addition to seasonal or trend analysis of different supply and outcome indicators, different fall-back mechanisms, or adaptations has been used as indicators of these aspects. In the wider security dimension, issues of sustainable food supply systems for rapidly growing populations in resource poor areas are more recently considered.

CHILDREN ARE SPECIALLY VULNERABLE

Also within households food is not equally distributed and some members and groups are more at risk of food insecurity than others. Of special concern is the situation of young children. Nutrition surveys in low income countries in 1990 showed that nearly 200 million or 34 percent of children under five year of age were undernourished. Regional data shows that the highest percentage and the largest number of underweight children is in South Asia, but also that the rate of improvement is high there as in several other regions, including East Asia and Latin America.

Child nutrition is an outcome of many factors, and only some of these are directly linked to food security. However, with a definition of food security which includes an adequate diet (and thus also micronutrients) and also where illnesses which interfere with nutrient uptake or food intake are considered, young children are clearly a major risk group.

Children together with adult women are the major risk group for micro nutrient deficiencies or 'hidden hunger'. About 10 percent of the world population suffer from goitre due to iodine deficiency and around 300 million suffer from lowered mental ability from the same deficiency, many of them school age children. Children are also the victims of Vitamin A deficiency, and around 200 million pre-school children are at risk of developing clinical signs. Many of these children die, often in connection with infections and illnesses as there are strong interrelations between vitamin A deficiency and lowered immune functions. Iron deficiency anaemia, due to deficient diets or heavy parasite loads, also affect large groups of children and women.

1.8 MEAL PATTERN

Promoting healthy diets and lifestyles to reduce the global burden of noncommunicable diseases requires a multisectoral approach involving the various relevant sectors in societies. The agriculture and food sector figures prominently in this regard and must be given due importance in any consideration of the promotion of healthy diets for individuals and population groups. Food strategies must not merely be directed at ensuring food security for all, but must also achieve the consumption of adequate quantities of safe and good quality foods that together make up a healthy diet. Any recommendation to that effect will have implications for all components in the food chain. It is therefore useful at this juncture to examine trends in consumption patterns worldwide and deliberate on the potential of the food and agriculture sector to meet the demands and challenges.

Economic development is normally accompanied by improvements in a country's food supply and the gradual elimination of dietary deficiencies, thus

NOTES

improving the overall nutritional status of the country's population. Furthermore, it also brings about qualitative changes in the production, processing, distribution and marketing of food. Increasing urbanization will also have consequences for the meal patterns and lifestyles of individuals, not all of which are positive. Changes in diets, patterns of work and leisure often referred to as the "nutrition transition" are already contributing to the causal factors underlying noncommunicable diseases even in the poorest countries. Moreover, the pace of these changes seems to be accelerating, especially in the low-income and middle-income countries.

The dietary changes that characterize the "nutrition transition" include both quantitative and qualitative changes in the diet. The adverse dietary changes include shifts in the structure of the diet towards a higher energy density diet with a greater role for fat and added sugars in foods, greater saturated fat intake (mostly from animal sources), reduced intakes of complex carbohydrates and dietary fibre, and reduced fruit and vegetable intakes. These dietary changes are compounded by lifestyle changes that reflect reduced physical activity at work and during leisure time. At the same time, however, poor countries continue to face food shortages and nutrient inadequacies.

Diets evolve over time, being influenced by many factors and complex interactions. Income, prices, individual preferences and beliefs, cultural traditions, as well as geographical, environmental, social and economic factors all interact in a complex manner to shape dietary consumption patterns. Data on the national availability of the main food commodities provide a valuable insight into diets and their evolution over time. FAO produces annual Food Balance Sheets which provide national data on food availability (for almost all commodities and for nearly all countries). Food Balance Sheets give a complete picture of supply (including production, imports, stock changes and exports) and utilization (including final demand in the form of food use and industrial non-food use, intermediate demand such as animal feed and seed use, and waste) by commodity. From these data, the average per capita supply of macronutrients (*i.e.*, energy, protein, fats) can be derived for all food commodities. Although such average per capita supplies are derived from national data, they may not correspond to actual per capita availability, which is determined by many other factors such as inequality in access to food. Likewise, these data refer to "average food available for consumption", which, for a number of reasons (for example, waste at the household level), is not equal to average food intake or average food consumption. In the remainder of this chapter, therefore, the terms "food consumption" or "food intake" should be read as "food available for consumption".

Actual food availability may vary by region, socioeconomic level and season. Certain difficulties are encountered when estimating trade, production and stock changes on an annual scale. Hence three-year averages are calculated in order to

NOTES

reduce errors. The FAO statistical database (FAOSTAT), being based on national data, does not provide information on the distribution of food within countries, or within communities and households.

Developments in the Availability of Dietary Energy

Food consumption expressed in kilocalories (kcal) per capita per day is a key variable used for measuring and evaluating the evolution of the global and regional food situation. A more appropriate term for this variable would be "national average apparent food consumption" since the data come from national Food Balance Sheets rather than from food consumption surveys. Analysis of FAOSTAT data shows that dietary energy measured in kcals per capita per day has been steadily increasing on a worldwide basis; availability of calories per capita from the mid-1960s to the late 1990s increased globally by approximately 450 kcal per capita per day and by over 600 kcal per capita per day in developing countries (*see Table* 2). This change has not, however, been equal across regions. The per capita supply of calories has remained almost stagnant in sub-Saharan Africa and has recently fallen in the countries in economic transition. In contrast, the per capita supply of energy has risen dramatically in East Asia (by almost 1000 kcal per capita per day, mainly in China) and in the Near East/North Africa region (by over 700 kcal per capita per day).

Table 2. Global and Regional Per-capita Food Consumption (kcal per-capita per day)

Region	*1964 - 1966*	*1974 - 1976*	*1984 - 1986*	*1997 - 1999*	*2015*	*2030*
World	2358	2435	2655	2803	2940	3050
Developing countries	2054	2152	2450	2681	2850	2980
Near East and North Africa	2290	2591	2953	3006	3090	3170
Sub-Saharan Africa[a]	2058	2079	2057	2195	2360	2540
Latin America and the Caribbean	2393	2546	2689	2824	2980	3140
East Asia	1957	2105	2559	2921	3060	3190
South Asia	2017	1986	2205	2403	2700	2900
Industrialized countries	2947	3065	3206	3380	3440	3500

NOTES

Transition countries	3222	3385	3379	2906	3060	3180
Excludes South Africa.						

Source: reproduced, with minor editorial amendments from reference 3 with the permission of the publisher.

In short, it would appear that the world has made significant progress in raising food consumption per person. The increase in the world average consumption would have been higher but for the declines in the transition economies that occurred in the 1990s. It is generally agreed, however, that those declines are likely to revert in the near future. The growth in food consumption has been accompanied by significant structural changes and a shift in diet away from staples such as roots and tubers towards more livestock products and vegetable oils. *Table* 2 shows that current energy intakes range from 2681 kcal per capita per day in developing countries, to 2906 kcal per capita per day in transition countries and 3380 kcal per capita per day in industrialized countries. Data shown in *Table 3* suggest that per capita energy supply has declined from both animal and vegetable sources in the countries in economic transition, while it has increased in the developing and industrialized countries.

TABLE 3. VEGETABLE AND ANIMAL SOURCES OF ENERGY IN THE DIET (KCAL PER CAPITA PER DAY)

Region	*1977 - 1979*			*1987 - 1989*			*1997 - 1999*		
	T	*V*	*A*	*T*	*V*	*A*	*T*	*V*	*A*
Developing countries	2254	2070	184	2490	2248	242	2681	2344	337
Transition countries	3400	2507	893	3396	2455	941	2906	2235	671
Industrialized countries	3112	2206	906	3283	2333	950	3380	2437	943

T, total kcal; V, kcal of vegetable origin; A, kcal of animal origin (including fish products).

Source: FAOSTAT, 2003.

Similar trends are evident for protein availability; this has increased in both developing and industrialized countries but decreased in the transition countries. Although the global supply of protein has been increasing, the distribution of the increase in the protein supply is unequal. The per capita supply of vegetable

NOTES

protein is slightly higher in developing countries, while the supply of animal protein is three times higher in industrialized countries.

Globally, the share of dietary energy supplied by cereals appears to have remained relatively stable over time, representing about 50% of dietary energy supply. Recently, however, subtle changes appear to be taking place (*see Fig. 2*). A closer analysis of the dietary energy intake shows a decrease in developing countries, where the share of energy derived from cereals has fallen from 60% to 54% in a period of only 10 years. Much of this downwards trend is attributable to cereals, particularly wheat and rice, becoming less preferred foods in middle-income countries such as Brazil and China, a pattern likely to continue over the next 30 years or so. *Fig. 3* shows the structural changes in the diet of developing countries over the past 30-40 years and FAO's projections to the year 2030.

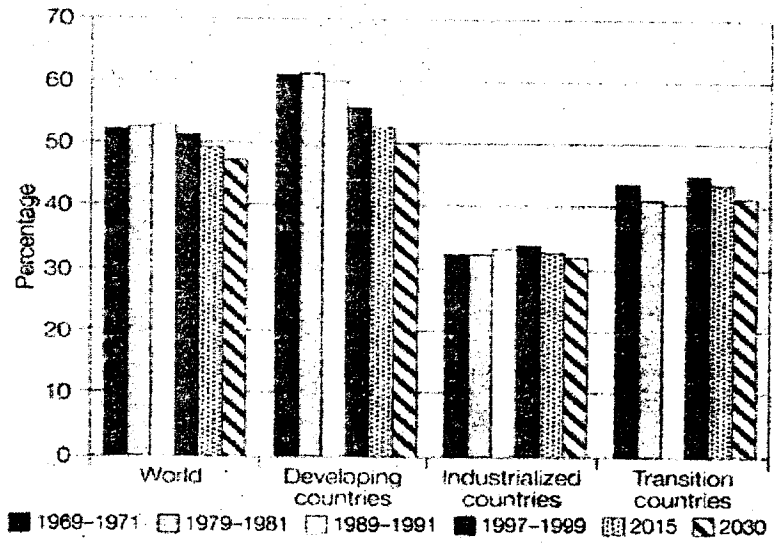


FIGURE 2. THE SHARE OF DIETARY ENERGY DERIVED FROM CEREALS

AVAILABILITY AND CHANGES IN CONSUMPTION OF DIETARY FAT

The increase in the quantity and quality of the fats consumed in the diet is an important feature of nutrition transition reflected in the national diets of countries. There are large variations across the regions of the world in the amount of total fats (*i.e.*, fats in foods, plus added fats and oils) available for human consumption. The lowest quantities consumed are recorded in Africa, while the highest consumption occurs in parts of North America and Europe. The important point is that there has been a remarkable increase in the intake of dietary fats over the past three decades *(see Table 4)* and that this increase has taken place practically everywhere except in Africa, where consumption levels have stagnated.

The per capita supply of fat from animal foods has increased, respectively, by 14 and 4 g per capita in developing and industrialized countries, while there has been a decrease of 9 g per capita in transition countries.

NOTES

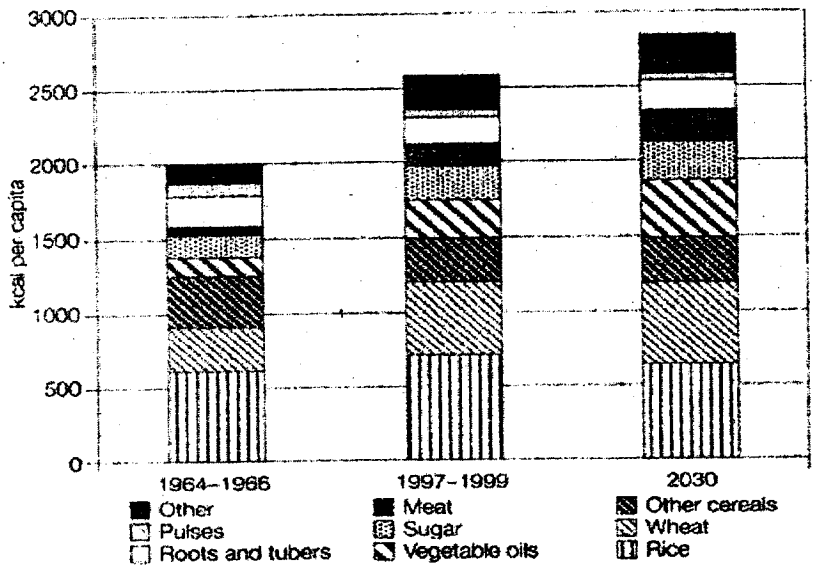


FIGURE 3. CALORIES FROM MAJOR COMMODITIES IN DEVELOPING COUNTRIES

TABLE 4. TRENDS IN THE DIETARY SUPPLY OF FAT

Region	*Supply of fat (g per capita per day)*				
	1967 - 1969	*1977 - 1979*	*1987 - 1989*	*1997 - 1999*	*Change between 1967 - 1969 and 1997 - 1999*
World	53	57	67	73	20
North Africa	44	58	65	64	20
Sub-Saharan Africa[a]	41	43	41	45	4
North America	117	125	138	143	26
Latin America and Caribbean	54	65	73	79	25

NOTES

China	24	27	48	79	55
East and South-East Asia	28	32	44	52	24
South Asia	29	32	39	45	16
European Community	117	128	143	148	31
Eastern Europe	90	111	116	104	14
Near East	51	62	73	70	19
Oceania	102	102	113	113	11
* *Excludes South Africa*					

Source: FAOSTAT, 2003.

The increase in dietary fat supply worldwide exceeds the increase in dietary protein supply. The average global supply of fat has increased by 20 g per capita per day since 1967-1969. This increase in availability has been most pronounced in the Americas, East Asia, and the European Community. The proportion of energy contributed by dietary fats exceeds 30% in the industrialized regions, and in nearly all other regions this share is increasing.

The fat-to-energy ratio (FER) is defined as the percentage of energy derived from fat in the total supply of energy (in kcal). Country-specific analysis of FAO data for 1988-1990 found a range for the FER of 7-46%. A total of 19 countries fell below the minimum recommendation of 15% dietary energy supply from fat, the majority of these being in sub-Saharan Africa and the remainder in South Asia. In contrast, 24 countries were above the maximum recommendation of 35%, the majority of these countries being in North America and Western Europe. It is useful to note that limitations of the Food Balance Sheet data may contribute much of this variation in the FER between countries. For instance, in countries such as Malaysia with abundant availability of vegetable oils at low prices, Food Balance Sheet data may not reflect real consumption at the individual household level.

Rising incomes in the developing world have also led to an increase in the availability and consumption of energy-dense high-fat diets. Food balance data can be used to examine the shift in the proportion of energy from fat over time and its relationship to increasing incomes.

In 1961-1963, a diet providing 20% of energy from fat was associated only with countries having at least a per capita gross national product of US$ 1475. By

1990, however, even poor countries having a gross national product of only US$ 750 per capita had access to a similar diet comprising 20% of energy from fat. (Both values of gross national product are given in 1993 US$.) This change was mainly the result of an increase in the consumption of vegetable fats by poor countries, with smaller increases occurred in middle-income and high-income countries. By 1990, vegetable fats accounted for a greater proportion of dietary energy than animal fats for countries in the lowest per capita income category. Changes in edible vegetable oil supply, in prices and in consumption equally affected rich and poor countries, although the net impact was relatively much greater in low-income countries. An equally large and important shift in the proportion of energy from added sugars in the diets of low-income countries was also a feature of the nutrition transition.

NOTES

Examinations of the purchasing habits of people, aimed at understanding the relationship between level of education or income and the different amounts or types of commodities purchased at different times were also revealing. Research conducted in China shows that there have been profound shifts in purchasing practices in relation to income over the past decade. These analyses show how extra income in China affects poor people and rich people in a differential manner, enhancing the fat intake of the poor more than that of the rich.

A variable proportion of these fat calories are provided by saturated fatty acids. Only in the two of the most affluent regions (*i.e.*, in parts of North America and Europe) is the intake of saturated fat at or above 10% of energy intake level. In other less affluent regions, the proportion of dietary energy contributed by saturated fatty acids is lower, ranging from 5% to 8%, and generally not changing much over time. National dietary surveys conducted in some countries confirm these data. The ratio of dietary fat from animal sources to total fat is a key indicator, since foods from animal sources are high in saturated fat. Data sets used to calculate country-specific FERs can also be used to calculate proportions of animal fat in total fat. Such analysis indicated that the proportion of animal fat in total fat was lower than 10% in some countries (Democratic Republic of Congo, Mozambique, Nigeria, Sao Tome and Principe, and Sierra Leone), while it is above 75% in some other countries (Denmark, Finland, Hungary, Mongolia, Poland and Uruguay). These findings are not strictly divided along economic lines, as not all of the countries in the high range represent the most affluent countries. Country-specific food availability and cultural dietary preferences and norms to some extent determine these patterns.

The types of edible oils used in developing countries are also changing with the increasing use of hardened margarines (rich in trans fatty acids) that do not need to be refrigerated. Palm oil is becoming an increasingly important edible oil

NOTES

in the diets of much of South-East Asia and is likely to be a major source in the coming years. Currently, palm oil consumption is low and the FER ranges between 15% and 18%. At this low level of consumption, the saturated fatty acid content of the diet comprises only 4% to 8%. Potential developments in the edible oil sector could affect all stages of the oil production process from plant breeding to processing methods, including the blending of oils aimed at producing edible oils that have a healthy fatty acid composition.

Olive oil is an important edible oil consumed largely in the Mediterranean region. Its production has been driven by rising demand, which has increasingly shifted olive cultivation from traditional farms to more intensive forms of cultivation. There is some concern that the intensive cultivation of olives may have adverse environmental impacts, such as soil erosion and desertification. However, agricultural production methods are being developed to ensure less harmful impacts on the environment.

Availability and Changes in Consumption of Animal Products

There has been an increasing pressure on the livestock sector to meet the growing demand for high-value animal protein. The world's livestock sector is growing at an unprecedented rate and the driving force behind this enormous surge is a combination of population growth, rising incomes and urbanization. Annual meat production is projected to increase from 218 million tonnes in 1997-1999 to 376 million tonnes by 2030.

There is a strong positive relationship between the level of income and the consumption of animal protein, with the consumption of meat, milk and eggs increasing at the expense of staple foods. Because of the recent steep decline in prices, developing countries are embarking on higher meat consumption at much lower levels of gross domestic product than the industrialized countries did some 20-30 years ago.

Urbanization is a major driving force influencing global demand for livestock products. Urbanization stimulates improvements in infrastructure, including cold chains, which permit trade in perishable goods. Compared with the less diversified diets of the rural communities, city dwellers have a varied diet rich in animal proteins and fats, and characterized by higher consumption of meat, poultry, milk and other dairy products. *Table 5* shows trends in per capita consumption of livestock products in different regions and country groups. There has been a remarkable increase in the consumption of animal products in countries such as Brazil and China, although the levels are still well below the levels of consumption in North American and most other industrialized countries.

As diets become richer and more diverse, the high-value protein that the livestock sector offers improves the nutrition of the vast majority of the world.

NOTES

Livestock products not only provide high-value protein but are also important sources of a wide range of essential micronutrients, in particular minerals such as iron and zinc, and vitamins such as vitamin A. For the large majority of people in the world, particularly in developing countries, livestock products remain a desired food for nutritional value and taste. Excessive consumption of animal products in some countries and social classes can, however, lead to excessive intakes of fat.

TABLE 5. PER CAPITA CONSUMPTION OF LIVESTOCK PRODUCTS

Region	Meat (kg per year)			Milk (kg per year)		
	1964 - 1966	1997 - 1999	2030	1964 - 1966	1997 - 1999	2030
World	24.2	36.4	45.3	73.9	78.1	89.5
Developing countries	10.2	25.5	36.7	28.0	44.6	65.8
Near East and North Africa	11.9	21.2	35.0	68.6	72.3	89.9
Sub-Saharan Africa[a]	9.9	9.4	13.4	28.5	29.1	33.8
Latin America and the Caribbean	31.7	53.8	76.6	80.1	110.2	139.8
East Asia	8.7	37.7	58.5	3.6	10.0	17.8
South Asia	3.9	5.3	11.7	37.0	67.5	106.9
Industrialized countries	61.5	88.2	100.1	185.5	212.2	221.0
Transition countries	42.5	46.2	60.7	156.6	159.1	178.7

[a] *Excludes South Africa.*

Source: Adapted from reference 4 with the permission of the publisher.

The growing demand for livestock products is likely to have an undesirable impact on the environment. For example, there will be more large-scale, industrial production, often located close to urban centres, which brings with it a range of environmental and public health risks. Attempts have been made to estimate the environmental impact of industrial livestock production. For instance, it has been estimated that the number of people fed in a year per hectare ranges from 22 for potatoes and 19 for rice to 1 and 2, respectively, for beef and lamb. The low

NOTES

energy conversion ratio from feed to meat is another concern, since some of the cereal grain food produced is diverted to livestock production. Likewise, land and water requirements for meat production are likely to become a major concern, as the increasing demand for animal products results in more intensive livestock production systems.

Availability and Consumption of Fish

Despite fluctuations in supply and demand caused by the changing state of fisheries resources, the economic climate and environmental conditions, fisheries, including aquaculture, have traditionally been, and remain an important source of food, employment and revenue in many countries and communities. After the remarkable increase in both marine and inland capture of fish during the 1950s and 1960s, world fisheries production has levelled off since the 1970s. This levelling off of the total catch follows the general trend of most of the world's fishing areas, which have apparently reached their maximum potential for fisheries production, with the majority of stocks being fully exploited. It is therefore very unlikely that substantial increases in total catch will be obtained in the future. In contrast, aquaculture production has followed the opposite path. Starting from an insignificant total production, inland and marine aquaculture production has been growing at a remarkable rate, offsetting part of the reduction in the ocean catch of fish.

The total food fish supply and hence consumption has been growing at a rate of 3.6% per year since 1961, while the world's population has been expanding at 1.8% per year. The proteins derived from fish, crustaceans and molluscs account for between 13.8% and 16.5% of the animal protein intake of the human population. The average apparent per capita consumption increased from about 9 kg per year in the early 1960s to 16 kg in 1997. The per capita availability of fish and fishery products has therefore nearly doubled in 40 years, outpacing population growth.

As well as income-related variations, the role of fish in nutrition shows marked continental, regional and national differences. In industrialized countries, where diets generally contain a more diversified range of animal proteins, a rise in per capita provision from 19.7 kg to 27.7 kg seems to have occurred. This represents a growth rate close to 1% per year. In this group of countries, fish contributed an increasing share of total protein intake until 1989 (accounting for between 6.5% and 8.5%), but since then its importance has gradually declined and, in 1997, its percentage contribution was back to the level prevailing in the mid-1980s. In the early 1960s, per capita fish supply in low-income food-deficit countries was, on average, only 30% of that of the richest countries. This gap has been gradually reduced, such that in 1997, average fish consumption in these

NOTES

countries was 70% of that of the more affluent economies. Despite the relatively low consumption by weight in low-income food-deficit countries, the contribution of fish to total animal protein intake is considerable (nearly 20%). Over the past four decades, however, the share of fish proteins in animal proteins has declined slightly, because of faster growth in the consumption of other animal products.

Currently, two-thirds of the total food fish supply is obtained from capture fisheries in marine and inland waters, while the remaining one third is derived from aquaculture. The contribution of inland and marine capture fisheries to per capita food supply has stabilized, around 10 kg per capita in the period 1984–1998. Any recent increases in per capita availability have, therefore, been obtained from aquaculture production, from both traditional rural aquaculture and intensive commercial aquaculture of high-value species.

Fish contributes up to 180 kcal per capita per day, but reaches such high levels only in a few countries where there is a lack of alternative protein foods grown locally or where there is a strong preference for fish (examples are Iceland, Japan and some small island states). More typically, fish provides about 20–30 kcal per capita per day. Fish proteins are essential in the diet of some densely populated countries where the total protein intake level is low, and are very important in the diets of many other countries. Worldwide, about a billion people rely on fish as their main source of animal proteins. Dependence on fish is usually higher in coastal than in inland areas. About 20% of the world's population derives at least one-fifth of its animal protein intake from fish, and some small island states depend almost exclusively on fish.

Recommending the increased consumption of fish is another area where the feasibility of dietary recommendations needs to be balanced against concerns for sustainability of marine stocks and the potential depletion of this important marine source of high quality nutritious food. Added to this is the concern that a significant proportion of the world fish catch is transformed into fish meal and used as animal feed in industrial livestock production and thus is not available for human consumption.

Availability and Consumption of Fruits and Vegetables

Consumption of fruits and vegetables plays a vital role in providing a diversified and nutritious diet. Alow consumption of fruits and vegetables in many regions of the developing world is, however, a persistent phenomenon, confirmed by the findings of food consumption surveys. Nationally representative surveys in India, for example, indicate a steady level of consumption of only 120-140 g per capita per day, with about another 100 g per capita coming from roots and tubers, and some 40 g per capita from pulses. This may not be true for urban

populations in India, who have rising incomes and greater access to a diverse and varied diet. In contrast, in China, - a country that is undergoing rapid economic growth and transition - the amount of fruits and vegetables consumed has increased to 369 g per capita per day by 1992.

At present, only a small and negligible minority of the world's population consumes the generally recommended high average intake of fruits and vegetables. In 1998, only 6 of the 14 WHO regions had an availability of fruits and vegetables equal to or greater than the earlier recommended intake of 400 g per capita per day. The relatively favourable situation in 1998 appears to have evolved from a markedly less favourable position in previous years, as evidenced by the great increase in vegetable availability recorded between 1990 and 1998 for most of the regions. In contrast, the availability of fruit generally decreased between 1990 and 1998 in most regions of the world.

The increase in urbanization globally is another challenge. Increasing urbanization will distance more people from primary food production, and in turn have a negative impact on both the availability of a varied and nutritious diet with enough fruits and vegetables, and the access of the urban poor to such a diet. Nevertheless, it may facilitate the achievement of other goals, as those who can afford it can have better access to a diverse and varied diet. Investment in periurban horticulture may provide an opportunity to increase the availability and consumption of a healthy diet.

Global trends in the production and supply of vegetables indicate that the current production and consumption vary widely among regions, as indicated in Table 5. It should be noted that the production of wild and indigenous vegetables is not taken into account in production statistics and might therefore be underestimated in consumption statistics. In 2000, the global annual average per capita vegetable supply was 102 kg, with the highest level in Asia (116 kg), and the lowest levels in South America (48 kg) and Africa (52 kg). These figures also include the large amount of horticultural produce that is consumed on the farm. *Table 6* and *Figure 4* illustrate the regional and temporal variations in the per capita availability of vegetables per capita over the past few decades.

TABLE 6. SUPPLY OF VEGETABLES PER CAPITA, BY REGION, 1979 AND 2000 (KG PER CAPITA PER YEAR)

Region	*1979*	*2000*
World	66.1	101.9
Developed countries	107.4	112.8

Developing countries	51.1.	98.8
Africa	45.4	52.1
North and Central America	88.7	98.3
South America	43.2	47.8
Asia	56.6	116.2
Europe	110.9	112.5
Oceania	71.8	98.7

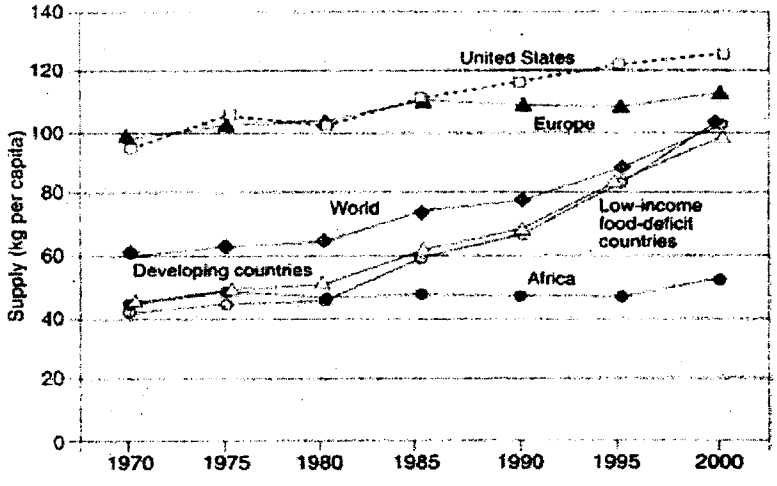


FIGURE 4. TRENDS IN THE SUPPLY OF VEGETABLES PER CAPITA, BY REGION, 1970-2000

FUTURE TRENDS IN DEMAND, FOODAVAILABILITY AND CONSUMPTION

In recent years the growth rates of world agricultural production and crop yields have slowed. This has raised fears that the world may not be able to grow enough food and other commodities to ensure that future populations are adequately fed. However, the slowdown has occurred not because of shortages of land or water but rather because demand for agricultural products has also slowed. This is mainly because world population growth rates have been declining since the late 1960s, and fairly high levels of food consumption per person are now being reached in many countries, beyond which further rises will be limited. It also true that a high share of the world's population remains in poverty and hence lacks the necessary income to translate its needs into effective demand. As a result, the growth in world demand for agricultural products is expected to fall from an

average 2.2% per year over the past 30 years to an average 1.5% per year for the next 30 years. In developing countries the slowdown will be more dramatic, from 3.7% per year to 2% per year, partly as a result of China having passed the phase of rapid growth in its demand for food. Global food shortages are unlikely, but serious problems already exist at national and local levels, and may worsen unless focused efforts are made.

The annual growth rate of world demand for cereals has declined from 2.5% per year in the 1970s and 1.9% per year in the 1980s to only 1% per year in the 1990s. Annual cereal use per person (including animal feeds) peaked in the mid-1980s at 334 kg and has since fallen to 317 kg. The decline is not a cause for alarm, it is largely the natural result of slower population growth and shifts in human diets and animal feeds. During the 1990s, however, the decline was accentuated by a number of temporary factors, including serious economic recessions in the transition countries and in some East and South-East Asian countries.

The growth rate in the demand for cereals is expected to rise again to 1.4% per year up until 2015, slowing to 1.2% per year thereafter. In developing countries overall, cereal production is not expected to keep pace with demand. The net cereal deficits of these countries, which amounted to 103 million tonnes or 9% of consumption in 1997-1999, could rise to 265 million tonnes by 2030, when they will be 14% of consumption. This gap can be bridged by increased surpluses from traditional grain exporters, and by new exports from the transition countries, which are expected to shift from being net importers to being net exporters.

Oil crops have seen the fastest increase in area of any crop sector, expanding by 75 million hectares between the mid-1970s and the end of the 1990s, while cereal area fell by 28 million hectares over the same period. Future per capita consumption of oil crops is expected to rise more rapidly than that of cereals. These crops will account for 45 out of every 100 extra kilocalories added to average diets in developing countries between now and 2030.

There are three main sources of growth in crop production: expanding the land area, increasing the frequency at which it is cropped (often through irrigation), and boosting yields. It has been suggested that growth in crop production may be approaching the ceiling of what is possible in respect of all three sources. A detailed examination of production potentials does not support this view at the global level, although in some countries, and even in whole regions, serious problems already exist and could deepen.

Diets in developing countries are changing as incomes rise. The share of staples, such as cereals, roots and tubers, is declining, while that of meat, dairy products and oil crops is rising. Between 1964-1966 and 1997-1999, per capita

meat consumption in developing countries rose by 150% and that of milk and dairy products by 60%. By 2030, per capita consumption of livestock products could rise by a further 44%. Poultry consumption is predicted to grow the fastest. Productivity improvements are likely to be a major source of growth. Milk yields should improve, while breeding and improved management should increase average carcass weights and off-take rates. This will allow increased production with lower growth in animal numbers, and a corresponding slowdown in the growth of environmental damage from grazing and animal wastes.

In developing countries, demand is predicted to grow faster than production, resulting in a growing trade deficit. In meat products this deficit will rise steeply, from 1.2 million tonnes per year in 1997-1999 to 5.9 million tonnes per year in 2030 (despite growing meat exports from Latin America), while in the case of milk and dairy products, the rise will be less steep but still considerable, from 20 million tonnes per year in 1997-1999 to 39 million tonnes per year in 2030. An increasing share of livestock production will probably come from industrial enterprises. In recent years, production from this sector has grown twice as fast as that from more traditional mixed farming systems and more than six times faster than that from grazing systems.

World fisheries production has kept ahead of population growth over the past three decades. Total fish production has almost doubled, from 65 million tonnes in 1970 to 125 million tonnes in 1999, when the world average intake of fish, crustaceans and molluscs reached 16.3 kg per person. By 2030, annual fish consumption is likely to rise to some 150-160 million tonnes, or between 19-20 kg per person. This amount is significantly lower than the potential demand, as environmental factors are expected to limit supply. During the 1990s the marine catch levelled out at 80-85 million tonnes per year, and by the turn of the century, three-quarters of ocean fish stocks were overfished, depleted or exploited up to their maximum sustainable yield. Further growth in the marine catch can only be modest.

Aquaculture compensated for this marine slowdown, doubling its share of world fish production during the 1990s. It is expected to continue to grow rapidly, at rates of 5-7% per year up to 2015. In all sectors of fishing it will be essential to pursue forms of management conducive to sustainable exploitation, especially for resources under common ownership or no ownership.

Concluding Remark

A number of conclusions can be drawn from the preceding discussion.

- Most of the information on food consumption has hitherto been obtained from national Food Balance Sheet data. In order to better understand the

NOTES

relationship between food consumption patterns, diets and the emergence of noncommunicable diseases, it is crucial to obtain more reliable information on actual food consumption patterns and trends based on representative consumption surveys.

- There is a need to monitor how the recommendations in this report influence the behaviour of consumers, and what further action is needed to change their diets (and lifestyles) towards more healthy patterns.
- The implications for agriculture, livestock, fisheries and horticulture will have to be assessed and action taken to deal with potential future demands of an increasing and more affluent population. To meet the specified levels of consumption, new strategies may need to be developed. For example, a realistic approach to the implementation of the recommendation concerning high average intake of fruit and vegetables, requires attention to be paid to crucial matters such as where would the large quantities needed be produced, how can the infrastructure be developed to permit trade in these perishable products, and would large-scale production of horticultural products be sustainable?
- A number of more novel matters will need to be dealt with, such as:
  - o the positive and negative impacts on noncommunicable diseases of intensive production systems, not only in terms of health (*e.g.*, nitrite in vegetables, heavy metals in irrigation water and manure, pesticide use), but also in terms of dietary quality (*e.g.*, leaner meats in intensive poultry production);
  - o the effects of longer food chains, in particular of longer storage and transport routes, such as the higher risk of deterioration (even if most of this may be bacterial and hence not a factor in chronic diseases), and the use and misuse of conserving agents and contaminants;
  - o the effects of changes in varietal composition and diversity of consumption patterns, for example, the loss of traditional crop varieties and, perhaps even more significantly, the declining use of foods from "wild" sources.
- Trade aspects need to be considered in the context of improving diet, nutrition and the prevention of chronic diseases. Trade has an important role to play in improving food and nutrition security. On the import side, lower trade barriers reduce domestic food prices, increase the purchasing power of consumers and afford them a greater variety of food products. Freer trade can thus help enhance the availability and affordability of food and contribute to a better-balanced diet. On the export side, access to markets abroad creates new income opportunities for domestic farmers

and food processors. Farmers in developing countries in particular stand to benefit from the removal of trade barriers for commodities such as sugar, fruits and vegetables, as well as tropical beverages, all these being products for which they have a comparative advantage.

- The impact that agricultural policies, particularly subsidies, have on the structure of production, processing and marketing systems and ultimately on the availability of foods that support healthy food consumption patterns should not be overlooked.

STUDENT ACTIVITY

1. Discuss the interrelation of population and consumption.

2. Outline the characteristics of current global meal pattern.

3. Discuss the factors influencing the future world food security.

1.9 INTERRELATION OF SOCIO-CULTURAL AND ECONOMIC ASPECTS AND THEIR IMPACT ON NUTRITIONAL WELL BEING IN THE INDIVIDUAL, FAMILY AND NATIONAL CONTEXTS

The social and cultural aspects of every society evolve in the context of certain interacting ecological, demographic, technological and economic characteristics particular to it. The ecological and related resource determinants are characteristics that tend to exhibit a fair degree of stability since they are significantly nature-determined. The demographic, technological and economic variables seem to undergo a greater degree of change, as they are products of human enterprise. The social and cultural aspects, which arise from this historical nature-human interaction, takes effect within a work a day routine of livelihood and provide the element of specificity to the society. They accumulate over time and form a corpus of certain behavioural facets of a people. In the more ancient societies, such as those in Asia, these socio-cultural traits have been handed down largely through learning-by-doing and oral traditions of songs, stories and sayings. They evolve to represent a "world view" of the communities and represent in succinct fashion a coherent "practice-knowledge-belief" system.

The social and cultural aspects of developing societies were considered to be a "drag" on their transformation into modern economies. For example, certain communitarian principles and diet preferences, which had evolved in the context of resource fragility and population pressure, were perceived to be barriers to technological change and market expansion. The many failures of the largely techno-economic orientation to development policies, provide the basis for a new search.

A search for giving fresh meaning to hitherto neglected socio-cultural norms before they are transformed beyond recognition. The initial resource and ecological context of fish, and much of the traditional techno-economic aspects of fisheries in the tropical developing countries of Asia, have given rise to a considerable fund of socio-cultural features which are rooted in the context of people's pursuit for livelihood and food security. Examining some facets of this neglected reality, provide an opportunity to assess their continued relevance for the inextricably intertwined objectives of maintaining the integrity of the ecosystem and ensuring the food and livelihood security of the community.

Such a pursuit also attains particular relevance in this era of globalisation that often entails a continual substitution of culture and cultural knowledge by objective knowledge and formal institutions. This process sets into momentum tendencies for homogenization of social and cultural specificities. In the long run

this threatens the variety and diversity of both the practices and the visions which societies have about their future. The sustainability of any society will depend in large measure on the degree of diversity and self-reliance that it is able to maintain with regard to reproducing its social and cultural concomitants. At the core of this are issues pertaining to the food and livelihood security of its people.

Food security, an important element of poverty reduction, is a one of the priority foci of development. Food and Nutrition Security (FNS) has evolved significantly during the last decades in theory and practice. This overview provides some basic information about the current understanding on FNS. It serves as a reference point for exchanging experiences among all stakeholders involved in programs and projects, which foster policy and strategy development. It introduces the concepts of FNS and briefly illustrates operational instruments and processes.

Global FNS has a history of more than 50 year, and has evolved through a sequence of definitions and paradigms *(Figure 5)*. After the historic Hot Spring Conference of Food and Agriculture in 1943, in which the concept of a "secure, adequate and suitable supply of food for everyone" was accepted internationally, bilateral agencies from donor countries such as the USA or Canada were created in the 1950s and started to dispose of their agricultural surplus commodities overseas.

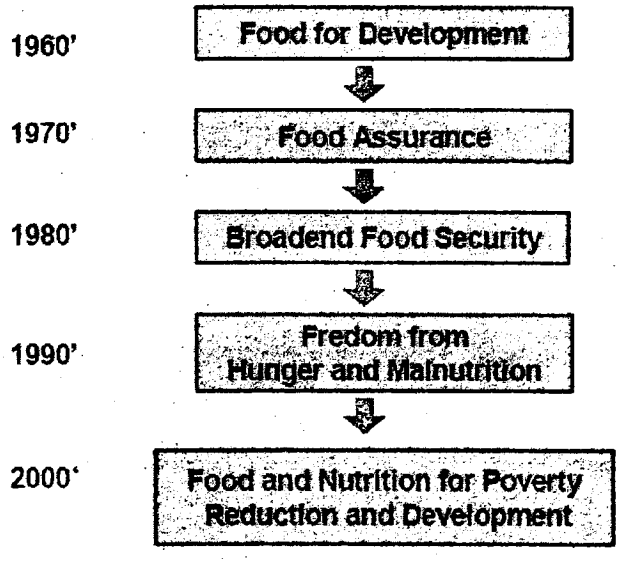


FIGURE 5. THE EVOLUTION OF FOOD AND NUTRITION SECURITY CONCERNS

NOTES

In the 1960s, when it was acknowledged that food aid may hinder for developing selfsufficiency, the concept of food for development was introduced and institutionalized. The creation of the World Food Program (WFP) in 1963 is one prominent example. The food crisis of 1972/74 marked a dramatic turning point from the past era of food abundance of donor countries to highly unstable cood supplies and prices on the world market. As a result, food security insurance schemes, which assured international access to physical food supplies, were developed in the 1970s.

Improved food security assurance was to be achieved through better coordination among donor organizations and agencies and food availability surveillance in recipient countries.

In the 1980s, following the success of the green revolution which helped to increase food production (food availability), it was recognized that food emergencies and even famines were not caused as much by catastrophic shortfalls in food production as by sharp declines in the purchasing power of specific social groups. Therefore, food security was broadened to include both physical and economic access to food supply. In this decade, poverty alleviation and the role of women in development was promoted.

In the 1990s, concrete plans were defined to eradicate or at least reduce hunger and malnutrition drastically. In addition, the human right to adequate food and nutrition was internationally reaffirmed and committed national governments to a more proactive role. Finally, reduced international public support of donor agencies reduced food aid to crisis management and prevention.

In the 2000s, decreasing hunger and malnutrition has increasingly come to be seen in the context of overall development, poverty reduction and the achievement of the Millennium Development Goals. These internationally accepted development targets can only be achieved, if adequate food and nutrition are ensured for all members of a society.

A Holistic Understanding of Food and Nutrition Security

Food security historically referred to the overall regional, national, or even global food supply and shortfalls in supply compared to requirements. But, with increased observation of insufficient food intake by certain groups (despite overall adequacy of food supply), the term has more recently been applied mostly at a community, local, household or individual level. Further, the term has been broadened beyond notions of food supply to include elements of access, vulnerability, and sustainability.

However, food security is a concept that has evolved over time. The most common definitions vary around that proposed by the World Bank (1986) and

NOTES

were summed up by Maxwell and Frankenberger as "secure access at all times to sufficient food for a healthy life". In their exhaustive review of the literature on household food security, they list 194 different studies on the concept and definition of food security and 172 studies on indicators.

According to a currently accepted definition (FAO 2000), 'Food Security' is achieved when it is ensured that "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". Food is here defined as any substance that people eat and drink to maintain life and growth. As a result, safe and clean water is an essential part of food commodities.

The nutrition focus adds the aspects of caring practices and health services and healthy environments to this definition and concept. This aims at what is more precisely called 'Nutrition Security', which can be defined as adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times.

Definition of Food and Nutrition Security

> "Food and nutrition security is achieved, if adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily used and utilized by all individuals at all times to live a healthy and active life."

This definition combines food and nutrition security and emphasizes several aspects, *i.e.*, 'Availability', 'Accessibility', and 'Use and Utilization' of food. The inclusion of the use and utilization aspect underscores the fact that 'Nutrition Security' is more than 'Food Security.'

A holistic understanding of FNS stresses the various dimensions of the concept:

1. categorical aspects,
2. socio-organizational aspects, and
3. managerial aspects.

Aspects of Food and Nutrition Security

The Categorical Aspects

The conceptual framework of food security *Figure 6* illustrates the relationship among the categorical elements within the conceptual framework of food security.

Two factors influence the framework: a physical and a temporal factor. The physical determinant is the food flow: Availability — Accessibility — Use and Utilization.

NOTES

The temporal determinant of FNS refers to stability, which affects all three physical elements.

In this context **availability** refers to the physical existence of food, be it from own production or on the markets. On national level food availability is a combination of domestic food production, commercial food imports, food aid, and domestic food stocks, as well as the underlying determinants of each of these factors. Use of the term availability is often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level.

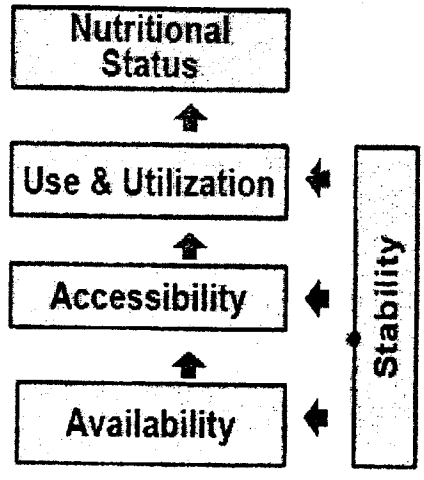


FIGURE 6: FOOD SECURITY AND NUTRITION

Access is ensured when all households and all individuals within those households have sufficient resources to obtain appropriate foods for a nutritious diet. It is dependent on the level of household resources capital, labor, and knowledge and on prices. Note that adequate access can be achieved without households being self-sufficient in food production. More important is the ability of households to generate sufficient income which, together with own production, can be used to meet food needs.

Food access also is a function of the physical environment, social environment and policy environment which determine how effectively households are able to utilize their resources to meet their food security objectives. Drastic changes in these conditions, such as during periods of drought or social conflict, may seriously disrupt production strategies and threaten the food access of affected households. To the extent that these shocks often lead to the loss of productive assets such as livestock, they also have severe implications for the

future productive potential of households and, therefore, their long-term food security.

Use of food refers to the socio-economic aspect of household food security. If sufficient and nutritious food is both available and accessible the household has to make decisions concerning what food is to be purchased, prepared and consumed (demanded) and how the food is allocated within the household. In households where distribution is unequal, even if the measured aggregate access is sufficient, some individuals may suffer from food deficiency. The same is true if the composition of the consumed food is unbalanced. Another aspect is the social function that food can have in terms of community cohesion through offerings, ritual meals etc. especially in food deficit times. All these socio-economic aspects are determined by knowledge and habits. This is especially critical for feeding infants (breast feeding, weaning foods etc.).

Focusing on the individual level food security also requires taking the biological utilization of food into consideration. This refers to the ability of the human body to take food and convert it into either energy which is either used to undertake daily activities or is stored. Utilization requires not only an adequate diet, but also a healthy physical environment, including safe drinking water and adequate sanitary facilities (so as to avoid disease) and an understanding of proper health care, food preparation, and storage processes.

Stability or sustainability refers to the temporal dimension of nutrition security *i.e.*, the time frame over which food security is being considered. In much of the food security literature, a distinction is made between chronic food insecurity—the inability to meet food needs on an ongoing basis and transitory food insecurity when the inability to meet food needs is of a temporary nature. Transitory food insecurity is sometimes divided into two subcategories:

- cyclical, where there is a regular pattern to food insecurity, *e.g.*, the 'lean season' or 'hungry season' that occurs in the period just before harvest, and
- temporary, which is the result of a short-term, exogenous shock such as droughts or floods. Also civil conflict belongs to the temporary category, although their negative impact on food security often continues over long periods of time.

The Conceptual Framework of Malnutrition

Figure 7 shows the conceptual framework of malnutrition, developed by UNICEF and widely accepted at the international level. Although mainly used in the context of under-nutrition in rural areas of developing countries, it is also applicable to overnutrition in an urban context. According to this framework, malnutrition occurs as a result of a number of factors which directly and indirectly cause malnutrition.

NOTES

The immediate causes of the nutritional status manifest themselves at the level of the individual human being. These are dietary intake and health status. These factors themselves are interdependent. Dietary intake must be adequate in quantity and in quality, and nutrients must be consumed in appropriate combinations for the human body to be able to absorb them (energy, protein, fat, and micronutrients). On household level the decision what food is being put on the table (demand) and who is to eat it (intra-household distribution) determines the composition of the meals for the individual. Habits (*e.g.*, food taboos) and knowledge (*e.g.*, preparation, processing, child feeding practices) influence the composition but also the biological utilization of the food.

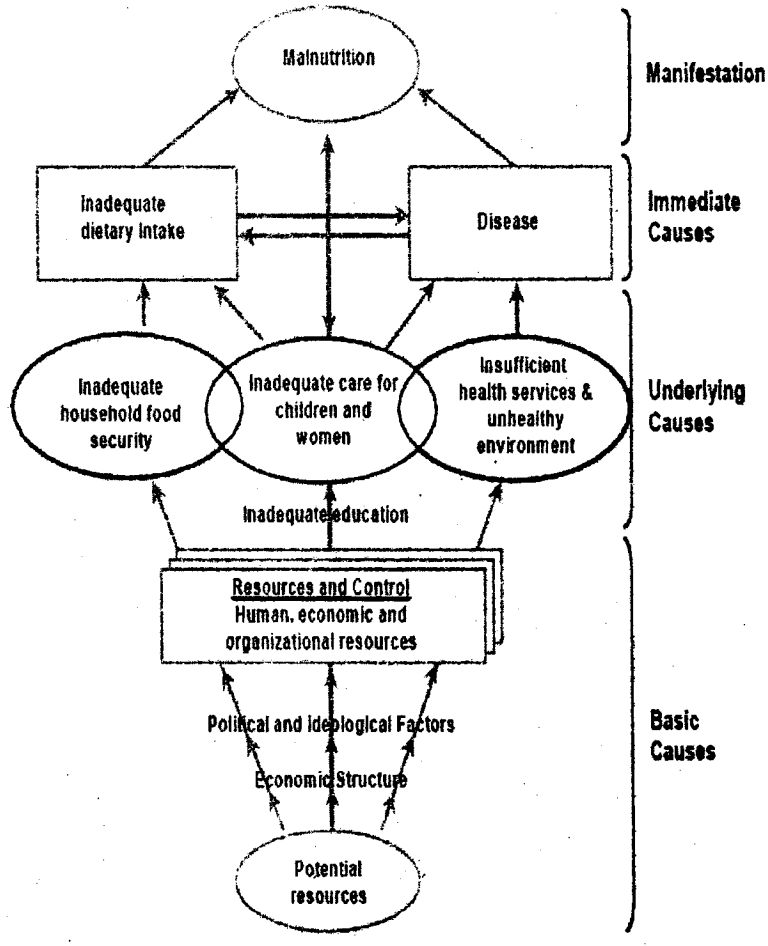


FIGURE 7: CONCEPTUAL FRAMEWORK OF MALNUTRITION (UNICEF 1991)

There are strong synergistic relationships between the health status and the nutritional status. A sick person is likely to lose his/her appetite, thus eating a

poor diet, digest his/her food poorly and must use some of his nutrients to fight infection. A poorly nourished person has a weakened immune system and is more prone to infections. Infections increase the potential for and severity of malnutrition. In developing countries, infectious diseases, such as diarrhoeal diseases (DD), and acute respiratory infections (ARI), are the most important nutrition-related health problems.

The immediate causes of the nutritional status are, in turn, influenced by four underlying causes manifesting themselves at the household level. These are adequate household food security (availability and access), adequate care for mothers and children (specifically relevant in the case of child nutritional status), a proper health environment as well as access to health services. Associated with each is a set of basic causes for achieving them which are briefly outlined below.

The resources necessary for gaining access to food are food production, income for food purchases, or in-kind transfers of food (whether from other private citizens, national or foreign governments or international institutions). Whether or not enough food is available (food availability) is determined, aside from own household production, by the market supply which originates from the combination of domestic food stocks, commercial food imports, food aid and domestic food production.

Caring capacity, the second underlying determinant, is the provision in households and communities "of time, attention, and support to meet the physical, mental, and social needs of the growing child and other household members". Examples of caring practices are child feeding, health seeking behaviours, support and cognitive stimulation for children, and care and support for mothers during pregnancy and lactation. The adequacy of such care is determined by the caregiver's control of economic resources, autonomy in decision making, and physical and mental status. Decisive to execute control is the caretaker's status relative to other household members. A final resource for care is the caretaker's knowledge and beliefs.

The third underlying cause of the nutritional status is the availability of a functioning health service. They have a direct impact on morbidity and mortality and in consequence on the nutrition status. A further key issue which plays a role is the caretaker's knowledge about health and nutrition related topics.

The last cause refers to the environmental conditions. They play a crucial role in influencing the nutritional status via the health situation and mainly include the availability of safe water, sanitation, and environmental safety, and shelter. Water and sanitation improvements, in association with changes in hygiene behaviour, can have significant effects on a population and its health by reducing a variety of conditions for diseases such as diarrhoea, intestinal helminthes, guinea

NOTES

worm, and skin diseases. These improvements in health can, in turn, lead to reduced morbidity and mortality and improved nutritional status.

Finally, the general socio-economic and political conditions of a country influence the causes of nutrition (and poverty). These include the potential resources available within the natural environment of a country or community, access to technology, and the quality of human resources. Political, economic, cultural, and social factors affect how these potential resources and used for food security, care and health services and a safe environmental. These factors are considered basic causes that contribute to malnutrition.

This model relates the causal factors for malnutrition with different social-organizational levels. The immediate causes affect individuals, the underlying causes relate to families or households and communities, and the basic causes are related to the sub-national, the national and the regional level.

The Conceptual Framework of the Nutritional Status at Household Level

Figure 8 depicts a simplified causal model of linking nutritional status with causal factors at household level. In this conceptual framework, the nutritional status is an outcome of food intake and health status. However, the underlying causes of health environmental causes and health services have been depicted in different boxes due to their different natures. A reduced state of health may be due in part to tenuous access to health care, poor housing and environmental conditions, and is possibly worsened by malnutrition, which predispose individuals to diseases. The distinction between health services and environment is necessary to select appropriate intervention strategies.

The four underlying causes of food intake and health status are influenced by several determinants. In addition, each determinant has several contributing factors. For example, as shown in *Figure 8*, access to food is affected by food production, food purchase and/or food donation. This conceptual framework emphasizes the difference between 'Food Security' and 'Nutrition Security'. The first refers to the area of causes and effects of food availability at household level (= access to food), here illustrated as the small, dotted triangle. The latter refers to the entire relationships, depict in the larger lined triangle.

Figure 8 suggests another important fact that should be taken into consideration when designing programs, *i.e.*, the less direct the relationship between a causal factor of malnutrition and the nutritional status, the more time is required to improve the situation.

Food, Health and Nutrition

The two most commonly used conceptual frameworks show significant differences: (1) The food security framework emphasizes an economic approach

in which food as a commodity is a central focus. (2) The nutrition security or malnutrition framework adopts a biological approach in which centres on the nutritional status of the human being.

NOTES

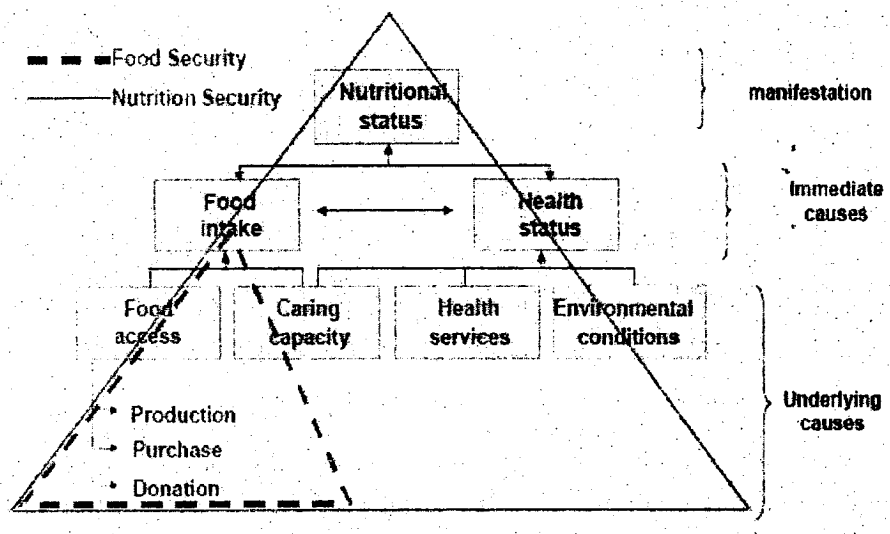


FIGURE 8: CONCEPTUAL FRAMEWORK OF THE NUTRITIONAL STATUS AT HOUSEHOLD LEVEL

However, common to both frameworks is the promotion of an interdisciplinary approach to ensure FNS. Both acknowledge that food alone is not sufficient to secure a sustainable satisfactory nutritional status and, therefore, aspects of health must be considered. As a result, nutrition is the function of food intake and health status (illustrated in *Figure 8*).

The conceptual framework of FNS *(Figure 8)* integrates the food security and the malnutrition framework. Although each starts from a different conceptual perspective, both arrive at similar program design by using common instruments and processes.

THE SOCIO-ORGANIZATIONAL ASPECTS

Levels of Social and Administrative Organization

The categorical elements of FNS, *i.e.*, availability, access, use and utilization and stability, are relevant to all levels of social and administrative organizations *(Table 7)*, from the individual and the household (micro level), to the community (sub-district, district and province) or meso level, and the nation and the global level (macro level). However, the relative importance of each determinant of malnutrition (as presented in *Figure 7*) changes with the level of social organization.

At higher levels of social organization the overall political, economic and ecological conditions become more important. Given the diverse nature of the determinant factors of human nutritional status, and the different levels of society in which they interact, FNS will necessarily have to involve aspects from both the natural sciences and the social sciences. As a result, the relevance of FNS at all socio-organizational levels and the interaction between these levels stresses the importance of an interdisciplinary approach of FNS.

TABLE 7: LEVELS OF SOCIAL AND ADMINISTRATIVE ORGANIZATION

Macro	World Region Nation	
Meso	Community	Province / City District / Town Village
Micro	Household / Family Individual	

Food and Nutrition Security at the Different Social/Administrative levels

Figure 9 illustrates a merging of the categorical and the socio-organizational dimensions. Availability, Accessibility, Use and Utilization of food and the Stability of these three elements differ in their nature, causes and effects at the Macro, Meso and Micro level respectively. For example, food may be available in a country but not in certain disadvantaged districts or among discriminated population groups. The seasonality of food availability and utilization, for example, due to cyclic appearance of diseases, may be a rural but not an urban phenomenon.

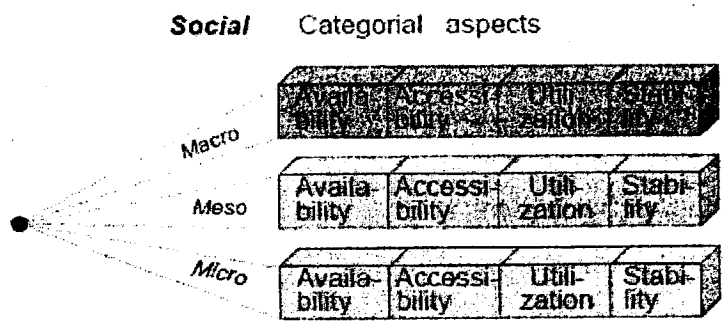


FIGURE 9: FOOD AND NUTRITION SECURITY AT DIFFERENT LEVELS

The same merger could also apply to the malnutrition framework with its categories: Food, Care, Health and Environment. However, these four categories affect, and are affected differently at each of the specific socio-organizational level.

NOTES

The Managerial Aspect

The Project Cycle Management

The third dimension is the managerial aspect of FNS projects and programs. As shown in *Figure 10,* management follows the classical project cycle, which may have different names in different organizations. However, all development agencies agree that program implementation follows a cyclic learning process consisting of the following steps:

Assessment – Analysis – Action/Intervention – Monitoring and Evaluation (or Re-assessment)

The current situation and problems are identified through assessment. Feasible solutions or actions can then be elaborated based on a comprehensive analysis of causes of problems and their causal relationship. This process is essential to implement the efficient, sustainable, and acceptable actions required to improve the FNS situation of the targeted risk groups.

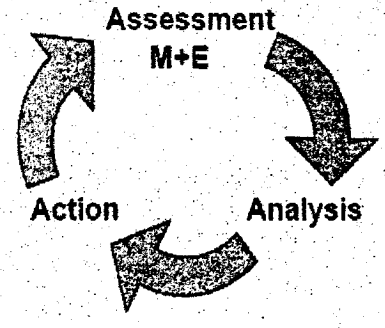


Figure 10: Concept of Triple 'A' or Project Cycle Management (PCM)

Assessment and Intervention in Food and Nutrition Security at Different Social and Administrative Levels

Figure 11 illustrates FNS in three dimensions (categorical, socio-organizational, and managerial). It should be noted that the instruments and processes selected for assessment are specific, but also interlinked. Measures to assess the availability of food at the macro level are different from those used at the meso or micro levels. The same observation applies for instruments and processes selected for program implementation with respect to food availability at the three levels. Despite these differences, all elements are interrelated vertically and horizontally by nature, cause and effect. For example, inappropriate assessment of food availability may lead to the formulation of ineffective interventions that actually reduce access and utilization.

As indicated throughout, FNS is a complex system. Food and nutrition insecurity at different socio-organizational levels are caused by different factors and requires specific solutions. Consequently, an effective FNS program needs a holistic program approach.

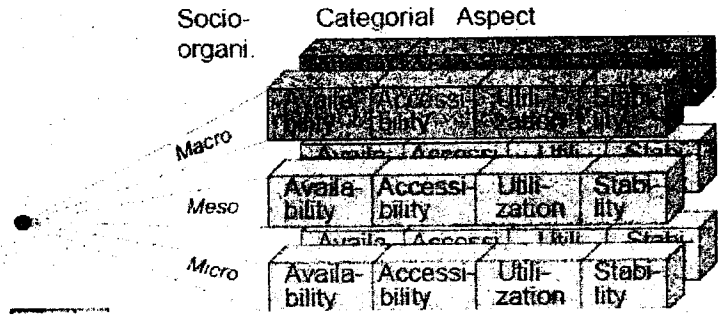


FIGURE 11: ASSESSMENT AND INTERVENTION IN FOOD AND NUTRITION SECURITY AT DIFFERENT SOCIAL AND ADMINISTRATIVE LEVEL

Examples of Instruments to Assess Food and Nutrition Security at Different Social and Administrative Levels

During all stages of the PCM there is a need for the continuous collection of information to define targets, to select appropriate interventions, and to monitor and evaluate program progress, process and impact. *Table 8* provides selected examples of assessment instruments related to the different categories of FNS at macro, meso, and micro level.

TABLE 8: EXAMPLES OF INSTRUMENTS TO ASSESS FOOD AND NUTRITION SECURITY SITUATION AT DIFFERENT SOCIAL LEVELS

Social Level	Availability	Accessibility	Use and Utilization	Stability
Macro	Precipitation Record Food Balance Sheet	Vulnerability Analysis and Mapping (VAM)	Demographic and Health Surveys (DHS)	Global Information and Early Warning System (GIEWS) Health Surveillance System (WHO)

Meso	Food Market Survey	Food Focus Group Discussion	District Health Survey	Anthro-pometric Survey of Children
Micro	Agricultural Production Plan	Intra-household Food Frequency Questionnaire	Immunization Chart	Weighing Chart of Pregnant Women

At the macro level, precipitation records can predict future food production. Food balance sheets provide information on food availability at national level. The World Food Programme (WFP) developed the Vulnerability Analysis and Mapping (VAM) project to analyze the vulnerability to food insecurity of target populations. A prominent part of VAM is related to access to food. The Demographic and Health Survey (DHS), funded by USAID, provides health data for many countries to help them design their national policy. FAO has developed the Global Information Early Warning System (GIEWS) which collects data related to temporary food insecurity. Under the leadership of WHO, several health surveillance systems have been developed and implemented to monitor the epidemiology of various forms of malnutrition and of selected diseases.

At the meso or sub-national level, food market surveys provide data on the availability of food. Qualitative surveys, such as food focus group discussions, provide information on accessibility to food for those in greatest need. District health surveys describe health conditions that may reflect food utilization problems.

Finally, agricultural production surveys, intra-household food frequency interviews, immunization surveys and anthropometric surveys of children under five can be used to assess the availability, accessibility, and use and utilization of food and its stability at micro level.

Rational for Investing in Food and Nutrition Security

There are a number of good reasons why it is imperative, profitable and worthwhile investing in food and nutrition security.

Basic Need, Humanitarian Task and Ethical Obligation

Adequate nutrition is a basic human need. Only if people can satisfy their nutritional requirements on a regular basis, and use and utilize adequate and safe food with the respective energy, protein, vitamin and mineral content, is one of the most important precondition for an active, healthy and decent life fulfilled.

Box 1: Ensuring food and nutrition security is fulfilling basic needs and ethical obligations

"Hunger is one of the worst violations of human dignity. In a world of plenty, ending hunger is within our grasp. Failure to reach this goal should fill every one of us with shame. The time for making promises is over. It is time to act. It is time to do what we have long promised to do – eliminate hunger from the face of earth."

Source: Kofi Anan, Secretary General of the United Nations, at the World Food Summit: five years later in June 2002 in Rome

Prolonged lack of food and nutrients leads to various physical and mental impairments of human beings. It prevents children from growing into productive members of the society and be adults who are fully able to participate in the economic and social development of their countries. In extreme cases, it leads to premature death which could be prevented with relatively simple and inexpensive measures. Sustainable food and nutrition security is life saving for people today and beneficial for future generations. Hunger is a human catastrophe and unacceptable (Box 1) in a world which produces enough food for all and which knows enough about appropriate solutions to the problem.

Human Rights

Food insecurity and malnutrition are viewed as a lack of human rights. The International Covenant on Economic, Social and Cultural Rights adopted by the United Nations General Assembly in 1966 defined and formalized the right to food as a basic human right, which had already been mentioned in the Universal Declaration of Human Rights of the United Nations in 1948.

Box 2: The right to food

"Every man, woman and child has the inalienable right to be free from hunger and malnutrition in order to develop fully and maintain their physical and mental faculties."

Source: United Nations 1974

However, "today, 800 million men, women and children are denied the most basic human right of all: the right to food."

Source: Kofi Annan, Secretary General of the United Nations

Considering food and nutrition security to be a basic human right of every individual means that no compromise is acceptable concerning the right to food. The right to food imposes obligations on states to respect, protect and fulfill food and nutrition security. And apart from the obligations of national and local governments, others also have duties: communities, families, parents, as well as the international community.

NOTES

> Commitment 7 of the World Food Summit Plan of Action (1996) requests the UN High Commissioner for Human Rights (WFS 1996b) "... to clarify the content of the right to adequate food and the fundamental right of everyone to be free from hunger, as stated in the International Covenant on Economic, Social and Cultural Rights and other relevant international and regional instruments, and to give particular attention to implementation and full and progressive realization of this right as a means of achieving food security for all".

This clarification has been achieved the adoption of the Resolution on the Right to Food by UNHCR and the adoption of the General Comment 12 on the Right to Food by the international community (Haddad 1999). For the first time, this comment provides a comprehensive and authoritative interpretation of the human right to adequate food.

In addition, the international community is currently working on the elaboration of a "Code of Conduct" for the implementation of the right to food, which will provide important guidelines for future activities in the field of food and nutrition security.

Economic Considerations

Malnutrition among adults and children has serious consequences. These are low birth weight of babies and a perpetuation of malnutrition over generations, decreased physical and mental abilities with lower capacities for learning and working, specific and partly irreversible physical impairments, increased susceptibility to infections and increased mortality. The World Health Organization (WHO) estimates that more than half of the annual 11 million child deaths can be attributed directly or indirectly to malnutrition.

Malnutrition is one of the most important causes of underdevelopment and poverty. Investments in nutrition are investments in human capital. These investments support men, women, boys and girls who can only then use their growth and development potential for the development of their families and societies once such investments in nutrition have been made.

The World Bank assumes that investments in nutritional programs are efficient investments. Cost-benefit analyses show that – depending on the program approach 0.9 to 84 US$ per 1 US$ invested are gained through increased remuneration and decreased incapacity to work. This is achieved through the impact on adult labour force participation and productivity, on improved health and school performance and ultimately on economic growth investments in nutrition.

The gains from reduction of malnutrition are substantial. In Pakistan, school enrolment rates increased substantially (2 percent for boys and 10 percent for

NOTES

girls) when nutrition improved measured through increased height-for-age. Nutrition education, vitamin A supplementation and breast feeding promotion are among the most cost-effective public health interventions in terms of disability adjusted life years (DALYs) gained.

Box 3: Investing in food and nutrition security pays

"We do not have the excuse that we cannot grow enough or that we do not know enough about how to eliminate hunger. The cost of inaction is prohibitive. The cost of progress is both calculable and affordable."

Source: FAO (2002), p. 4

According to a FAO proposal for an Anti-Hunger-Programme, public investment of US$ 24 billion a year would be enough to jump-start an accelerated campaign against hunger that could reach the target of halving hunger and malnutrition by the year 2015. These costs are very low compared to the more than US$ 300 billion that the OECD nations transferred in 2001 to support their own agriculture. The payoff of investing in food and nutrition security would be impressively high. FAO has estimated that freeing several hundred million people from hunger as formulated in the above mentioned target would yield at least US$ 120 billion per year in benefits as a result of longer, healthier and more productive lives.

STUDENT ACTIVITY

1. Outline the aspects of food and nutritional security.

2. Write a short note on "Food as right".

Nutritional Trends Food and Society

NOTES

Food is very much a part of popular culture, and the beliefs, practices, and trends in a culture affect its eating practices. Popular culture includes the ideas and objects generated by a society, including commercial, political, media, and other systems, as well as the impact of these ideas and objects on society.

There has been an increasing trend in many countries toward consumerism, a trend that is reflected in more people eating away from home; the use of dietary and herbal supplements; foods for specific groups (*e.g.*, dieters, women, athletes, older adults); the use of convenience and functional foods ; and ethnic diversity in diets. Mainstream populations in developed countries want low-calorie, low-fat foods, as well as simple, natural, and fresh ingredients.

Internationally, there has been an "Americanization" of diets through the growth and use of fast-food restaurants and convenience foods . In developing countries there is still a need for some basic foods, and governments and the food industry are working to develop products that can reduce international food shortages and nutrient deficiency problems.

What foods an individual eats is affected by the ability to access foods. Economic status, geography, and politics have influenced the diets of people throughout history. Poverty is linked to malnutrition , while economic growth and a rise in population pose new nutritional problems. Ironically, diets high in complex carbohydrates and fiber in poor economic times give way to consumption of foods high in sugars and fat when economic conditions improve.

Between 1995 and 1997, among countries that showed an increase in per capita incomes, average caloric consumption also showed a significant increase. Between 1970 and 1972, and between 1996 and 1997, world consumption of calories from complex carbohydrates fell by 30 percent while the consumption of calories from meat increased by a third (33%) and those from vegetable oil by almost half (46.2%). As nations become wealthier, people move from eating "a poor man's diet " of high levels of grains, fruits, and vegetables to consuming diets with more fats and sugar. Fat still remains the food for the rich—with more income, people start to eat more meat and poultry, and vegetable oils become more available. Combined with cane and corn sugars, vegetable oils are used to produce baked goods and snack foods high in calories.

The Westernization of Dietary Patterns

Toward the end of the twentieth century, economic growth among developing countries caused the phenomenon of the Westernization of traditional eating patterns. Industrialization and modern transportation brought baking technology and Western food styles to developing countries. New and tasty foods

NOTES

high in fat, sugar, and salt became the choice of the new rich. Trendy fast foods, soft drinks, and meat products replaced traditional ethnic foods.

Fortunately, in many emerging societies the poor are still unable to afford Western fast foods, and are thus spared the ills of high consumption of fats, meat, and sugars. For example, many people in India still spend more than half their income on food consumed at home, compared to the average American, who spends less than 8 percent of his or her disposable income on home-cooked food.

The American diet, much like that of many industrialized nations, derives its calories from fats, sugars, and animal products in foods prepared or processed away from home. One out of every three meals in America is consumed away from home. From 1990 to 2000 there was a 14 percent decrease in the number of meals eaten at home. In 1977 only 16 percent of all meals and snacks were eaten way from home. By 1995, this rose to 27 percent. In 1995, away-from-home foods provided 34 percent of total caloric intake, an increase from 18 percent in 1977. In addition, eating at home does not always mean cooking. Supermarkets and grocery stores provide thousands of ready-made meals, frozen foods, and processed meals that require little preparation at home.

Total fat consumption in the United States increased from 18 percent in 1977 to 38 percent in 1995. According to Lin and Frazao, away-from-home foods deliver more calories in fat and saturated fat and are lower in fiber and calcium than home-cooked foods. The average total calories consumed by Americans rose from 1,807 calories in 1987 to 2,043 calories in 1995. Since away-from-home foods deliver more fat and more calories, the trend of eating out can become a health hazard. People tend to eat more from restaurants and fast-food places because many eating establishments "supersize" their portions. Customers feel that they get their money's worth when they receive more food than they need.

Influence of Diet on Health

Childhood and adulthood obesity are on the rise. Between 1988 and 1994, 11 percent of U.S. children and adolescents aged six to nine years of age were overweight or obese . During this same period, 35 percent of the American adult population aged twenty and over were obese, compared to 25 percent during the years 1976 through 1980. The rising trend in obesity pervades the Middle East, the Caribbean, Europe, Latin America, Brazil, Japan, South East Asia, Australia, and China.

Since being overweight is associated directly with many chronic illnesses, such as heart disease , hypertension , hyperlipidemia , cancer , stroke , and type II diabetes , an increase in the incidence of overweight and obesity is a serious concern. The top three leading causes of death in the United States during the 1990s were

NOTES

heart disease, cancer, and stroke. Diabetes ranked seventh in 1997—it was not even in the top ten in 1987. The U.S. Surgeon General reported in 1998 that type II diabetes, an adult health problem related to obesity, was being seen in children as young as four years old. Diabetes among adults increased by 70 percent between 1990 and 1998 among individuals 30 to 39 years of age; by 41 percent among individuals 40 to 49; and by 31 percent among those 50 to 59. By 1998, 16 million American adults suffered from diabetes. In addition to the health threat, obesity can cause emotional pain due to social stigmatization, discrimination, and lowered self-esteem. In 2000, the World Health Organization estimated that there are 1.2 billion obese individuals around the world.

Food Safety

The increase in the number of fast-food restaurants, supermarkets, and restaurants in developing countries, and the rising trend of eating meals away from home, present a global challenge to ensure that food is appealing and safe. Many countries have agencies that set and regulate standards for food safety. In the United States, the U.S. Department of Agriculture (USDA) has the task of regulating and inspecting meats and poultry during slaughter and processing, while the Food and Drug Administration (FDA) is responsible for conducting tests, setting standards, and enforcing laws regulating food quality and processing. FDA inspectors check restaurants to make sure that they practice food safety regulations. FDA officials also review the safety of chemicals that manufacturers use as food additives . Importing foods from countries where food safety is not strictly monitored presents a global health threat.

The biggest problem with food safety is food poisoning . Some bacteria and viruses that cause food poisoning are: Escherichia coli, Salmonella, Listeria monocytogenes, Shigella, Campylobacter, and yersinia. Bacteria, viruses, toxins , parasites , and chemical contaminants can all cause food-borne illnesses, and it takes only a small amount of contaminated food to cause severe food illnesses.

Signs and symptoms of food-borne illness may present within thirty minutes of eating contaminated food, or they may not show up for up to three weeks. While some food-borne illnesses may last for a couple of days, some may last for weeks. Severe cases can be life threatening.

Eating Away from Home

Internationally, the proportion of money spent on food eaten away from home, as well as the number of restaurants, has been steadily increasing since the second half of the twentieth century. People may dine at formal, sit-down restaurants, at fast-food eateries, at cafes, or they may purchase food from street vendors.

NOTES

Fast-food restaurants have become very common, and are visited by all types of people. The growth and popularity of fast food has come to be known as the "McDonaldization" of America. In the United States, eating in these restaurants has decreased slightly among heavy users in the 18–34 age group, but has increased among other groups. Their popularity has also increased internationally.

Many eateries now offer the option of larger serving (portion) sizes for a nominal additional fee (a "super size"). Eating away from home, and the shift to a more sedentary lifestyle , has been linked to the increasing rates of obesity in several countries.

Supplements

Pills, liquids, or powders that contain nutrients and other ingredients are now readily available in stores. Supplements that contain herbs (or some herbal components) are growing in popularity. However, supplement production and use is not always well regulated, so consumers must be careful about what they purchase and consume.

Convenience Foods

To satisfy individuals who want to eat well at home but are short on time or do not want to prepare elaborate meals, many eateries also offer take-out meals or items. Fully or partially prepared "TOTE" (take-out-to-eat) foods, including home-delivered meals, are generally referred to as convenience foods. As more women (the traditional preparers of family meals) enter the labour force, people's desire to save time increases along with the use of convenience foods.

Functional Foods

The term functional food is often used in reference to foods that have nutrients (or non-nutrients) that might protect against disease. The term is used when referring to foods that have been fortified , have specific phytochemicals or active microorganisms added, or have been developed using genetic engineering techniques. However, all foods can support health in some way, and there is no legal definition of functional food. In addition, the actual benefit of these foods, if any, can vary and is open to interpretation. For example, both a candy bar and orange juice may have additional calcium added, and can therefore be called functional foods. The consumer must determine the benefit of such items.

Ethnic Foods

People now eat foods with origins in cultures other than their own, especially in the developed countries, where almost all dishes originated elsewhere but have been modified to suit the tastes and popularity of the mainstream population.

Since the late twentieth century, however, there has been an increased incorporation of ethnic cuisines into the Indian diet, including foods from East Asia, the Middle East, and Latin America. This trend is part of a larger movement toward diversity in all aspects of life.

Although all humans need food to survive, people's food habits (how they obtain, prepare, and consume food) are the result of learned behaviours . These collective behaviours, as well as the values and attitudes they reflect, come to represent a group's popular culture.

What People Eat ?

In each culture there are both acceptable and unacceptable foods, though this is not determined by whether or not something is edible. For example, alligators exist in many parts of the world, but they are unacceptable as food by many persons. Likewise, horses, turtles, and dogs are eaten (and even considered a delicacy) in some cultures, though they are unacceptable food sources in other cultures. There are also rules concerning with whom it is appropriate to eat. For example, doctors in a health facility may eat in areas separate from patients or clients.

Obtaining, Storing, Using, and Discarding Food

Humans acquire, store, and discard food using a variety of methods. People may grow, fish, or hunt some of their food, or they may purchase most of it from supermarkets or specialty stores. If there is limited access to energy sources, people may store small amounts of foods and get most of what they eat on a day-to-day basis. In homes with abundant space and energy, however, people purchase food in bulk and store it in freezers, refrigerators, and pantries. In either case there must also be proper disposal facilities to avoid environmental and health problems.

Exposure to Foods

There are innumerable flavours and food combinations. A liking for some flavours or food combinations is easily acceptable, but others must develop or be learned. Sweetness is a universally acceptable flavour, but a taste for salty, savory, spicy, tart, bitter, and hot flavours must be learned.

The more a person is exposed to a food and encouraged to eat it the greater the chances that the food will be accepted. As the exposure to a food increases, the person becomes more familiar and less fearful of the food, and acceptance may develop. Some persons only eat specific foods and flavour combinations, while others like trying different foods and flavours.

NOTES

Influences on Food Choices

There are many factors that determine what foods a person eats. In addition to personal preferences, there are cultural, social, religious, economic, environmental, and even political factors.

Individual Preferences

Every individual has unique likes and dislikes concerning foods. These preferences develop over time, and are influenced by personal experiences such as encouragement to eat, exposure to a food, family customs and rituals, advertising, and personal values. For example, one person may not like frankfurters, despite the fact that they are a family favorite.

Cultural Influences

A cultural group provides guidelines regarding acceptable foods, food combinations, eating patterns, and eating behaviours. Compliance with these guidelines creates a sense of identity and belonging for the individual. Within large cultural groups, subgroups exist that may practice variations of the group's eating behaviours, though they are still considered part of the larger group. For example, a hamburger, French fries, and a soda are considered a typical American meal. Vegetarians in the United States, however, eat "veggie-burgers" made from mashed beans, pureed vegetables, or soy, and people on diets may eat a burger made from lean turkey. In the United States these are appropriate cultural substitutions, but a burger made from horsemeat would be unacceptable.

Social Influences

Members of a social group depend on each other, share a common culture, and influence each other's behaviours and values. A person's membership in particular peer, work, or community groups impacts food behaviours. For example, a young person at a basketball game may eat certain foods when accompanied by friends and other foods when accompanied by his or her teacher.

Religious Influences

Religious proscriptions range from a few to many, from relaxed to highly restrictive. This will affect a follower's food choices and behaviours. For example, in some religions specific foods are prohibited, such as pork among Jewish and Muslim adherents. Within Christianity, the Seventh-day Adventists discourage "stimulating" beverages such as alcohol, which is not forbidden among Catholics.

Economic Influences

Money, values, and consumer skills all affect what a person purchases. The price of a food, however, is not an indicator of its nutritional value. Cost is a complex combination of a food's availability, status, and demand.

Environmental Influences

The influence of the environment on food habits derives from a composite of ecological and social factors. Foods that are commonly and easily grown within a specific region frequently become a part of the local cuisine. However, modern technology, agricultural practices, and transportation methods have increased the year-round availability of many foods, and many foods that were previously available only at certain seasons or in specific areas are now available almost anywhere, at any time.

Political Influences

Political factors also influence food availability and trends. Food laws and trade agreements affect what is available within and across countries, and also affect food prices. Food labelling laws determine what consumers know about the food they purchase.

Eating habits are thus the result of both external factors, such as politics, and internal factors, such as values. These habits are formed, and may change, over a person's lifetime.

Socio-Economic Status, Nutrition and Health

In 1946, The World Health Organisation adopted a definition of health, which today is still widely accepted and frequently cited in many contexts. It says: "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

This three-dimensional definition of health clearly illustrates a sound change in the way of thinking about health, that has taken place during the 20th century and that has definitively abandoned the purely organic view that was so typical for the science of medicine in previous centuries. With this definition, health was no longer the exclusive area of medicine but had entered a much broader arena of scientific disciplines and multi-sectoral societal debate.

Scientists from a broad variety of research areas (social, political, economical, behavioural, etc.) have come into play and have provided valuable new insights regarding the relevance of social and economical conditions for the thorough understanding of inequalities in health and have made suggestions for the tackling of these inequalities.

Although the term "complete well-being" is perhaps difficult to interpret "optimal" might have been more appropriate as it suggests a theoretical maximal level that can be achieved by every human being, the WHO definition yet offers a comprehensive conceptual framework for a multidisciplinary approach aimed

NOTES

at achieving that elementary level of health and well-being all humans deserve access to.

Perhaps naively paraphrasing, one could derive directly from this definition that social inequality by definition leads to inequality in health and that on population level – health could substantially be improved by reducing the gaps between socially deprived subgroups of the population and those that are much better off in this respect. In other words, the mere existence of social inequalities themselves legitimate continued public policy and public health initiatives aimed at reducing these inequalities.

Although such a qualitative approach surely has a value in its own right, there is of course also a need to quantify differences in socio-economic status, to quantify their impact on public health and to elucidate the mechanisms that underlie these phenomena.

Some of the mechanisms leading to social inequalities in health are undoubtedly acting partially through nutrition a lifestyle factor one cannot cease to maintain on a daily basis and which is obviously already on an intuitive basis linked to many surrounding factors (geographical, material, personal, social, psychological, etc).

Fortunately, today, we do not need to rely on intuitive knowledge in this domain. Excellent multidisciplinary scientific research has been carried out over the past decades, which has brought us substantial insight in the mechanisms through which social inequality can lead to nutrition inequality and from there to inequalities in health.

In this section, some observations and insights from literature regarding the interaction between socio-economic status (SES), nutrition and health are brought together and discussed.

A Complex Constellation of Contributing Factors

The three main components of the overall issue regarding SES, nutrition and health can be visualised as three angles of an equilateral triangle, such that the notions "top" and "basis" (respectively referring to "endpoint" and "predictor" variables of interest) could vary according to the specific context one is interested in. The sides of such a triangle would then represent the interaction between the angles, which in themselves represent clusters of subcomponents.

In order to get a better understanding of the triangle, it is worth looking at its components. The first question that needs to be addressed regards the impact of nutrition on health.

Although there are still today many gaps in the knowledge of this relationship, there is at the same time a substantial body of evidence available

(from fundamental, clinical and different types of epidemiological research), which allows to conclude that – on population level – nutrition plays a measurable and significant role in the development of many diseases.

NOTES

From a public health point of view, this refers in the first place to a number of chronic degenerative diseases (cardiovascular diseases, cancer, diabetes, obesity, osteoporosis, etc.) that are to a large extent responsible for overall and premature patterns of morbidity and mortality in most Western countries.

The relationship between nutrition and health relates to many different aspects of nutrition (energy intake, nutrient intake, types of foods, meal patterns, etc.) and nutritional status (body composition, energy balance, metabolic parameters, antioxidant capacity, etc.).

Moreover, there seems to be an important interaction between different nutritional factors and between nutritional factors and other lifestyle factors, such as smoking and physical activity.

The overall body of evidence on the association between nutrition and physical activity on health and the potential of prevention through acting upon these lifestyles, has recently been reviewed by a large number of European experts from different fields and has been summarised in a series of reports and papers, known as the "EURODIET" reports.

According to this scientific review, unbalanced eating patterns and inactive lifestyles are held responsible in Europe for – amongst others:

- between 30 and 40% of all cancers
- at least one third of premature deaths resulting from cardiovascular diseases
- the pan-European epidemic in obesity and related disorders
- the steep increase in osteoporosis and its health consequences
- a large prevalence of micronutrient deficiencies (like iron and iodine).

All these public health endpoints are known to have higher incidence or prevalence in lower SES subgroups of the population (further elaborated below).

From a health economic point of view, it has been calculated by researchers from the Institute of Public Health in Sweden, that – taking into account disability adjusted life years lost – dietary factors and inactive lifestyles impose costs which exceed that of tobacco use within the EU.

One can only speculate to what extent this cost could be reduced by improving socio-economic conditions of socially deprived subgroups of the population. Obviously, such efforts would also have to be financed by public resources but would at the same time potentially improve the quality of life of many people.

NOTES

A second question that needs to be examined, relates to the side of the equilateral triangle that links SES with health.

Again, we are confronted here with a huge area of multidisciplinary research which is very suggestive for a strong positive association between these two clusters, but which at the same time is still wrestling with many unresolved questions.

It seems important however, to first outline briefly the broad scope of the problem in a semantic and conceptual context.

According to JP Mackenbach from the University of Rotterdam in the Netherlands – who has done a substantial amount of research on this topic – socio-economic inequalities in health can be defined as "systematic differences in morbidity and mortality rates between individual people of higher and lower socio-economic status to the extent that these are perceived to be unfair".

Two terms in this definition seem at first sight difficult to measure ("SES" and "unfair") and indeed they are. In the literature on health inequality, there is still according to Mackenbach no consensus as far as the definitions and conceptualisation of socio-economic status and its determinants (income, educational level, job status, ethnicity, etc.) are concerned and that is a considerable problem both in the design of studies and in the interpretation of research results.

In general, two main conceptual frameworks are widely used. Some scientists prefer to work with models based on "social class" which are derived from theories of society such as the Marxist theory while other scientists prefer to avoid incorporation of political and economical forces in their models and then mostly use the term "status" instead of class.

The notion of "unfair" is also subject to significant variation in interpretation. This has been very comprehensively elaborated by Ilona Kickbusch during a recent congress on this topic in Copenhagen (Denmark) in the year 2000. "Inequality in health is a political issue", she argues, "and social justice is not on everyone's agenda. Health has therefore to be defended as a basic human right continuously. However, to the extent that social differences in health are inherent characteristics of societies, it might be more pragmatic to rephrase the whole issue in more readily understandable and realistic terms: how much inequality are we willing to accept both locally and globally?".

In other words, what degree of inequality is considered to be unavoidable, who is entitled to outline the criteria for such an evaluation and how can we deal with that on societal level? Obviously, this question is deeply rooted in ideological discussions.

There is sufficient evidence from historical research that socio-economic inequalities in health are not a recent phenomenon. For a long period in history, however, these differences went unrecognised.

NOTES

Ever since from the nineteenth century onwards population (public health) statistics (*e.g.*, on mortality) have gradually been collected in a more systematic and standardised way in many European countries, interest in the association between SES and health outcomes has also gradually increased and has come under thorough scientific investigation during the past decades.

Due to substantial improvement in many areas of public health, there has been a very general decline in overall mortality during the 20th century and the absolute differences in mortality between people with high and low SES have significantly decreased. However, this has most likely not been accompanied by a decline in relative differences. The higher relative risks of dying (in different age groups) for people at lower as compared to higher SES, have remained remarkably stable for a long period.

Today, the evidence on social inequalities in health in Europe – as in the rest of the world is endorsed by many epidemiological studies. The most worrisome conclusion from most of this research is that relative differences in health inequalities between social subgroups have been increasing very rapidly in most European countries over the past four, five decades. This is even more emphatically the case in a number of Eastern-European countries as a result of rapidly changing political, social and economical patterns in these countries. As a consequence, inequalities in health are considered by some scientists as the major public health issue for the 21st century.

Substantial evidence on the association between SES and health has been produced – amongst many others – in the UK, where data on occupational class have been collected and have been prospectively linked to mortality.

From *figure 12* it can be derived that individuals employed in the lowest occupational class (unskilled workers) had an overall mortality which is substantially higher than the mortality rates in individuals from the highest occupational class (professionals) and that – on the whole – the range of occupational positions from lower to higher is accompanied by a gradual consistent increase in mortality on population level.

Also clear from this figure is that trends are going in diverging directions with higher occupational classes improving their situation and lower occupational classes worsening (about 20% difference in the fourth decade up to around 70% difference in the seventh decade of the 20th century).

Although a classification of occupations in five distinct categories is of course a huge reduction of a very complex reality, these data are strongly suggestive for a positive correlation between determinants of health (or preventing factors for disease) on the one hand and people's capability to achieve a higher position on the labour market on the other hand.

NOTES

The latter is in turn undoubtedly correlated with people's educational level, although in fact the reality is much more complex than that. It also relates to such factors like job aspirations, job perception, job satisfaction, etc., which are in turn co-determined by personal characteristics, which – again – have at least part of their roots in "social background".

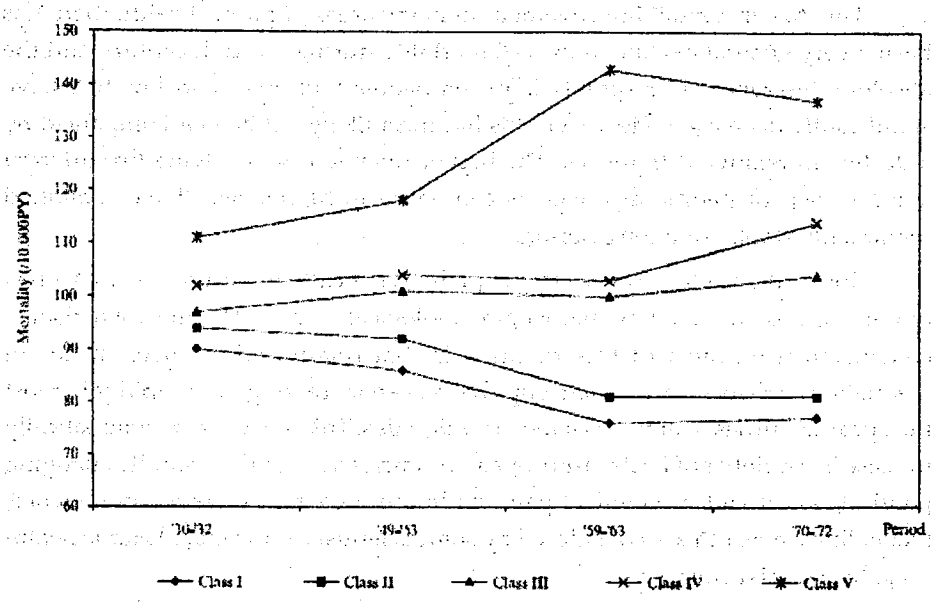


FIGURE. 12: MORTALITY (/10,000 PY) OF MEN AGED 35-64 BY OCCUPATIONAL CLASS IN THE UK IN THE PERIOD 1930-1975.

Other intriguing data on the relationship between SES and health have been provided by the work of Professor David Barker from Southampton (UK). *Figure 13* shows data on infant mortality and mortality at age 55-65 in three small English towns in the county of Lancashire in two different time periods during the 20th century. Substantial differences in infant mortality between these three cities were observed for the period 1911-1913. These differences are largely explained by fairly well documented differences in the overall socio-economic situation of these three cities. Due to (unequal) growth in socio-economic environment in all cities, infant mortality has declined to much lower levels and has become comparable in all three cities by the 1970s.

The most intriguing observation from *figure 13*, however, relates to the fact that the geographical patterns of age standardised mortality in older adults during the seventies show a striking parallel with infant mortality in the period when these people were born, *i.e.*, the second decade of the 20th century.

Professor Barker has found many other similar associations between several factors (such as birth weight, length at 1 year, etc.) – which in themselves are related to socio-economic conditions – and health outcomes in later life.

One of the conclusions that David Barker has drawn from these observations is that social class environment during pregnancy and early infancy is a strong predictor of morbidity and mortality in later adult life. The "social environmental" factors are considered to be particularly strongly related to – amongst other conditions – nutrition and nutritional status of pregnant mothers and young children.

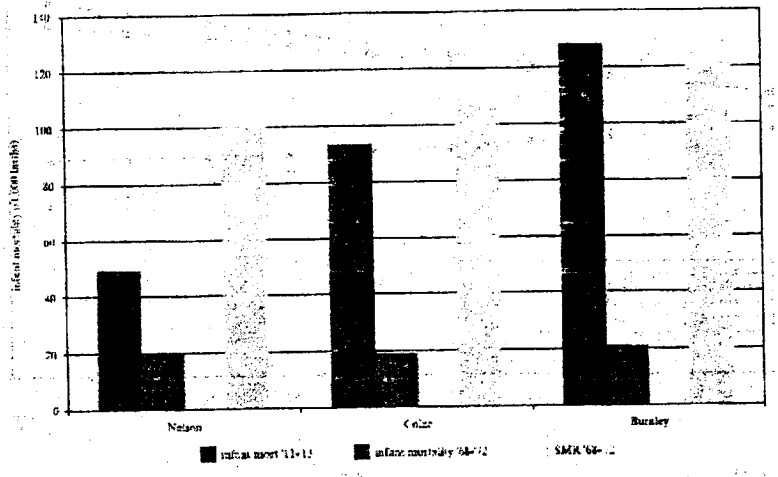


FIGURE. 13: INFANT MORTALITY (/1,000 BIRTHS) AND MORTALITY AT AGE 55-74 (SMR) IN THREE ENGLISH TOWNS IN TWO PERIODS DURING THE 20TH CENTURY.

The above-mentioned data are of course collected on an ecological level and therefore should be interpreted with some caution. They are however compatible with analogous observations on the association between SES and health on individual level.

It therefore seems plausible that – on the whole – socio-economic gradients in the population are accompanied by parallel gradations in "environmental" exposures with potential beneficial or adverse health effects.

In Belgium, some data that are suggestive for the differential effects of SES on health outcomes, are available. In the context of the WHO MONICA project (Multinational Monitoring of Trends and Determinants of Cardiovascular Diseases), Professor G. De Backer (Ghent University) and co-workers have convincingly shown that important regional variations in coronary heart disease (CHD) incidence can occur within such small geographical entities such as cities (in casu Ghent) and that – moreover – on population level, the patterning of

NOTES

CHD incidence within the city showed a striking parallel with the distribution of a calculated index of socio-economic status across the city of Ghent.

In the same MONICA project, Professor M. Kornitzer from the Université Libre de Bruxelles, has demonstrated a remarkable parallel between diverging trends in CHD incidence in two Belgian cities (CHD incidence decreasing in Ghent and increasing in Charleroi) on one hand and trends in unemployment that were in a similar way diverging in these two cities in the same period (*figure 14*) on the other hand.

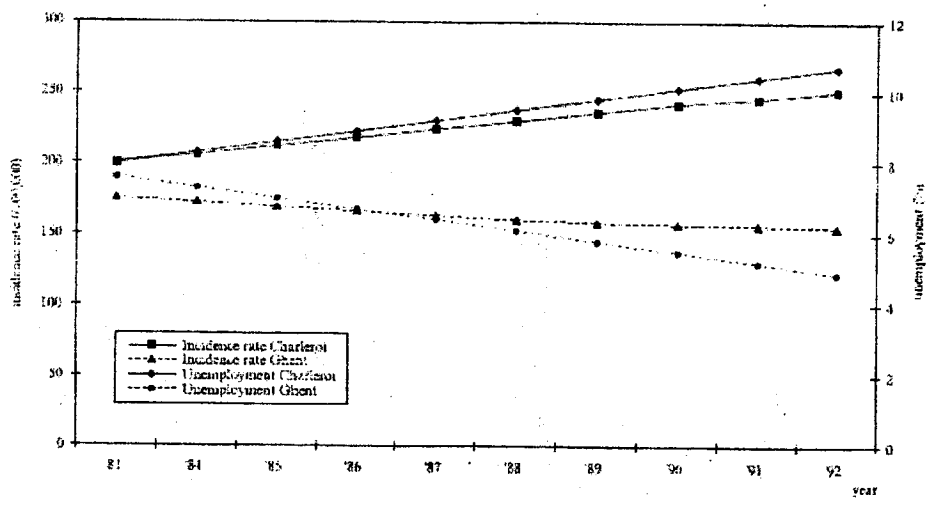


FIGURE. 14: TRENDS IN INCIDENCE RATE OF AMI AND IN UNEMPLOYMENT BETWEEN 1983 AND 1992 IN MEN AGED 25-69 YEARS IN GHENT AND CHARLEROI.

EXPLANATORY MODELS FOR SOCIAL INEQUALITIES IN HEALTH

Over the past decades, several models have been developed that try to disentangle the complexity of the above described phenomena and to identify and quantify individual predictors that play a role in the overall picture. These models all overlap with each other to some extent in the sense that there is a large consensus among experts on the role that is played by a number of specific predictors or intermediate factors that lead to health inequalities. These factors are grouped mostly under the common denominators of "material", "behavioural" and "psychosocial" factors. Examples of such explanatory factors are respectively "income", "lifestyle" and "job strain".

Almost all explanatory models have in common that they try to visualise the development of social inequalities in health as a "layered" or a "chain-like" process.

NOTES

The main differences between the models are related to the "exposure time" or "exposure period" that is taken into consideration, the integration – or not – of "biological pathways"; the integration – or not – of "macroeconomic", "macrosocial" and "political" elements and, finally, the notion that the relation between SES and health is working in a "reverse" way or not.

One example of such a model – the so-called "Mackenbach model" is shown in *figure 15*. This model is very comprehensive and straightforward and therefore very useful as a basis for developing policies and intervention strategies. Mackenbach proposes in his model that the link between socio-economic status and health related problems is triggered and maintained by two distinct types of mechanisms that are active during different periods of life and that act through different pathways, namely "selection" processes and "causative" processes.

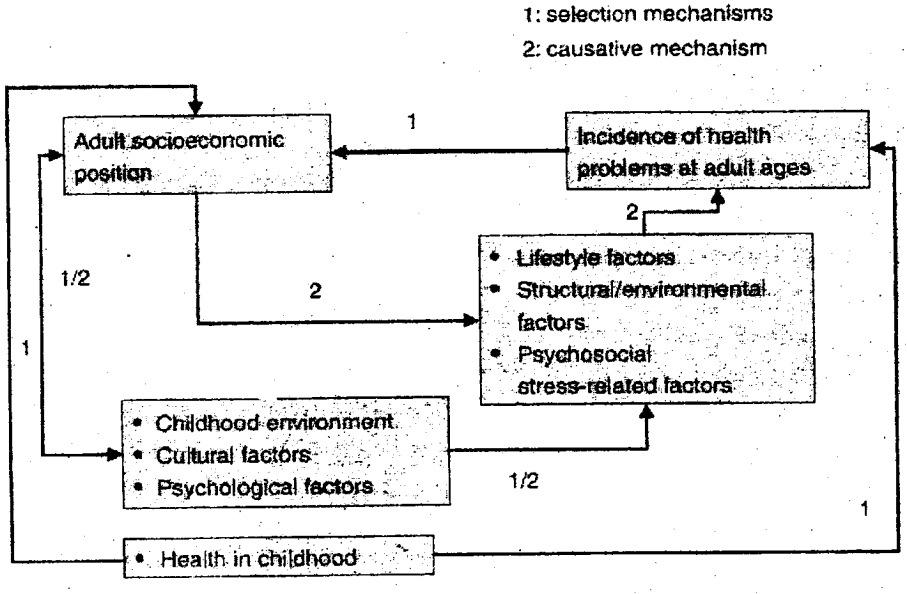


FIGURE. 15: SELECTIVE AND CAUSATIVE FACTORS INVOLVED IN THE DEVELOPMENT OF HEALTH INEQUALITIES IN SOCIETY: MODEL ACCORDING TO MACKENBACH.

A central position in the "selection" process is represented by "childhood health", which in itself is a major determinant of a second important selection parameter, namely "health in adulthood". The effect of health on the socio-economic position is further potentially modulated by factors which can act both as "selective" and "causative", namely "childhood environment", "psychosocial" and "cultural factors". The "causation mechanism" is mainly active through three groups of so-called "intermediate" risk factor clusters: lifestyle factors, structural/ environmental factors and psychosocial stress related factors. Through a number

NOTES

of closed cycles in the overall picture, health inequalities become self-perpetuating and hence often drag (groups of) people along in a downward negative spiral.

For example, adverse social environment during childhood can lead to lower socio-economic status at adult age through both selective and causative mechanisms. This lower socio-economic status at adult age can cause an unfavourable health behaviour which may in itself lead to health problems. These mechanisms may then become self-perpetuating as they can reinforce the downward process of socio-economic position, even more adverse health behaviour and more severe health problems.

Obviously, the main lifestyle factor of interest in this paper – nutrition – is nested within the overall lifestyle cluster and one can try to speculate on the particular role of this factor in the overall picture.

The Role of Nutrition

This brings up the third question of interest to this section: what fraction of SES differences in public health can be explained by differences in nutrition and what are the mechanisms?

As GD Smith points out, the precise role of nutrition in generating inequalities in health can hardly be delineated, let alone quantified, for several reasons. It is moreover very likely that its impact can vary considerably across cultures and even within cultures.

In order to understand this, one has to realise the complexity of the factors that are implicated in the process that eventually leads to the decision on which foods are eaten in which form, which degree of variation, which quantities, etc.

Figure 16 gives an overview of factors that can potentially play a role in household and individual purchase and consumption of foods. Without knowing the quantitative impact of factors like availability of and access to food, household composition, perception of "healthy foods", attitudes, cooking skills, etc, one can easily appreciate that the socioeconomic position of households and individuals will have a modulating effect on many of them.

A number of studies in India and Europe has clearly identified differences between socio-economic subgroups of the population on the level of foods, food groups and nutrients, pointing – in general – at a more healthy diet in higher educated people.

A recent review of socio-economic differences in the consumption of fruit and vegetables – based on eleven dietary surveys carried out in seven countries – has led to the conclusion that lower consumption of these food groups in lower socio-economic subgroups of the population are a fairly constant finding in Europe.

NOTES

However, differences between SES groups do not always go in the same direction. In the pan-European "Disparities in food habits" project based on household budget surveys in 15 European countries, it appeared that for instance consumption of butter and other animal fat was lower in higher SES groups in northern European countries, whereas the opposite was found to be true in a number of Western and Southern European countries. For fruit and vegetables however, the association with SES was consistently positive in most countries.

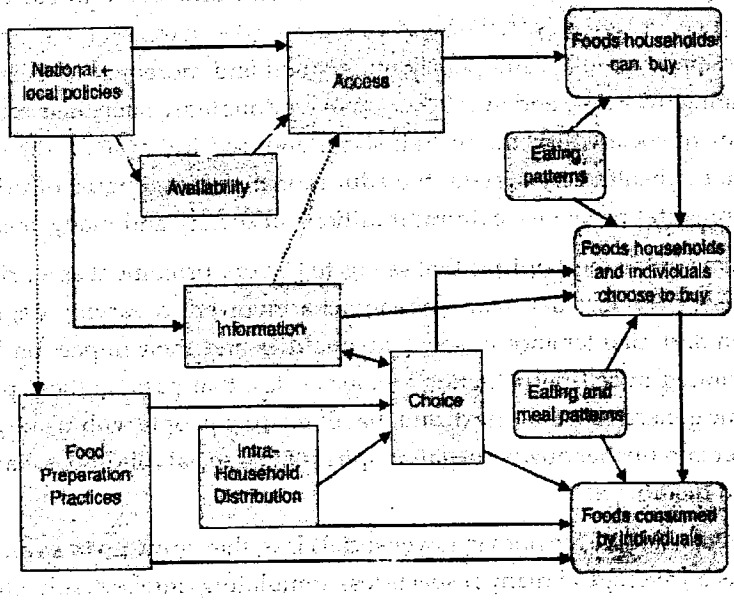


FIGURE. 16: FACTORS INVOLVED IN FOOD PURCHASE / CONSUMPTION AT INDIVIDUAL LEVEL.

Several studies in Europe have also shown the relationship with lower SES and a poorer micronutrient density of the diet.

CONCLUDING REMARK

The availability of and access to safe food in sufficient quantities and variation is considered to be a basic human right (Universal Declaration of Human Rights, 1948, Article 25.

Yet today, large subgroups of the population in both developing and developed countries are still limited in this respect because of social and economical (or other) constraints, that either directly influence the availability of food or the purchasing capacity of households and individuals or that create indirect circumstances which "drive" people towards less healthy food choices.

NOTES

The dynamics of social differentiation in society as depicted in several available theoretical explanatory models are moreover acting in such a way that they substantially increase the likelihood that on group level unhealthy food choices are accompanied by other unhealthy lifestyle factors and by other behavioural and psycho-social characteristics that have a negative impact on health.

These dynamics of social differentiation *i.e.*, the mechanisms ("circumstances") which underlie the social and economical constraints experienced by socially deprived subgroups of the population are considered to be extremely complex, still poorly understood and moreover to a certain extent fluctuating over time and over space. They undoubtedly have their roots in many faculties of society, like the overall social and political system, the economical system, the health care system, the educational system, degree of urbanisation, environmental problems, cultural traditions in society and many, many others.

One of the mechanisms that seems to be very prominent as a driving force, however, is the fact that many phenomena involved to varying degrees in the creation and maintenance of social inequalities and their impact on health, are incorporated in self-perpetuating vicious cycles, that pass on these phenomena from one generation to the next, and that often drag people within one generation – further and further down a negative spiral of bad social conditions, bad nutrition and bad health.

When people are born in lower social class, they grow up in an environment which is on average in many respects less stimulating (intellectually, emotionally, etc.) than for people who were born in higher social classes. It should therefore not be too surprising that the chances of achieving a higher ranking on the socio-economic scale for an individual born in a less stimulating social environment are substantially lower than the chances for an individual born from socially prosperous parents to maintain his/her position on the scale or even improve it further.

There are still many unresolved questions on the position and the role of nutrition in this broad context of self-perpetuating health inequalities. For instance, there is still a lot of debate on the question whether (one of) the reasons for an inferior diet of those at the bottom of the social scale are stronger related to an inadequate income than to an inadequate management of an adequate income (or a combination of both). Another example is the question whether social inequality leads to more nutritional imbalances in urban as compared to rural settings. Furthermore, there still is a lot of debate on the social determination of taste and food preferences and their impact on nutritional balance. And indeed on many other questions.

Such controversial items and unresolved questions – however interesting from a scientific point of view – should however not prevent public policy makers from continuous monitoring of people's social and living conditions and from taking initiatives to reduce the gap between socially deprived and socially advantaged subgroups of the population.

India' Economic Growth and Change in Food Pattern

In order for countries to be granted the title of a global market, they are examined at from an economic and financial perspective in terms of opportunities and threats as they operate in an external environment. It is up to an individual country to assume control of the opportunities offered by the increasing prevalence of globalization as it is manifested in the investiture of multi-national corporations and trade-governing bodies such as the World Trade Organization.

> "Many countries in the Asian market have shown remarkably rapid economic growth with the expansion of business methods and companies across national boundaries, leading to immense changes particularly in the food retail landscape" (A budget, 2003).

India, representing the world market with a population that is second only to China, offers a complicated picture as to which both opportunities and threats are assessed to the changing global market. This paper will examine India from a global perspective to see what are perceived as the positive and negative effects of globalization on the country's fiscal and trade sectors, and draw specific concentration on how the food retail industry in India is rapidly changing with the effects of globalization.

The perceived gap between India's potential and reality will be explained through the through sources that have been observing the nation's Gross Domestic Product for many years, and have seen India lag behind other Asian countries which have shown comparatively unparalleled economic growth. Changing economic policies that lifted many Indian trade restrictions in the early 1990's will be assessed in terms of both the increased opportunities they make for many individuals in the nation as well as, internally, the increased weaknesses that are represented by political interference and what is seen by many to be an increasing gap between rich and poor in the nation.

The increased gap of wealth amongst individuals of the nation will be explained through the progression of the retail industries, giving preference to the rich, while the poor are kept in deprivation of economic changes.

Population Distribution in India

Population (millions)	Number of Towns
More than 10	3
5-10	4
1-5	4
0.1-0.5	178
Less than 0.1	3,543
Villages	570,000

Structural Adjustment, Stabilization, and Globalization of India

When looking at structural adjustments of a country, terms such as meanings, aims, problems, context, and positive and negative results play a great role as to where changes need to be executed. In general terms, the aim of becoming a global market is to increase the quality of productive resources, human and physical and to increase productivity of physical and human resources through global trading and technological advances.

For India, we can use a model presented by Kuznets, the Nobel Prize recipient for economics. This model discusses specific structural adjustments, which explains his theory that economic growth in developed nations includes six factors, four of which are particularly relevant here:

1. High growth rate per capita output and population.
2. High increase in labour productivity.
3. High rate of structural transformation.
4. High rate of social and ideological transformation.

These terms play a role of reference in the international comparison of a country. India is often judged by the standards of similar nations that have large populations and are seen to be developing. "India is often compared to China in terms of economic growth and development, and is as often seen to lag behind the standards set by China in terms of annual increase in Gross Domestic Product" (A budget, 2003). Both countries present to the world what is potentially a huge market of consumers, but both countries also have internal problems with infrastructure and issues with power-supply and telecommunications dissemination.

India's market remains closed in many ways, though, and the country is seen to lag behind China in the relative speed of its economic development and openness to trade. This is perhaps a result of India's past, before the early 1990's

NOTES

and the institution of the New Economic Policy (NEP), when the nation was outwardly socialist. As one source states, "India has shed its socialist pretensions, especially after free market restructuring carried out under the tutelage of the International Monetary Fund and the World Bank in 1991. All this has meant an upward swing in the fortunes of India's upper classes".

There is definitely a contrast that is perceived between the old, socialist India, and the new, global-capitalist India. But this change is so recent that many sources wonder if it is not still in stages that could be said to be superficial. Since acquiring independence from Britain in 1947, the Indian economy has been primarily ruled by central planners with little interest in international trade expansion, and more interest in imposing government controls on what was seen to be a subsidized domestic market with a notoriously unproductive public sector. "Before the restructuring of the early '90s, restrictions on the operation of multinationals and tight regulation of the indigenous private sector meant that good jobs often were available only in the public sector, which occupied the 'commanding heights' of the economy" *(Pal, 2001)*.

The Indian market, the second largest national market in the world, was essentially closed off from the outside world by the strictures of a quasi-socialist control system. Imports were limited and foreign firms were not encouraged to enter the domestic sphere at all, as if they did so, the bureaucratic repercussions were often seen to be extremely prohibitive *(Pal, 2001)*. At the same time, this bureaucratic government structure incurred its own costs and labour issues, which were not alleviated by the flow of multi-national capital. The public sector became a sort of economic monolith within the country, and increases in bureaucracy made this structure increasingly inscrutable, even to those within its sphere of operation. At the same time, the private sector was being virtually ignored in terms of economic opportunity.

This situation culminated in the early 1990's with the introduction of nonnational capitalism in the form of the Indian NEP, under which national government control, unable to provide either clear parameters of operation or adequate health care for India's huge population, was dampened to encourage the development of unrestrained, privatized trade dependent on exports. Although the NEP produced many successful capitalists, some of whom undoubtedly had philanthropist tendencies, it did not assure any downscale of the widening gap between the rich and poor, prevent poverty, or check environmental destruction. The rules of the new economy were not humanitarian: open trade, specialized education for an information economy, and the attraction of capital were considered to be paramount, as it was, after all, an economic policy.

In the new national atmosphere encouraged by the NEP, many multinational corporations flourished in the subcontinent. These corporations did not, nor, arguably, could they be expected to, improve the nation's human-rights situation generally, but they did create new opportunities for India's wealthier citizens to take advantage of the new economic climate, and resulted in a new flurry of consumerism among the country's expanding middle-class. Despite this increase, he past decade has been harsh for the roughly 300 million people living below the poverty line. And the divide between the haves and the havenots has widened.

Many people who left India to emigrate abroad before the 1990s returned to find what they could only describe as an entirely different country; one in which conspicuous consumption was much more widespread and the economy was more out in the open. The change that brought about the NEP ushered in a new era in the nation of India's economy.

This new, global economic structure can be seen from the perspective of its positive and negative effects on the nation. Generally, the situation is complicated by what appears to be a vast split in opinion regarding the nature of multi-national corporate finance within India's domestic sphere. While some embrace the changes as the wave of the future, others are prone to point out the potentially exploitative nature of MNC outsourcing in areas of development. Others may oppose from a more nationalistic standpoint.

Although India's economy underwent great changes fairly recently, government deficit has remained fairly high, and just last year, reached a percentage of the Gross Domestic Product (10%) that was greater than even 1991 levels (A budget, 2003). India's transition into a global economy has shown on the surface level in terms of expanded consumer opportunities in metropolitan areas, but the deficit level within the government is indicative of what may be a continuing problem that is based on India's past.

Despite potential internal threats, the Indian economy has been growing steadily since the sweeping changes of the early 1990s. Foreign companies are being given incentives to invest, and largely, with a few exceptions, the liberalization of public sectors is seen to be proceeding accordingly. The private sector has grown with improved fiscal opportunities in terms of independently operating companies within previously state-run sectors. Restrictions on foreign investment have been discontinued, and although deficit levels made many ventures into India rather tentative at first, the economy has been seen by both internal and external sources to be expanding and strengthening as more and more of the market is opened up. Industry and services are both growing faster than before (at annual rates of 6.1% and 7.1% respectively), exports are up by a fifth, and the current account, after 24 years in the red, entered surplus in 2001.

At the same time, India's vast population is comprised of many hundreds of millions of individuals who are living below the poverty line, especially in the south of the country, and reactions to the NEP and other economic issues in the forefront of the nation, such as India's membership in the WTO, are often not as widespread as they could be in terms of assimilation and wealth distribution. As stated, the gap between the rich and the poor in India, which has always been a social-class-conscious society, is seen to have widened, despite general good returns that are offered in the form of governmental trade statistics.

Indian Income Dispersion (Households in millions)

Income Group	*Urban Households*	*Rural Households*
Low	16	75
Lower-middle	14	27
Middle	7	9
Upper-middle	3	3
High	2	2

The new India is part of the World Trade Organization, which is a stark change from the old, quasi-socialist India of most of the latter half of the twentieth century. The nation's relationships within the WTO are seen to be based on encouraging foreign investment and expenditure in a decentralized atmosphere that has resulted in India's reducing trade barriers and opening up the doors of its country to the world market.

In terms of spending, India has shown revitalization since the economic reforms of the early 1990s, but with that, has also shown a down side. "In a country of a billion people, a quarter of whom live below the poverty line, interest payments are the biggest single expense, accounting, with defense spending and subsidies, for 60% of recurrent expenditure" (A budget, 2003). At the same time, the government is optimistic in its prognosis for future growth. One source states that future indicators point towards an annual growth of up to nine percent in the Gross Domestic Product. "If the 9 percent growth is achieved, it will quadruple the real per capita income and reduce poverty levels to almost zero, the report says, adding that India will then attain a higher level of development than China, and will be on a par with upper-middle income countries like Argentina, Hungary and Malaysia" *(Mamata Singh, 2002)*. Many of India's citizens are already seeing changes in the commodities available to them, and if this prediction is correct, can expect further expansion.

Some of these expansions are concentrated upon the networked atmosphere of the global community in terms of providing as many Indians as possible with

access to computers and internet services. Companies and the government have merged to put up "'eSeva' centers in Hyderabad, where citizens can pay utility bills, register births and deaths, and conduct many other dealings with the government" (Government, 2003). Internet kiosks are also increasingly prevalent, and are marketed in a way that "speaks to the earnings conscious manager by arguing that bringing goods and services to the masses will also bring wealth to shareholders" (Murphy, 2002) while targeting poorer Indians as its market.

With a background provided of the economic growth of India, the following section will explain the immense growth of the food retail industry. The increasing gap in wealth amongst individuals will be shown as reasoning to why food retailers are expanding in sections where future growth is foreseen through individual spending.

Changes in the Food Retail Landscape

India's food retail industry has been of main focus to MNC's looking to grow in accordance with the economic growth of the country. India has the scale and the potential to transform itself into a food retail powerhouse. It has been rated as the fifth most attractive emerging market for retail by the International Council of Shopping Centers (ICSC), where over the next five years, the market is certain to evolve significantly and the growth of a certain few retailers beyond the Rs.10 billion turnover (USD 230 million), with significant expansion in network size, is expected to occur.

According to a consumer study conducted by RPG, owners of FoodMart supermarkets, key findings for the food retail industry in India include factors such as the emerging sense of dissatisfaction with small range of products currently available at traditional food retailing stores, and consequently, the need for a broader selection of different brands, and a growing demand for hands-on comparison shopping style. The concentration of two cities, Bangalore and Chennai, in this growing landscape has brought great attention as to where global retail companies will expand to.

In addition, the scope of packaging and branding of commodity-like products is an issue for further research that will affect the pace of growth in this industry. Major opportunities for imported food products within the Indian market will only advance once India moves from its restricted lists onto the Open General license. As compared to the total size of the Indian population, the market for consumer-ready food products is relatively small but is growing steadily.

Five Forces Model – Indian Food Retail industry

1. **Rivalry:** Small grocery stores tend to dominate the industry, while supermarket outlets are booming across India.
2. **Bargaining Power of Buyers:** The growing purchasing power of the middle class calls for better products, services, and attractions rendered

in this industry. Emerging low switching costs are due to a South Indian variety of food retailers.

3. **Bargaining Power of Suppliers:** Supermarkets purchase its supplies directly from producers/wholesalers to offer savings; retailers could possess a great bargaining power with manufacturers due to recent consolidations in the industry.
4. **Threat of Substitutes:** Supermarkets are the newest substitutes of traditional food retail stores. A risk might be not developing strategic alliances with foreign investors, of who can start to invade India and offer consumers more advances.
5. **Threat of New Entrants:** The entry of organized players will help build better efficiencies in the supply chain management. However, barriers to entef are high.

Consumers in India are serviced by a highly fragmented trade system consisting of over three million retail and wholesale outlets, as well as millions of market and roadside vendors expanded over both urban and rural sectors. The following is a detail classification for the general retail industry and the newly means of shopping patterns by upper-middle-class consumers:

Shopping Patterns (Upper-middle-class consumers)

Outlet Type	*Percent Who Named Outlet as Most Frequently Used*
Big grocery store	30
Supermarket	16
Small grocery store	11
General merchant	11
Wholesale dealer	8
Others/no fixed shop	24

For several generations the family grocery business dominated the food market. However, there are main indications in findings and studies of consumer behaviour that this could change soon. There are major factors influencing food shopping that has shaped the industry's desired attributes. These include a growing dissatisfaction with limited selection of products and services, currently available in principal stores, daily shopping and freshness, which is associated with the concept of convenience, and an upward demand for hands-on comparison shopping, where only a small percentage of consumers were familiar with unconventional store formats, and the notion that price would win over quality during the purchase decision process.

Furthermore, specific consumer behaviour and purchasing attitudes were established along with their socio-economic status:

- **The Wealthy:** Mostly relied on domestic help for grocery shopping; bought all kinds of staples, and preferred to buy fresh vegetables and foods from local small grocers and vendors, and other products from general merchants.
- **The Poor:** Purchased basic staples the first day of each month, any other staples they could afford daily, and later purchased more merchandise on credit. Single-use packages sales were frequent.
- **The Middle-class:** Divided purchasing habits; majority shopped on their own at their favorite local shop where concerns about the quality of low-priced products were critical.

The following table summarizes the latter choice of food retail stores (usage frequency):

Number of Retail Outlets in India

Grocery Stores	1,575,000
General merchandise stores	531,000
Convenience stores/tobacconists	276,000
Chemists	212,000
Confectioners	141,000
Supermarkets	30
Other retail	805,000

Monthly Household Expenditures

Food Category	*Rupees per Month*	*Percent of Total Purchases*
Cereals and breads	779	43.2%
Oils and oilseeds	244	13.6
Sugar	191	10.6
Meat, egg, and fish	189	10.5
Pulses (lentils)	106	5.9
Coffee, tea, spices	104	5.8
Tobacco	104	5.8
Beverages (including alcohol)	83	4.6
Total (Rs/month)	1,800	100.0%

The concerns of the increasing gap between the rich and the poor is shown in the shopping habits presented through these charts. The outlook for the food retail landscape is increasing daily, but restricts people of low class to afford and accept the changes brought about through globalization.

1.10 SUMMARY

- Agricultural production is the major activity of any part of the world and it consists of two large subsectors, animal production and crop production.
- Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs.
- Food security, poverty reduction and economic development are interrelated and depend critically on improvements in agriculture.
- Subsistence agriculture is the main source of food and income in many rural communities throughout the world, especially Asia and sub-Saharan Africa.
- Way of tracking food insecurity is through the 'global hunger index', which is based on a simple average of three indicators: the percentage of the population undernourished; the percentage of under-five children underweight; and the under-five mortality rate.
- The world population more than doubled in the latter half of the 20th century and reached almost 6.8 billion by 2009. While the annual rate of growth slowed in the 21st century, from around 2 percent in the 1970s to 1.2 percent in 2009, this is on a much larger population base.
- Population growth, along with changes in people's living standards and dietary preferences, largely determine changes in the demand for food.
- The food available for human use reflects what is left from available supply after deducting exports, industrial uses, farm inputs, and end of year inventories. Human food use is not directly measured or statistically estimated.
- In its simplest form, food security has been defined as "access by all people at all times to the food needed for a healthy life".
- Meal pattern must not merely be directed at ensuring food security for all, but must also achieve the consumption of adequate quantities of safe and good quality foods that together make up a healthy diet.

1.11 GLOSSARY

- **Agricultural Productivity:** It is measured as the ratio of agricultural outputs to agricultural inputs.
- **'Global Hunger Index':** It is based on a simple average of three indicators: the percentage of the population undernourished; the percentage of under-five children underweight; and the under-five mortality rate.
- **Food Availability:** It refers the food available for human use what is left from available supply after deducting exports, industrial uses, farm inputs, and end of year inventories.

- **Food Security:** Access by all people at all times to the food needed for a healthy life.
- **Food Stability:** It refers to the temporal dimension of nutrition security.

1.12 REVIEW QUESTIONS

1. What role does agriculture production play in the life of human being? Discuss.
2. What is the status of food security in Asian countries?
3. How is population pressure related to consumption pattern?
4. Disscuss the changing pattern of meal strategy.
5. How is food availability measured? Name the factors influence the availability of food.
6. Which are those factors influence the choice of food? Discuss.
7. How does socio-economic status of a country affect the nutritional intake?
8. What is the status of food consumption in India?

1.13 FURTHER READINGS

- *Global climate change and agricultural production. Direct and indirect effects of changing hydrological, pedological and plant physiological processes,* Published in 1996 by John Wiley & Sons Ltd, Edited by FAKHRI BAZZAZ.
- *Agriculture, Food Security, Poverty, and Environment Essays on Post- reform India* By C H Hanumantha Rao, Published at Oxford University Press.
- *Poverty and Food Security in India: Problems and Policies* by M S Bhatt, Published at Aakar Books.
- *Agriculture, Food Security, Poverty, and Environment : Essays on Post-reform India* by C. H. Hanumantha Rao, Published at University press.
- *Modernization Of Agriculture And Food Availability In India* by C K Jain, Published at Northern Book Centre (1989).

UNIT—II

PREGNANCY, LACTATION AND INFANCY

NOTES

OBJECTIVES

After going through this unit, students will be able to:

- state concepts pertaining to the planning of nutrition of pregnant mother;
- discuss the impact of nutrional plan on the physical and mental condition of mother;
- explain the conceptual understanding of lactation and current trends;
- describe the nutritional practices for infant;
- understand the growth and development of infant.

STRUCTURE

2.1 Introduction
2.2 Child Birth (Pregnancy)
— Diagnosis
— Nutritional Planning
— Physical Changes
2.3 Lactation
— Lactation Current Concepts and Concerns
— Lactation Changing Trends in Lactation
2.4 Factors Associated with Deterioration of Maternal Nutritional Status
2.5 Effect of Maternal Nutrition on Lactation
2.6 Concept of Breastfeeding
2.7 Infancy
— Developmental Snapshots: The First Two Years of Life
2.8 Growth and Development of Infants
2.9 Introducing Supplement Food to Wean the Child
2.10 Weanling Diarrhoea
2.11 Breastfeeding Effects
— Benefits for the Infant
— Benefits for Mothers
2.12 Summary
2.13 Glossary
2.14 Review Questions
2.15 Further Readings

NOTES

2.1 INTRODUCTION

A balanced, nutritious diet is an important aspect of a healthy pregnancy. Eating a healthy diet, balancing carbohydrates, fat, and proteins, and eating a variety of fruits and vegetables, usually ensures good nutrition. Those whose diets are affected by health issues, religious requirements, or ethical beliefs may choose to consult a health professional for specific advice.

Adequate periconceptional folic acid (also called folate or Vitamin B9) intake has been proven to limit fetal neural tube defects, preventing spina bifida, a very serious birth defect. The neural tube develops during the first 28 days of pregnancy, explaining the necessity to guarantee adequate periconceptional folate intake. Folates (from folia, leaf) are abundant in spinach (fresh, frozen, or canned), and are also found in green vegetables, salads, citrus fruit and melon, chickpeas (*i.e.*, in the form of hummus or falafel), and eggs.

DHA omega-3 is a major structural fatty acid in the brain and retina, and is naturally found in breast milk. It is important for a mother to consume adequate amounts of DHA during pregnancy and while nursing to support her well-being and the health of her infant. Developing infants cannot produce DHA efficiently, and must receive this vital nutrient from the mother through the placenta during pregnancy and in breast milk after birth.

Several micronutrients are important for the health of the developing fetus, especially in areas of the world where insufficient nutrition is prevalent. In developed areas, such as Western Europe and the United States, certain nutrients such as Vitamin D and calcium, required for bone development, may require supplementation.

Dangerous bacteria or parasites may contaminate foods, particularly listeria and toxoplasma, toxoplasmosis agent. Careful washing of fruits and raw vegetables may remove these pathogens, as may thoroughly cooking leftovers, meat, or processed meat. Soft cheeses may contain listeria; if milk is raw the risk may increase. Pregnant women are also more prone to catching salmonella infections from eggs and poultry, which should be thoroughly cooked. Practicing good hygiene in the kitchen can reduce these risks.

Certain disorders, such as diabetes and high blood pressure, can increase the risk of problems during pregnancy. If women who have such a disorder wish to become pregnant, they should first talk with a doctor and try to get in the best physical condition possible before they become pregnant. After such women become pregnant, they may need special care, often from an interdisciplinary team. The team may include an obstetrician (who may also be a specialist in care of the disorder during pregnancy), a specialist in the disorder, and other health care practitioners (such as nutritionists).

Sometimes disorders that are not directly related to pregnancy develop during pregnancy. Some of them increase the risk of problems for pregnant women or the fetus. They include disorders that cause a high fever, infections, and disorders that require abdominal surgery.

Some disorders are more likely to occur during pregnancy because of the many changes pregnancy causes in a woman's body. Examples are thromboembolic disorders, anemia, and urinary tract infections.

2.2 CHILD BIRTH (PREGNANCY)

Childbirth is the process whereby an infant is born. It is considered by many to be the beginning of the infant's life, and age is defined relative to this event in most cultures.

A woman is considered to be in labour when she begins experiencing regular uterine contractions, accompanied by changes of her cervix — primarily effacement and dilation. While childbirth is widely experienced as painful, some women do report painless labours, while others find that concentrating on the birth helps to quicken labour and lessen the sensations. Most births are successful vaginal births, but sometimes complications arise and a woman may undergo a cesarean section.

During the time immediately after birth, both the mother and the baby are hormonally cued to bond, the mother through the release of oxytocin, a hormone also released during breastfeeding.

Diagnosis

The beginning of pregnancy may be detected in a number of different ways, either by a pregnant woman without medical testing, or by using medical tests with or without the assistance of a medical professional.

Most pregnant women experience a number of symptoms, which can signify pregnancy. The symptoms can include nausea and vomiting, excessive tiredness and fatigue, craving for certain foods not normally considered a favorite, and frequent urination particularly during the night.

A number of early medical signs are associated with pregnancy. These signs typically appear, if at all, within the first few weeks after conception. Although not all of these signs are universally present, nor are all of them diagnostic by themselves, taken together they make a presumptive diagnosis of pregnancy. These signs include the presence of human chorionic gonadotropin (hCG) in the blood and urine, missed menstrual period, implantation bleeding that occurs at implantation of the embryo in the uterus during the third or fourth week after last menstrual period, increased basal body temperature sustained for over 2

weeks after ovulation, Chadwick's sign (darkening of the cervix, vagina, and vulva), Goodell's sign (softening of the vaginal portion of the cervix), Hegar's sign (softening of the uterus isthmus), and pigmentation of linea alba Linea nigra, (darkening of the skin in a midline of the abdomen, caused by hyperpigmentation resulting from hormonal changes, usually appearing around the middle of pregnancy).

Pregnancy detection can be accomplished using one or more of various pregnancy tests, which detect hormones generated by the newly formed placenta. Clinical blood and urine tests can detect pregnancy 12 days after implantation, which is as early as 6 to 8 days after fertilization. Blood pregnancy tests are more accurate than urine tests. Home pregnancy tests are personal urine tests, which normally cannot detect a pregnancy until at least 12 to 15 days after fertilization. Both clinical and home tests can only detect the state of pregnancy, and cannot detect the age of the embryo.

In the post-implantation phase, the blastocyst secretes a hormone named human chorionic gonadotropin, which in turn stimulates the corpus luteum in the woman's ovary to continue producing progesterone. This acts to maintain the lining of the uterus so that the embryo will continue to be nourished. The glands in the lining of the uterus will swell in response to the blastocyst, and capillaries will be stimulated to grow in that region. This allows the blastocyst to receive vital nutrients from the woman.

Despite all the signs, some women may not realize they are pregnant until they are quite far along in their pregnancy, in some cases not even until they begin labour. This can be caused by many factors, including irregular periods (quite common in teenagers), certain medications (not related to conceiving children), and obese women who disregard their weight gain. Others may be in denial of their situation.

An early sonograph can determine the age of the pregnancy fairly accurately. In practice, doctors typically express the age of a pregnancy (*i.e.*, an "age" for an embryo) in terms of "menstrual date" based on the first day of a woman's last menstrual period, as the woman reports it. Unless a woman's recent sexual activity has been limited, she has been charting her cycles, or the conception is the result of some types of fertility treatment (such as IUI or IVF), the exact date of fertilization is unknown. Without symptoms such as morning sickness, often the only visible sign of a pregnancy is an interruption of the woman's normal monthly menstruation cycle, (*i.e.*, a "late period"). Hence, the "menstrual date" is simply a common educated estimate for the age of a fetus, which is an average of 2 weeks later than the first day of the woman's last menstrual period. The term "conception date" may sometimes be used when that date is more certain, though even

medical professionals can be imprecise with their use of the two distinct terms. The due date can be calculated by using Naegele's rule. The expected date of delivery may also be calculated from sonogram measurement of the fetus. This method is slightly more accurate than methods based on LMP. The beginning of labour, which is variously called confinement or childbed, begins on the day predicted by LMP 3.6% of the time and on the day predicted by sonography 4.3% of the time.

Diagnostic criteria are: Women who have menstrual cycles and are sexually active, a period delayed by a few days or weeks is suggestive of pregnancy; elevated B-hcG to around 100,000 mIU/mL by 10 weeks of gestation.

Nutritional Planning

Nutrient intake, and dietary planning that is undertaken before, during and after pregnancy work as one of the major factors in determining the future well-being of a child conceived, some factors of a diet are even noted to reduce childhood morbidity and mortality due to helping the supply of nutrients to the mother.

In a precursory study into the link between nutrition and pregnancy in 1950 women who consumed minimal amounts over the eight week period had a higher mortality or disorder rate concerning their offspring than women who ate regularly, because children born to well-fed mothers had less restriction within the womb.

Not only have physical disorders been linked with poor nutrition before and during pregnancy, but neurological disorders and handicaps are a risk that is run by mothers who are malnourished, a condition which can also lead to the child becoming more susceptible to later degenerative diseases.

The following sections refer to the pertinence of nutrition throughout pregnancy, and are thoroughly researched enough to be usable for mothers or couples planning on conceiving.

Nutrition Before Pregnancy

Factors mitigating against pre-pregnancy nutrition

It is known that good nutrition before pregnancy is important because of the amount of "resources" childbirth requires. The process of pre-pregnancy nutrition is a process of "building up" the immune system in preparation of pregnancy, and is known as being one of the major factors in determining the success rate of conceiving healthy children.

As with most situations, the most important factor in pre-pregnancy nutrition is ensuring that the mother is healthy and without any major factors

which could worsen the chances of conceiving, factors such as anorexia or bulimia are thought to be direct links with infertility; the minimum body mass index for conceiving mothers being 20.8.

This is also seen to be true with obese women with a BMI above 30 which is a direct result of decrementing amounts of insulin activity and sex hormones may reduce the viability of the ovum.

The ideal range of weight for women wishing to conceive children is thought to be optimal at body mass indexes between 20 and 26. If this, again, is used in conjunction with good nutrition and diet before pregnancy in terms of a normal balanced diet, then reserves of micronutrients, providing materials for pregnancy, would also be maximised.

Major benefactors in pre-pregnancy diets

As with most diets, there are chances of over-supplementing, however, as general advice, both state and medical recommendations are that mothers follow instructions listed on particular vitamin packaging as to the correct or recommended daily allowance (RDA).

- Magnesium and zinc supplementation for the binding of hormones at their receptor sites.
- Folic acid supplementation, or dietary requirement of foods containing it for the regular growth of the follicle.
- Regular Vitamin D supplementation decreases the chances of deficiencies in adolescence. More importantly, it is known to reduce the likelihood of rickets with pelvic malformations which make normal delivery impossible.
- Regular Vitamin B12 supplementation, again is known to reduce the chances of infertility and ill health.

Nutrition during Pregnancy

Factors mitigating against nutrition during pregnancy

As it is known, the embryo at conception, and in the subsequent weeks afterwards is the time when it is at its most vulnerable, as it is the time when the organs and systems develop within. The energy used to create these systems comes from the energy and nutrients in the mother's circulation, and around the lining of the womb, such is the reason why correct nutrient intake during pregnancy is so important.

During the early stages of pregnancy, the placenta is not formed yet, so there is no mechanism to protect the embryo from the deficiencies which may be inherent in the mother's circulation, so it is critical that the correct amount of nutrients and energy are consumed.

One problem that was found in trials with pregnant women is that deficiencies in folic acid contributed towards neural tube defection; women who had 4 mg of folic acid in their systems due to supplementing 3 months before childbirth significantly reduced the risk of NTD within the fetus. This is now advocated by the UK department of health, recommending 400 µg per day of folic acid.

Intake of retinol, in extreme cases, has been linked to birth defects and abnormalities. However, regular intake of retinol is not seen as dangerous. It is noted that a 100 g serving of liver may contain a large amount of retinol, so it is best that it is not eaten daily during pregnancy, something which is also the same with alcohol intake in binge drinking.

Excessive amounts of alcohol have been proven to cause Fetal alcohol syndrome. The World Health Organization recommends that alcohol should be avoided entirely during pregnancy, given the relatively unknown effects of even small amounts of alcohol during pregnancy.

Beneficial factors against pre-pregnancy nutrition

During pregnancy, the most important factor could be seen as the amount of fat content within the woman when in the early stages of pregnancy. It is recommended, again that women who may be obese, should lose fat before trying to conceive a baby due to the infertility related to obesity.

Again, research has shown that women who have had optimal fat stores, and who were well-supplemented, had a much lessened experience in childbirth in regards to the energy and effort required during metabolic changes within the body, which was noted by monitoring leptin levels during pregnancy.

Recommended nutrients during pregnancy

Nutrient	*Recommendation (Extra = Above RDA)*	*Maximum/Total amount recommended per day*
Energy	Increase by 200 kcal (840 kJ) per day in last trimester only.	RDA
Proteins	Extra 6 g per day	51 g per day
Thiamin	Increase in line with energy; increase by 0.1 mg per day	0.9 mg per day
Riboflavin	Needed for tissue growth; extra 0.3 mg per day	1.4 mg per day
Niacin	Regular supplementation/diet of substance. No increase required.	RDA

Folate	Maintain plasma levels; extra 100 μg per day	300 μg per day
Vitamin C	Replenish drained maternal stores; extra 120 mg per day	50 mg per day
Vitamin D	Replenish plasma levels of vitamin 10 μg per day.	RDA
Calcium	Needs no increase	RDA
Iron	Extra 3 mg per day needed	RDA
Magnesium, zinc, and copper	Normal supplementation or consumption.	RDA
Iodine	Extra 100 μg per day.	250 μg per day

Nutrition after Pregnancy

Proper nutrition is important after delivery to help the mother recover, and to provide enough food energy and nutrients for a woman to breastfeed her child. Women having serum ferritin <= 70 μg/L may need iron supplements to prevent iron deficiency anaemia during pregnancy and postpartum.

Physiological Changes

The body must change its physiological and homeostatic mechanisms in pregnancy to ensure the fetus is provided for. Increases in blood sugar, breathing and cardiac output are all required.

Hormonal Changes

Levels of progesterone and oestrogens rise continually throughout pregnancy, suppressing the hypothalamic axis and subsequently the menstrual cycle. The woman and the placenta also produce many hormones.

Prolactin levels increase due to maternal Pituitary gland enlargement by 50%. This mediates a change in the structure of the Mammary gland from ductal to lobular-alveolar. Parathyroid hormone is increased due to increases of calcium uptake in the gut and reabsorption by the kidney. Adrenal hormones such as cortisol and aldosterone also increase.

Placental lactogen is produced by the placenta and stimulates lipolysis and fatty acid metabolism by the woman, conserving blood glucose for use by the fetus. It can also decrease maternal tissue sensitivity to insulin, resulting in gestational diabetes.

Musculoskeletal Changes

The body's posture changes as the pregnancy progresses. The pelvis tilts and the back arches to help keep balance. Poor posture occurs naturally from the

NOTES

stretching of the woman's abdominal muscles as the fetus grows. These muscles are less able to contract and keep the lower back in proper alignment. The pregnant woman has a different pattern of gait. The step lengthens as the pregnancy progresses, due to weight gain and changes in posture. On average, a woman's foot can grow by a half size or more during pregnancy. In addition, the increased body weight of pregnancy, fluid retention, and weight gain lowers the arches of the foot, further adding to the foot's length and width. The influences of increased hormones such as estrogen and relaxin initiate the remodeling of soft tissues, cartilage and ligaments. Certain skeletal joints such as the symphysis pubis and sacroiliac widen or have increased laxity.

Physical Changes

One of the most noticeable alterations in pregnancy is the gain in weight. The enlarging uterus, the growing fetus, the placenta and liquor amnii, the acquisition of fat and water retention, all contribute to this increase in weight. The weight gain varies from person to person and can be anywhere from 5 pounds (2.3 kg) to over 100 pounds (45 kg). In America, the doctor-recommended weight gain range is 25 pounds (11 kg) to 35 pounds (16 kg), less if the woman is overweight, more (up to 40 pounds (18 kg)) if the woman is underweight.

Other physical changes during pregnancy include breasts increasing two cup sizes. Also areas of the body such as the forehead and cheeks (known as the 'mask of pregnancy') become darker due to the increase of melanin being produced.

The female body experiences many changes as the fetus grows through each trimester as shown and discussed in this pregnancy video. Two women at different stages in their pregnancy illustrate what has happened to their bodies.

Cardiovascular Changes

Blood volume increases by 40% in the first two trimesters. This is due to an increase in plasma volume through increased aldosterone. Progesterone may also interact with the aldosterone receptor, thus leading to increased levels. Red blood cell numbers increase due to increased erythropoietin levels.

Cardiac function is also modified, with increase heart rate and increased stroke volume. A decrease in vagal tone and increase in sympathetic tone is the cause. Blood volume increases act to increase stroke volume of the heart via Starling's law. After pregnancy the change in stroke volume is not reversed. Cardiac output rises from 4 to 7 liters in the 2nd trimester.

Blood pressure also fluctuates. In the first trimester it falls. Initially this is due to decreased sensitivity to angiotensin and vasodilation provoked by increased

NOTES

blood volume. Later, however, it is caused by decreased resistance to the growing uteroplacental bed.

Respiratory Changes

Decreased functional residual capacity is seen, typically falling from 1.7 to 1.35 litres, due to the compression of the diaphragm by the uterus. Tidal volume increases, from 0.45 to 0.65 litres, giving an increase in pulmonary ventilation. This is necessary to meet the increased oxygen requirement of the body, which reaches 50ml/min, 20ml of which goes to reproductive tissues.

Progesterone may act centrally on chemoreceptors to reset the set point to a lower partial pressure of carbon dioxide. This maintains an increased respiration rate even at a decreased level of carbon dioxide.

Metabolic Changes

An increased requirement for nutrients is given by fetal growth and fat deposition. Changes are caused by steroid hormones, lactogen, and cortisol.

Maternal insulin resistance can lead to gestational diabetes. Increased liver metabolism is also seen, with increased gluconeogenesis to increase maternal glucose levels.

Renal Changes

Renal plasma flow increases, as does aldosterone and erthropoietin production as discussed. The tubular maximum for glucose is reduced, which may precipitate gestational diabetes.

STUDENT ACTIVITY

1. Discuss the importance of nutrition during pregnancy.

2. Discuss the harmonal changes take place due to pregnancy.

NOTES

2.3 LACTATION

Lactation describes the secretion of milk from the mammary glands, the process of providing that milk to the young, and the period of time that a mother lactates to feed her young. The process occurs in all female mammals, and in humans it is commonly referred to as breastfeeding or nursing. In most species milk comes out of the mother's nipples; however, the platypus (a non-placental mammal) releases milk through ducts in its abdomen. In only one species of mammal, the Dayak fruit bat, is milk production a normal male function. In some other mammals, the male may produce milk as the result of a hormone imbalance. This phenomenon may also be observed in newborn infants as well.

Lactation - Current Concepts and Concerns

The importance of breastfeeding in infant nutrition, health and survival has long been recognized. The recognition that lactation may have profound effects on maternal nutrition and fertility is of more recent origin. It is now well established that over millennia, breastfeeding has been the major determinant of infant growth, health and survival and the contraceptive effect of lactation has been the principal regulator of human fertility.

The first half of the present century witnessed a profound decline in breastfeeding in industrialized countries, so that in the sixties most women in these countries were not breastfeeding their infants; bottle feeding had become the convenient norm and the symbol of sophistication. Luckily the tradition of universal prolonged lactation remained essentially unaltered during this period in developing countries like India..

Research studies carried out in the sixties and seventies in developed and developing countries brought out unique advantages of breastfeeding and showed that irrespective of the socio-economic status and standards of environmental hygiene, breastfeeding is the best for the other infant dyad. There was a global movement to promote breastfeeding in areas where it had declined and protect it in areas where it is still widely prevalent.

In India the traditional practice of near universal breastfeeding continues both in urban and in rural areas; however,some recent data indicate that there has been a reduction in the duration for which the infant is exclusively breastfed. Early introduction of supplements to infants could result in increased morbidity due to infections and consequent growth faltering, as well as faster return of fertility in the mother.

The present decade is witnessing marked changes in the life-style, nutritional status, morbidity profile, fertility pattern and contraceptives use in Indian women; some of these may directly or indirectly have an impact on breastfeeding practices.

There is increasing employment of women outside the home and consequent reduction in "demand feeding" and earlier introduction of supplements to the infant. Health education, appropriate contraceptive care and food supplements to lactating women could result in improvement in maternal nutritional status, more rapid return of fertility and faster advent of the next pregnancy if contraceptive care is not provided. With the advent of the HIV epidemic, conflicting advice from different agencies regarding breastfeeding in seropositive women has raised some doubts in the minds of both professionals and the general public regarding the continued advocacy for breastfeeding in all segments of population.

Currently efforts are underway to provide clear guidelines to medical and paramedical personnel on these issues and inform and empower women so that they understand the unique advantages of breastfeeding and therefore strive to achieve near universal practice of breastfeeding in spite of the pressures due to the rapidly changing socio-economic milieu and life-styles. The present write-up briefly reviews the current concepts and concerns on lactation - nutrition - infection - fertility interactions and the interventions required to sustain and support the beneficial trends and remedial steps to minimize if not eliminate adverse interactions.

Changing Trends in Lactation

Studies carried out in the fifties and sixties have shown that both in urban and rural areas in India breastfeeding was nearly universal; there were no marked differences between states or between different income groups. Two major areas of concern were that colostrum feeding was uncommon, and in rural areas there was a delay in. introduction of supplements. Efforts were therefore directed to inform women about the need to change these practices. In the seventies the debate among professionals regarding the energy needs for growth in infancy, led to conflicting advice regarding the appropriate time for introduction of supplements to breast fed infants, reaching the women especially the urban middle income group. Studies carried out in both the developed and developing countries have now clearly shown that breast milk alone is sufficient to meet all the nutrient, water and electrolytic needs of infants upto 6 months of age irrespective of maternal nutritional status and climatic conditions.

Data from the National family Health Survey indicate that breastfeeding is nearly universal with over 98 percent of infants being breastfed. There were no urban rural or interstate differences regarding initiation of lactation. This trend should be protected by emphasising the unique benefits conferred by breastfeeding to infants belonging to all segments of the population.

NOTES

Contrary to current recommendation that infants may be exclusively breast fed upto 6 months and that there is no need to introduce supplements and provide water earlier, only 50 percent of infants were exclusively breast fed even in the 0—3 months age group; 22 percent of infants received water and 23 percent milk or other fluids. In urban areas only one third of infants were exclusively breast fed in the 0-3 months age group; in rural areas the figure was 55.4 percent. There were substantial interstate differences also; in Punjab only 3.3 percent were exclusively breast fed at 0-3 months age, while 70.5 percent were exclusively breast fed in Andhra Pradesh. Too early introduction of supplements is likely to result in increased morbidity due to infections and hence should be discouraged.

It is essential that supplements preferably semisolids are introduced to breast fed infants at 6 months of age so that the nutrient requirement for growth is met; this message is being given as a part of health education in all maternal and child health (MCH) programmes. In spite of this, nearly a third of infants were not receiving additional nutrients either as semisolids or as other liquids even when they were 6-9 months of age. Delay in introduction of supplements was reported more often (nearly 30%) in rural than in urban (20%) areas. There were substantial differences between states; in Rajasthan only 9 percent of those in the 6-9 months age group received semisolid supplements while nearly 70 percent in Kerala were given semisolid supplements. In all major states except West Bengal, Kerala and Tamil Nadu, more than 50 percent of infants in the 6-9 months age did not receive semisolid supplements. Delay in introduction of supplements will result in growth retardation and hence the need for timely introduction of supplements should be stressed as a part of MCH care especially in rural areas in states where delay in introduction of supplements is reported.

It is, however, noteworthy that the practice of prolonged breastfeeding is still widely prevalent, 88 percent of children in the age group 12-15 months and 67 per cent of children in the 20-23 months are breastfed. There were marked interstate variations in breastfeeding at 20-23 months with West Bengal (84%) and Tamil Nadu (36%) at two ends of the spectrum.

The near universal initiation of breastfeeding and the long duration of lactation need to be protected and promoted; efforts to reverse the tendency to introduce supplements too early in infancy have to be vigorously continued to ensure that infants do not unnecessarily get exposed to the risk of infections.

Lactation and Maternal Nutrition

Diet surveys indicate that most lactating women from the poorer segments of population subsist on diets which provide 1,200-1,800 Kcal/day; there is no increase in dietary intake during lactation. Successful prolonged breastfeeding

NOTES

preventing deterioration in the nutritional status of lactating women include facilities to reduce physical activity and energy output such as provision of biogas plants and water in the vicinity of the house.

Effect of Food Supplementation during Lactation

Lactating women had been considered a nutritionally vulnerable group because of the obvious nutrient loss in milk production; therefore they have been one of the target groups for all food supplementation programmes in India. Available data suggest that there is no substantial improvement in maternal nutritional status even in carefully supervised food supplementation studies in which there was substantial increase in maternal dietary intake. Food supplementation did not result in any increase in quantity of milk secreted or improvement in quality of milk produced. It has been suggested that the additional food intake might have been utilized for reversal of adaptive changes and hence there is no improvement in maternal body weight. Weight gain is one of the parameters widely used for evaluation of the food supplementation programmes. Data from Gambia and elsewhere suggest that at least in lactating women, weight gain may not follow improvement in dietary intakes and so should not be used as a parameter to evaluate the success of food supplementation.

Studies from Gambia have shown that food supplementation and improvement in maternal nutritional status results in faster return of fertility in lactating women . Studies in India have demonstrated that return of fertility is more rapid in lactating women with higher body weight. These findings emphasize the need for providing concurrent contraceptive care as a part of the programmes aimed to improve maternal nutritional status to ensure that early advent of the next pregnancy does not undo the benefits of the food supplementation.

Impact of Ongoing Food Supplementation Programmes

Many developing countries including India have initiated massive food supplementation programmes aimed at improvement of maternal and child nutritional status among poorer segments of the population. Very few of these programmes have been formally evaluated. However, there is an impression among professionals that by and large these programmes have not produced any significant improvement in maternal and child nutritional status. This might be due to the fact that administrative bottlenecks and logistic problems come in the way of food reaching the target women. Even if this was achieved, food sharing and food substitution are so common that the net increase in dietary intake may be no more than 100-150 kcal/day. There is also a growing awareness that unless coupled with health care, increasing food intake alone might not result in improved nutritional and health status of the individual. The Integrated Child

Development Scheme attempts to achieve an integration of food supplementation, health care and health education.

NOTES

Many developing countries including India are facing a resource crunch and therefore there might be a need for better targeting of the existing programmes. Efforts may have to be directed towards identifying individuals who need the supplements most (such as women who are pregnant and lactating, those in whom fall in dietary intake or increase in physical activity is occurring) and ensure that they receive adequate food supplements through these food supplementation programmes.

2.5 EFFECT OF MATERNAL NUTRITION ON LACTATION

Duration of Lactation

Studies undertaken during the fifties in India showed that undernourished rural women successfully initiate lactation and continue to breast feed their offsprings for periods up to 24 months. Several global studies and studies from India have confirmed these observations. These data suggest that maternal undernutrition does not have any adverse effect either on initiation of lactation or duration of lactation. Prolonged successful lactation appears to be nature's protective evolutionary step to look after the nutritional needs of the vulnerable young infant in conununities where poverty and undernutrition are common.

Volume of Breast Milk

Studies conducted at the National Institute of Nutrition (NIN), Hyderabad, during the early sixties had shown that undernourished Indian women secrete 500-800 ml milk/day. More recent studies using electronic balances for measurement of milk intake of infants have confirmed these findings. Report from the developed countries indicate that milk intake of infants in these countries range from 600- 1,000 ml/day but milk intake of infants born to undernourished women was lower. The data suggest that quantity of milk produced by undernourished women from developing countries is less than that of well nourished women from developed countries.

In recent years the concept that the infant modulates maternal milk yield has gained wide acceptance. Infants of undernourished women weigh less at birth and during infancy compared to infants born to well nourished women. The nutrient needs for these smaller infants are likely to be lower and this may at least be one of the reasons for the lower volume of milk ingested by these infants. Data from some of the WHO collaborative studies (unpublished data) have shown that when infants of similar birth weight and body weight were investigated, there were no significant differences in volumes of milk produced between

NOTES

undernourished and well nourished mothers, supporting the hypothesis that infant size is one of the determinants of the volume of breast milk produced.

Composition of Breast Milk

Efforts to investigate the effect, if any, of maternal nutritional status on composition of breast milk began in the fifties. These studies showed that milk secreted by malnourished women had a somewhat lower fat content, protein levels were similar to those reported in well nourished women. In spite of these differences in composition, there were no significant differences in the calorie content of milk secreted by undernourished and well nourished women because in the former group the lactose content was higher. Subsequent studies in India and global studies have confirmed these observations. Most of the available data suggest that food supplementation tc undernourished women does not have any significant impact on macro-nutrient composition of breast milk. Available data suggest that differences in the macro-nutrient composition of breast milk in undernourished women do not have any impact on infant growth and development. It is possible that nature has ensured that the calorie content of breast milk remains unaltered by maternal undernutrition, so that infant growth is safeguarded. It is also possible that infants can adapt and thrive even when the composition of their diet varies substantially. In this context it is worth recalling that infant food formulae in the forties and fifties had low fat, high protein and high sugar content. Infants fed on these grew well and have reached middle age without showing any abnormalities attributable to their diet during infancy.

Studies on mineral and trace element content of breast milk have shown that there are no significant differences between milk secreted by well nourished and undernourished mothers. However, levels of almost all vitamins, appear to be lower in milk secreted by undernourished women. Majority of undernourished women from the low income group in India show biochemical evidence of vitamin deficiencies. It is therefore hardly surprising to note that their breast milk contains lower concentration of these vitamins. The nutritional consequences of this on breast fed infants are still not clearly understood and need to be investigated. Supplementation of vitamins to the lactating women led to improvement in vitamin content of milk.

Infant Nutrition and Growth

It is now well accepted that breast feeding is the best form of infant feeding for all segments of the population in all countries. Breast milk provides appropriate nutrients in adequate quantities to ensure optimal growth in early infancy. Presence of anti-infective factors in breast milk and the fact that breast milk reaches the infant without any contamination ensures minimal morbidity due to

infection in breast fed infants. Available global and Indian data from all segments of the population suggest that up to 6 months of age solely breast fed infants grow as well as those who receive supplements. It would therefore appear that, contrary to the earlier theoretical predictions based on recommended dietary allowances during infancy, breast milk alone might be sufficient to support the growth of infants up to 6 months of age.

Appropriate Time for Introduction of Supplements

Studies from India have shown that solely breast fed infants grow well during the first three months of life; their growth during this period is comparable to that observed among infants born to well nourished mothers. Solely breast fed infants from low income groups double their birth weight by six months of age indicating that breast milk alone is adequate to support infant growth in early infancy. However, after six months, growth faltering is common. Delay in introduction of supplementary foods to infants beyond six months of age results in growth retardation as the infants do not get adequate nutrients to support growth.

It is essential that the current knowledge that breast milk alone is sufficient to meet the nutritional needs of most infants in the first six months of life is communicated to all medical and paramedical personnel so that they in turn reassure women and counteract the existing tendency for too early introduction of supplements and its adverse consequences. Wherever possible, growth of infants should be monitored by monthly weighing.

In communities where weighing is not possible, if a solely breast fed infant below six months of age is not thriving, or is crying due to hunger, soon after breast feeds, the infant should be referred to the Primary Health Centre (PHC) for examination and appropriate advice . In the absence of any of these problems all women should be advised not to introduce supplements prior to 6 months of age because under the existing conditions of poor environmental sanitation such a practice is associated with increased risk of morbidity due to infection. Women should also be made aware that too early introduction of supplements will also result in faster return of fertility.

Appropriate Type of Supplements

A variety of processed cereal-pulse based supplements are available in the market. They are widely used by the urban mothers belonging to middle and high income groups because they are convenient and are affordable . These segments of population should be informed about the need to give the infant vegetables and fruits in addition to these cereal pulse based supplements, so that the micronutrient requirements of the infants are met.

Recipes for a large variety of low cost infant food supplements prepared from locally available cereal, pulse, sugar and jaggery have been published by several institutions in India. However, community based studies have shown that very few women are able to prepare the special foods daily. Even when prepared these weaning foods become heavily contaminated with bacteria and if fed a few hours after preparation can cause diarrhoea. It would therefore appear that giving freshly cooked unseasoned rice or pulse and vegetables from the family meal twice a day might be the most feasible method of introducing supplements to breast fed infants under the existing conditions in India. It is important that between 6 and 12 months of age the infant gets used to eating almost the whole range of adult food when it is freshly cooked. Studies from the NIN, Hyderabad, have shown that this practice was associated with a tripling of birth weight by the first year, relatively low morbidity due to infection and a reasonably long interpregnancy interval even in the absence of contraceptive care.

Delay in introduction of supplements beyond six months of age is associated with growth faltering and increased susceptibility to infection due to undernutrition. It is essential to ensure that health education messages advocating introduction of freshly cooked cereal, pulse and vegetable based semisolid supplements to infants by six months of age, reach and are followed by urban and rural women from low income groups in India.

HIV Infection and Breastfeeding

HIV infection has no adverse effect on lactation and lactation has no adverse effect on the course and outcome of HIV infection. Both HIV and antibodies to HIV are present in breast milk; presence of antibodies to HIV may provide some protection against transmission of HIV infection through breast milk. Research studies indicate that transmission of HIV through breast milk accounts for 1-3 percent of all mother to infant transmissions. Isolation of HIV from breast milk and the reported instances of HIV transmission through breast milk have led to the public apprehension and debate about advantages of breastfeeding in the era of the HIV pandemic. The concern has been heightened by the apparently conflicting recommendations of the advisory panels on breastfeeding in seropositive women.

Breastfeeding offers protection against a wide variety of infection and hence is crucial for survival for the high risk HIV infected neonates who might also be pre-term and have low birth weight. There are no tests by which HIV infected infants could be identified at birth. Unless all infants born to seropositive mothers are breastfed, HIV infected infants will be denied the benefit of breastfeeding. The advantages of breastfeeding by far out weigh the small potential risk of HIV infection through breastfeeding. Therefore, in the Indian context, breastfeeding

by the biological mother is to be advocated in all infants born to seropositive women.

In India very few of the infected mothers can be detected because universal HIV testing is not possible. Breastfeeding is essential for infant survival and growth especially among the poorer segments of the population, because infant food formulae are neither affordable nor safe. Hence breastfeeding by the biological mother should continue irrespective of the HIV infection status of the mother or infant, known or unknown. Promotion of breastfeeding by all mothers will therefore continue to be the national policy.

NOTES

Lactation and Fertility

Lactation prolongs post partum amenorrhoea and provides some protection against pregnancy. Suckling-induced endocrine changes result in relative infertility during lactation. It is estimated that in India universal and prolonged breastfeeding prevents more pregnancies than all other reversible contraceptives currently in use. However, it should be clearly understood that lactation provides reliable and effective protection against pregnancy only during the first few months of lactation when the woman is solely breastfeeding her offspring and is amenorrhoeic. Increasing duration of lactation beyond six months, introduction of supplements to breast fed infants or return of menstruation should all be taken as indications that lactating women should seek contraceptive care to prevent too early advent of an unwanted pregnancy. This advice should be given along with the health education message regarding the appropriate time for introduction of supplements to the breastfed infant, so that women understand the linkage between the infant feeding practice, morbidity in infants and return of fertility and refrain from starting supplements too early.

Effect of Maternal Nutritional Status on Lactational Infertility

Available data from developed and developing countries indicate that lactational amenorrhoea is shorter among well nourished women from developed countries and among socio-economically better-off segments of the population in developing countries. However, it has been suggested that the shorter duration of lactational amenorrhoca might, at least in part, be attributable to confounding variables such as the earlier introduction of supplements and schedule feeding among well nourished women, rather than a better nutritional status per se. In the last decade, two studies have attempted to define the role of maternal nutritional status on duration of lactational amenorrhoea. One of these studies was undertaken among urban low income group women with similar breastfeeding practices who did not receive any health and/or nutritional intervention. The mean durations of lactation and lactational amenorrhoea were significantly shorter in

women whose body weights were over 55 kg. The other evidence came from studies in Gambian women; data from the study showed that prolactin levels were higher and the duration of lactational amenorrhoca was longer during the rainy season, when calorie intakes were lower. Food supplementation to lactating mothers resulted in a fall in prolactin levels and a reduction in the duration of lactational amenorrhoea. Average birth intervals were also shorter in women receiving supplements.

Obviously, under conditions of food scarcity and consequent undernutrition, nature and evolution have ensured a longer inter-birth interval so that the advent of the next pregnancy does not cause further deterioration in both maternal and infant nutritional status. Currently several programmes aimed at improving maternal nutritional status are underway. It is essential to ensure that efforts to improve maternal nutritional status are linked to programmes aimed at providing contraceptive care, so that the advent of the next pregnancy does not undo the benefits of food supplementation. Contraceptives given to lactating women should be carefully chosen so that they do not have any adverse effect on lactation, the breastfed infant or the mother.

Concluding Remark

Surveys carried out in the country during the nineties indicate that universal initiation of lactation and prolonged breastfeeding continue to be the rule in India both in urban and rural areas.There is a tendency for too early introduction of supplements to breastfed infants especially in urban areas; this practice may have adverse consequences such as increased morbidity in breastfed infants and faster return of fertility in the mother and hence need to be countered through health education. Advent of the HIV epidemic has provided one more reason to protect the existing practice of universal and prolonged breastfeeding.

Available data suggest that lactation does not have an adverse effect on maternal nutrition in undernourished women subsisting on habitual low calorie diets. Chronic, mild and moderate maternal undernutrition does not have any adverse effect on initiation of lactation, duration of lactation, quantity and quality of milk secreted and the growth of the breast fed infant. However, further reduction in dietary intake, advent of the next pregnancy or increase in energy expenditure result in deterioration in maternal nutritional status and lactational performance. Food supplements given to these women prevent these adverse consequences.

Lactation provides reliable protection against pregnancy in the first few months when the infant is solely breastfed; this effect is more marked in undernourished women. Improvement in maternal nutritional status is associated with faster return of fertility in lactating women; therefore efforts to improve

maternal nutritional status should always be coupled with adequate provision for contraceptive care so that the too early advent of the next pregnancy does not result in deterioration in maternal nutritional status.

Early introduction of supplements to infants is likely to result in faster return of fertility in lactating women. Health education that solely breast fed infants grow and thrive normally during the first six months and in them the risk of infection is lower should be linked with advice that once supplements are introduced all lactating women should seek contraceptive care. Contraceptives should be chosen with care so that they have no effect on lactation, maternal or infant nutrition.

2.6 CONCEPT OF BREASTFEEDING

Breastfeeding is the feeding of an infant or young child with breast milk directly from human breasts rather than from a baby bottle or other container. Babies have a sucking reflex that enables them to suck and swallow milk. Most mothers can breastfeed for six months or more, without the addition of infant formula or solid food.

Human breast milk is the healthiest form of milk for human babies. There are few exceptions, such as when the mother is taking certain drugs or is infected with tuberculosis or HIV. Breastfeeding promotes health, helps to prevent disease and reduces health care and feeding costs. In both developing and developed countries, artificial feeding is associated with more deaths from diarrhoea in infants. Experts agree that breastfeeding is beneficial, but may disagree about the length of breastfeeding that is most beneficial, and about the risks of using artificial formulas.

Emphasizing the value of breastfeeding for both mothers and children, the World Health Organization (WHO) and the American Academy of Pediatrics (AAP) both recommend exclusive breastfeeding for the first six months of life and then supplemented breastfeeding for at least one year and up to two years or more. While recognizing the superiority of breastfeeding, regulating authorities also work to minimize the risks of artificial feeding.

2.7 INFANCY

"Infant" is derived from the Latin word, "infans," meaning "unable to speak." Thus, many define infancy as the period from birth to approximately 2 years of age, when language begins to flourish. It is an exciting period of "firsts"— first smile, first successful grasp, first evidence of separation anxiety, first word, first step, first sentence. The infant is a dynamic, ever-changing being who undergoes an orderly and predictable sequence of neurodevelopmental and

NOTES

physical growth. This sequence is influenced continuously by intrinsic and extrinsic forces that produce individual variation and make each infant's developmental path unique. Intrinsic influences include the child's physical characteristics, state of wellness or illness, temperament, and other genetically determined attributes. Extrinsic influences during infancy originate primarily from the family: the personalities and style of caregiving by parents and siblings, the family's economic status with its impact on resources of time and money, and the cultural milieu into which the infant is born.

Neurodevelopmental sequences can be viewed broadly in terms of the traditional developmental milestones. Developmental milestones provide a systematic approach by which to observe the progress of the infant over time. Attainment of a particular skill builds on the achievement of earlier skills; only rarely are skills skipped. When this happens, the advanced skill may represent a "splinter" skill, that is, a deviant developmental pattern. For example, five-word sentences in a 2-year-old child who does not follow simple commands may represent echolalia typical of autism. The sentences are not meaningful and have no communicative intent. Delays in one developmental domain may impair development in another domain. For example, immobility due to neuromuscular disorders prevents exploration of the environment and, in turn, impedes cognitive development arising through manipulation of objects. Last, a deficit in one domain may compromise the assessment of skill levels in another domain, even though development in the second domain is normal. For example, it is difficult to assess problemsolving skills in a child who has cerebral palsy because the child may understand the concept of matching geometric forms, yet be unable to insert them physically into a formboard.

Developmental milestones serve as the basis of most standardized assessment and screening tools. Although these screening tools provide the clinician with a structured method of observing the infant's progress and help define a developmental delay, many lack sensitivity. Parental concern in the face of normal results in developmental screening should not be disregarded. Focusing narrowly on discrete milestones may fail to reveal a typical organizational processes that are involved in the child's developmental progress. Thus, it is important to analyze all milestones within the context of the child's history, growth, and physical examination. Only then is it possible to formulate an overall impression of the child's true developmental status and the need for intervention.

Evolution of Developmental Theory

Developmental theory has been shaped by the persistent debate of whether nature (intrinsic forces) or nurture (extrinsic forces) is the predominant influence. At the turn of the century, developmental theories promoted nature as the major

influence. Gesell (early 1900s) was one of the first to study infant development systematically and establish developmental norms. Development was seen as a function of neurologic maturation and growth. Because advancing age and genetic endowment were the chief mechanisms for change, babies were believed to develop at a predetermined biological pace, with parents needing to do little more than provide a good nurturing environment.

By mid-century, theories that stressed the importance of nurture began to prevail. Pavlov (1930s), Watson (1950s), and Skinner (1960s) promoted the opposing view that development was a function of learning. Operant conditioning (positive and negative reinforcements through social interactions or environmental changes) promoted learning and shaped the child's development. The quality of the infant's relationships with key individuals was considered central to future development.

During the second half of the century, the name of Piaget became almost synonymous with child development. Piaget was the first to describe the infant as having intelligence. For centuries, it had been assumed that the infant's mind was a "blank tablet waiting to be written on." Because infants could not tell us what they were experiencing, it was believed that they saw and heard little and thought even less, with consciousness as adults knew it not existing. Piaget revealed that infants were, indeed, capable of thinking, analyzing, and assimilating. He viewed development as stage like cognitive changes. The child actively explores objects in an effort to understand his or her environment. Depending on the developmental stage, a child organizes this information to form new theories about the way the world works.

It was not until the last part of this century that emotional and social development began to receive the same degree of attention as that given to the motor and cognitive domains. Research has revolved around theories regarding infant expression of emotion (Mandler, 1970s), attachment (Bowlby, 1960s; Mahler, 1970s; and Ainsworth, 1980s), and temperament (Thomas and Chess, 1970s). Once it was recognized that newborns could demonstrate distress (pain and hunger), interest, and disgust, these facial expressions have been used to study information processing in infancy prior to the age when thoughts can be verbalized. As the 20th century comes to a close, remarkable advances in behavioural genetics, together with recent discoveries regarding innate infant abilities, have swung the pendulum back in favour of nature as the primary influence on the developmental process.

2.8 GROWTH AND DEVELOPMENT OF INFANTS

Growth and development are the main themes of every baby's life; the physical and mental activities that parents call,"growing up".

Since this process has everything to do with health at the juvenile stages of life, it is a fundamental topic in pediatrics. The normal growth and development of infants has a known course and range of values for most characteristics considered important enough to measure. These include height, weight, head circumference and other physical parameters, as well the ages that an infant can manage relatively complex and volitional body movements. Certain of these behaviours, like sitting up and walking, are called developmental milestones, because the age and order in which they occur are markers of the normal progress of the maturation of neuromuscular deveopment.

There are very short periods during any stage when a youngster is mainly just getting bigger; but infancy, childhood and adolescence are never focused on a mere increase in size. Instead, growing-up alters the shape, composition, and abilities of body and mind. In the first era of life the newborn baby changes, in a certain sense, transforms into an entirely different creature: the toddler. No one word in English encompasses that concept, and in life sciences, "growth and development" is the conventional term for these serial changes that occur from birth to maturity in each normal individual.

Through them, a newborn becomes a toddler and then a child, and continued growth and development in childhood and through puberty, usher her into adulthood. There are two stages in human life when growth and development are most rapid; (1) one is in infancy and very early childhood, and (2) the other is during puberty and adolescence. This article examines the early part of the first of these periods, covering the normal progress of a newborn up to the time of walking; generally, about the first year to 18 months of life. (The next stage of life is discussed in Toddler growth and development, which will cover the normal child from the time of walking to the socialization of the preschool era; from about age 1 year to age 4 years.)

The Newborn's Head and Brain are Small

Oddly enough, there is an inherent connection between the very immature state of the newborn brain, a fundamental feature at the starting point of infancy; and the very human act of walking upright, the end point of our discussion here, and the one that marks the beginning of a child's "toddler stage".

Human beings, as a species, have a large brain that is capable of a high intelligence, and an upright body position that is propelled by walking on two legs. Walking upright allows for less leeway in size and structure in the human pelvis than exists for those animals that walk on all fours. That means that big-headed babies are born to mothers with relatively constrained birth canals. If both mother and baby are to survive the birth process unscathed, the baby's

brain cannot be fully developed in size or complexity at birth. No matter how precocious we may fancy that our children are, no human baby is precocious as a horse's newborn foal or a duckling just out of the egg. Unlike those new babies, that can run and swim when only hours old, humans are unable to do much more than feed and interact with their caregivers until several months of life have passed.

Our newborns have a skull that contains a brain case only one quarter the size that it will become in the adult. The brain comprises 100 billion neurons at birth, with each neuron developing on average 15,000 synapses by 3 yr of age. Much of the growth of the brain; and the concommittent expansion of the head; has occurred by the age of 2 years; at that age the neurocranium (which means the bony skull that surrounds the brain) is 75% of the adult size by volume, and the brain is about 80% of its adult weight. By about 10 years of age, the brain (and skull) are approximately 95% their ultimate size. Overall, the human brain more than triples in size (3.5 X) from birth to adulthood.

Even with the relatively small head diameter of the newborn, that skull has some adaptations that allow it to be molded in the birth canal, so that the diameter can become even smaller, allowing the baby to emerge without harm to itself or to its mother. These same adaptations give the baby's skull the ability to expand to accommodate the growing brain they are the suture lines and fontanelles of the infant skull. The suture lines allow the bony plates of the skull to slide a bit, and provide an extra dimension of flexibility for the emergence of the baby's head without damage to the brain.

When babies are brought to the pediatrician or other health care provider for well-child care, the infant's length, weight, and head circumference are routinely measured. The "soft spots" of the skull, the fontanelles, are gently touched and assured to be either properly open or closing, and not unduly tense. The baby is also checked for reflexes and activities that are the signs of normal physical and mental progress.

Although the rate of change is a bit different for each individual child, the changes follow a set of curves that are so similar for all children that deviations from the expected values are signs that trouble may be afoot. Since youngsters are so adaptable, and so many problems are now amenable to treatment with early intervention and proper medical care, many things that would have once proved devastating to the baby's future can be averted or minimized with careful monitoring of our infants progress and judicious evaluation of possible abnormalities.

This article reviews the important milestones, and their timing, that unfold during an infant's life. Strictly, the term "infant" only applies to baby during the

NOTES

first year, but since such activities as walking can normally occur either during the first year or after, a broader range of ages is considered here.

NEWBORNS

A newborn baby's normal range of perception and activity is different than it will be later in life. Newborns are nearsighted, with a fixed focal length of 8–12 in, which is approximately the distance from the breast to the mother's face. (reference: Hearing is Behavioural testing of newborns has established that as well as an inborn visual preference for faces.

Just after birth, most babies are alert and able to participate in social interaction. "The initial period of social interaction, usually lasting about 40 min, is followed by a period of somnolence. After that, briefer periods of alertness or excitation alternate with sleep. If a mother misses her baby's first alert-awake period (because she has been anesthetized), she may not experience as long a period of social interaction for several days."

Whereas older babies and adults normally have air in their middle ears, for example, just after birth babies normally have some fluid which will dissipate over time. Hearing in babies is present at near normal adult levels, but measuring that hearing is not straightforward.

The metabolism of a newborn baby is much higher than an adults', and the baby's body dissipates the heat generated by metabolic processes very efficently, since there is so much surface area as compared to mass.

Transitional Changes: Adapting to the New World

Every normal newborn baby has just exchanged an internal environment within her mother's body for the the external world. That statement is obvious, but its ramifications are quite profound. Not only is the baby's pre and post birth environment tremendously different, but his role as a living thing in that environment also changes. He changes his status from being esentially another organ in his mother's body to being an entirely independent entity who must breathe through his own airway and oxygenate his blood with lungs, and obtain his own nutrients from nursing and digesting his mother's milk or formula through his own digestive system.

Every Newly Born Infant is not a "Normal Full-Term Infant": Exceptions

The characteristics of newborns that have been discussed so far are not true for every newly born baby, but instead describe the general group of so-called normal, healthy, full-term infants. At birth, many babies fall outside these limits. When infants are born prematurely, they may or may not be healthy, but their abilities and characteristics are not the same as infants born after the full

development in the uterus that occurs when pregnancy lasts an optimal period of time. Their usual characteristics can be pretty well predicted according to just how long they did develop which is their gestational age. In other words, the extent of their prematurity, usually measured in weeks, is of cardinal importance in describing the premature infant. Like premature infants, infants who have been "in too long", and are born postmature, have features and characteristics that are predictable depending on the length of intrauterine development. Additionally, there are infants who had a normal length of time in the womb, but are so far above or below the usual size of a full-term infant that they are sometimes described separately. Although these infants may grow up to be normal adults, the extra-small infants who are "small for gestational age", and the extra-large infants who are much larger than average, each, within their groups, share some features. All of these groups of newborn are discussed in the following sections.

Premature Newborns

When babies are born prematurely, they have left the intrauterine environment "too soon". In a sense, there are different dimensions of "too soon", ranging from what appear to be insignificant lengths of time, in which the baby has achieved all the characteristics that are associated, objectively, with a fullterm infant, all the way to so early that the baby, even with maximal life-support technology, cannot survive. The limits for how early a baby can be born, and the odds that a premature baby at any given stage can survive outside the womb have changed, and are changing, with advances in medicine and technology. At any given stage, the individual characteristics of the infant also influence survival.

The Concept of "Gestational Age Adjustments"

Gestational age is the amount of time that the baby has developed in the womb, and when full-term, this is a total of about 37 weeks from conception to birth. Obstetrical conventions for the calculation of the gestational age is slightly different, it has to do with the date of the last menstrual period, and therefore, since ovulation in a 28 day cycle is likely to have occurred 2 weeks later, would add 2 weeks to the estimated time of conception.

"Infants who are born after completing less than 37 completed weeks of gestation are considered to be preterm (or premature). Term infants have completed 37 to 42 weeks, and infants past 42 weeks of gestation are postterm (or postmature)."

If a baby is born prematurely, say at 33 weeks instead of 37, then the baby's age after birth is adjusted, in the minds of physicians, nurses, and other allied health science caregivers, to reflect that prematurity. The baby born at 33 weeks has an adjusted age of 11 months on his first birthday, at least in terms of of his expected development.

Just how precisely can we judge the gestational age of any newborn? Unless the birth mother had used some accurate means to calculate ovulation at the time of conception, or has had such extremely regular menstrual periods that conception can reliably be assumed to have occurred about 14 days before the first missed period, or, for some reason, has had a series of ultrasounds during prenatal care, before about 20 weeks, the time in the uterus from conception to the birth of the infant is always an estimated one.

"Small for Gestational Age" Newborns

Not every small baby is a premature baby. Fullterm or not, a percentage of babies at every gestational age are born much smaller than their peers, most often because of impaired nutrition through the placenta. Small for gestational age babies are usually defined as the babies who are below the 10th percentile in weight for their stage of development.

"Large for Gestational Age" Newborns

Large for gestational age infants are those above the 90th percentile for weight at birth. When the fetus gets enriched nutrition in the womb, the baby may be born "extra-large". Mothers who have high blood glucose (diabetes) during the last trimesters of pregnancy are more likely to have such babies. The size of a newborn is more closely related to the efficiency of the placenta and the nutrients available in the mother's bloodstream, than to the size of the mother and father.

Physical Size and Growth

Height (Length), Weight (Body Mass), and Head Circumference

Babies are measured after birth because this information provides immediate means for evaluating the infant, but most importantly because the measurements serve as a baseline to follow future growth. Length is measured from the tip of the newborns skull (vertex) to her heels, with legs fully stretched out in an extended position. Weight is measured when the baby is wiped off and the umbilical cord has been cut. The head circumference is measured around the head from back to front, above the ears.

There is a range that descibes these values in newborns of both genders and a pattern of the increase in these values over the months and years that has been compiled from the records of infants and children. These values are useful when they are expressed in percentiles and an individual child's progress in charted and compared to the known growth curves.

Except for the first week or so after birth, babies normally increase in weight rather than decrease. "During the first week after delivery, infants born at term tend to lose about 5% of their birth weight." Although this amount of weight loss

is not only normal, but is expected in full-term infants, premature infants actually lose more weight in those first days. The youngest of premature infants may lose 15 to 20% of their birth weight with no apparent ill effects.

As babies get older, otherwise, they normally grow, and changes in weight and length are always increases and never decreases. Although transient weight loss might occur with illness or an inadequate diet, it is never "normal" once those first weeks are passed. In fact, not only is weight loss abnormal but an absence of weight gain is of potential concern. An infant whose weight and height are stable rather than increasing is said to have "failure to thrive". There are many reasons that can account for this failure to grow, and many are temporary and treatable.

Growth and Nutrition

Diet plays an important role in growth during infancy. Not only are certain components, like adequate proteins and vitamins crucial for normal growth, but an adequate number of calories must be consumed over and above that required for metabolic activities for growth to occur.

Breastfeeding is the preferred feeding for infants,unless maternal infection with an illness transmissible in breast milk is present. However, infant formulas can support growth at rates equal to breast milk feeding and without any apparent deficits resulting in infants.

Growth Rates and the Incidence of Certain Medical Conditions in Adulthood

There have been recent studies in countries with highly developed health systems and excellent record keeping that have revealed statistically significant correlates between some of the early growth values and medical conditions in later life.

For example, numerous studies have shown an association between having low percentile values for age adjusted weight from birth to age 1 year and an increased risk of stroke and heart attack in adulthood. The researchers have concluded that this statistical correlation has to do with maternal physique and inherited factors.

The Face

Baby faces are different than adult faces, and for good reason. The newborn's forehead is relatively enormous, with the eyes more or less centered mid-height of the face. In an adult, the eyes are about a third of the way down from the top of the face, with the forehead, the midface, and the lower face each making up about a third of the total height.

NEUROLOGIC AND MOTOR DEVELOPMENT

Just as the physical development of an infant during the first year or so or life is a vector in which the values of height, weight, and head circumference always increase, there is a normal series of behavioural milestones that can be arrayed in a timeline over this period, and the individual infant's passing of these miletones is always in a forward direction. These behaviours require growth and development of the nervous system, as well as the bones and muscles, and co-ordination of all these aspects in the growing infant.

The absolute age at which a child may first demonstrate one of these behaviours, such as, say, sitting up, or walking, is variable and is perfectly normal within a relatively broad range. It is never normal, however, for a baby to be able to sit up and then to lose that ability, or to be able to walk well and then not be able to walk at all, or to become less adept at walking. The manner in which a youngster accomplishes a behaviour, like walking, also changes with growth and development and those changes also follow a pattern that normally proceeds only in a forward direction. Regression is a cause for concern and for further evaluation.

Milestones

Head and Torso Control

By about 1 month of age, a baby can lift his head when lying prone. Strength and control normally increase so that, by 2 months of age, she can manage to lift her chest up as well, when lying in this same prone position and keep her head in the midline. At 3 months, he is expected to be able to support himself with his forearms, holding his chest up off the floor or table, and keeping his head held steadily in the midline.

A newborn required head support and his head will lag behind if his shoulders arer lifted. By 3 months, if the baby is pulled by her arms to a sitting position she is able to keep her head in line with her torso, without head lag.

Discovering Midline

A baby will bring her hands together and discover her midline by 3 months.

Rolling Over

Rolling over can be done in two ways: from laying on one's belly to rolling onto the back (prone to supine), and from laying on the back to resting face down on one's belly (supine to prone). The first (belly to back) is the first to occur and rolling over from the prone position is expected by 4 months of age. Since some babies do it sooner, even much sooner, it's important to keep the baby safe

when laying her down on a surface she might roll off of and not allow her first success at rolling over to cause injury.

Rolling from back to belly is a later milestone, accomplished (on average) by 6 and a half months of age.

NOTES

Sitting Up

By 7 months, a baby should be able to sit unsupported, at least briefly.

Grasp (Thumb and Fingers)

The pincer grasp is not only an important developmental milestone, it has important consequences for the child's safety. A fine motor grasp of finger to thumb usually occurs by 8 months of age and allows a sudden increase in the child's ability to manipulate objects.

Walking

Walking may begin in some children as early as 7 or 8 months, but is most often seen to begin at about 1 year of age. When walking has not been accomplished by 17-18 months of age, then the manner of walking changes over time. At first, the baby stands with the feet spaced further apart than she will as she becomes older, and the term "baby steps" literally describes the small distance taken with each forward movement of the foot. Steps are taken toe first rather than with a heel strike and shift to the toe. As she masters the movement her forward velocity will become greater. Those baby steps do not become longer as she gets faster at covering ground, but instead the cadence of steps is more rapid. She gets further faster because of better balance and quicker gait rather than with a longer stride.

By age two, the average child will show increased step length compared to his gait at age one, and will be able to cover ground faster than before despite a diminished cadence. "Most of the adult gait patterns are present in children by 3—yr of age, with changes of velocity, stride, and cadence continuing to 7 yr. The gait characteristics of a 7-yr-old child are similar to those of an adult." George H. Thompson.

Those children who start later may accelerate the intermediate stage of walking, so that by age 3 or so the early and late starters are all walking well and doing so with changes in stride length, good balance, and a heel toe gait.

CHANGES IN THE BODY THAT COME FROM ACTIVITIES

Body parts are not static structures, they change depending on how they are used. Weight bearing and mechanical forces thicken bone, and so muscles and bone change together as they grow. For example, the mastoid process, which is the thick bump that can be felt behind any adult's ear (down around the region of the upper earlobe), does not exist in the newborn baby, instead the baby's

skull is flat behind the ear. A muscle in the neck, the sternocleidomastoid muscle, runs, in part, from this spot on the skull, down to the collar bone and the top of the sternum. As the muscle contracts with the greater force as the baby grows and develops the ability to raise his head and hold it up, the bone actually thickens and the mastoid process developes. Other changes in the body occur with standing and walking. The spine developes what is called "lordosis", the straight backed baby has a different back contour than the walking toddler. The bottom of the feet in the baby who does not stand are "rocker-bottom" shape, and change as the child puts weight on those feet and change still more with walking. In those disabled children who never walk , the feet retain their infant contour.

2.9 INTRODUCING SUPPLEMENT FOOD TO WEAN THE CHILD

The weaning is a transitional period and process of introducing foods other than breast milk to an infant and gradually increasing the amount, so that eventually the infant becomes accustomed to the full adult diet.

Weaning before 4 months is called early and after 9 months is called late weaning. Early weaning is associated with obesity, atherosclerosis and influence the severity of celiac disease. The late weaning put the child at risk of developing under nutrition and to accustom the child to solid foods.

The human milk in reasonable quantities alone cannot provide all the energy and protein required for maintaining an adequate velocity of growth for the infant after the age of 4-6 months. It is, therefore, necessary to introduce more concentrated nutritional supplements beyond this age.

Stages of Weaning:

Stage-1: This lasts for one month starting from 6 months. At this stage a small amount of foods, such as cereal gruel, followed by a basic mix, is introduced and the food is offered after the breastfeeding.

Stage-2: In this stage, the weaning foods are offered gradually in increasing amounts, switching to the multimix, along with the breastfeeding. The aims are to accustom the child to the family foods by the first birth day.

Stage-3: There is decreasing amount of breast milk from partial to token breastfeeding with increasing amount of family foods, ultimately to a meal to complete weaning.

Age at Weaning :

It is recommended to start weaning from 4—6 months of age as:

(i) **Nutritional:** There are evidences that exclusive breastfeeding no more sufficient for the growth and development of the baby.

(ii) **Transition from the neonatal extrusion reflex** by which the infant pushes against the given spoon to the acceptance of spoon-feeding occurs at 4-6 months. The tongue is depressed; food is accepted in the posterior part of the mouth and swallowing follows.

(iii) **Acceptance of weaning foods concerns chewing skill.** By 7-9 months, rhythmic biting movements occur even if no teeth have erupted. There seems to be a "critical period of development" in which chewing is learned. Further, texture, taste, smell and the appearance of food may stimulate chewing.

(iv) **The gastric acid secretion** approaches to adult values around 6 months.

(v) **Alfa-amylase activity** becomes pronounced by the age of 4 months.

Weaning Foods:

The characteristics of weaning foods should be :

(i) **Balanced food** - that a diet based on a mixture of a staple (carbohydrate), and a legume with a animal proteins (protein) and a dark green leafy vegetables (vitamins and minerals) with added oils (fat) will be nutritionally well balanced and energy dense. The adding of oil and sugar are the best way to make the weaning food energy dense and less bulky,

(ii) **Consistency** - soft can be achieved by adding fats and oils. The consistency of gruel becomes solid when cool and difficult to eat by infant. When oil is added to the gruel it stays soft, even when cool,

(iii) Locally available and low cost,

(iv) Culturally acceptable.

(v) **Clean and safe** - the hands and utensils should be clean and prepared foods must be covered to protect from insects and dirt. Freshly prepared food should be served and leftover should be discarded.

Development of Recipes for Weaning Foods:

The foods suitable for weaning vary from one place to another, depending on availability, cost, culture, food preferences, palatable, provide a sense of satiety, energy, nutritious and so on. A meal is usually made from several foods; each food supplies some energy and different nutrients. It is important that the foods are in the right proportion so that there is an adequate balance between the nutrients and energy.

NOTES

The simplest recipe for weaning food is one, which has only two ingredients, and called basic mix, for example; cereal mixed with a legume. A multimix has four ingredients such as a staple, a protein supplement, an energy supplement and a vitamin and mineral supplement. When these four ingredients are used together in suitable proportions they form a complete meal. One way in which this can be illustrated is as a Food Square.

Introduction of Weaning Foods:

- A single weaning food is added at a time in small quantities followed by the second weaning food after some time.
- Start with basic mixes for about two weeks and then multimix. To train an infant to chew and become accustomed to new foods give 1-2 tea spoonfuls of cereal gruel (*e.g.*, rice), boiled and mashed tubers (*e.g.*, potato) or freshly peeled mashed fruits (*e.g.*, banana).
- Gluten-containing foods (wheat and wheat products) better not to introduce before six months and may delayed further.
- Wait a few days until the infant is used to one food before introducing a new one.
- Once a new food is accepted, give it fairly frequently, so that it becomes familiar.
- Gradually increase the frequency and quantity.
- Use spoon initially and allow handling the food and encouraging to feed himself.
- During the first year give the breastfeeding first and during the second year give the complementary foods first.
- Never forced the infant to eat. Keep trying daily until takes the food well.
- The whole process of weaning should be gradually completed by 9-12 months of age.

STUDENT ACTIVITY

1. Discuss the changing trends of lactation.

2. Write a short note on "Infancy and Nutrition".

NOTES

2.10 WEANLING DIARRHOEA

To most individuals, diarrhoea means an increased frequency or decreased consistency of bowel movements; however, the medical definition is more exact than this. In many developed countries, the average number of bowel movements is three per day. However, researchers have found that diarrhoea best correlates with an increase in stool weight; stool weights above 10oz (300 gs) per day generally indicates diarrhoea. This is mainly due to excess water, which normally makes up 60-85% of fecal matter. In this way, true diarrhoea is distinguished from diseases that cause only an increase in the number of bowel movements (hyperdefecation) or incontinence (involuntary loss of bowel contents).

Diarrhoea is also classified by physicians into acute, which lasts one or two weeks, and chronic, which continues for longer than 2 or 3 weeks. Viral and bacterial infections are the most common causes of acute diarrhoea.

Diarrhoea occurs because more fluid passes through the large intestine (colon) than that organ can absorb. As a rule, the colon can absorb several times more fluid than is required on a daily basis. However, when this reserve capacity is overwhelmed, diarrhoea occurs.

Diarrhoea is caused by infections or illnesses that either lead to excess production of fluids or prevent absorption of fluids. Also, certain substances in the colon, such as fats and bile acids, can interfere with water absorption and cause diarrhea. In addition, rapid passage of material through the colon can also do the same.

Symptoms related to any diarrhoeal illness are often those associated with any injury to the gastrointestinal tract, such as fever, nausea, vomiting, and abdominal pain. All or none of these may be present depending on the disease causing the diarrhoea. The number of bowel movements can vary—up to 20 or more per day. In some patients, blood or pus is present in the stool. Bowel movements may be difficult to flush (float) or contain undigested food material.

NOTES

The most common causes of acute diarrhoea are infections (the cause of traveler's diarrhoea), food poisoning, and medications. Medications are a frequent and often over-looked cause, especially antibiotics and antacids. Less often, various sugar free foods, which sometimes contain poorly absorbable materials, cause diarrhoea.

Chronic diarrhoea is frequently due to many of the same things that cause the shorter episodes (infections, medications, etc.); symptoms just last longer. Some infections can become chronic. This occurs mainly with parasitic infections (such as Giardia) or when patients have altered immunity (AIDS).

The following are the more usual causes of chronic diarrhoea:

- AIDS
- colon cancer and other bowel tumors
- endocrine or hormonal abnormalities (thyroid, diabetes mellitus, etc.)
- food allergy
- inflammatory bowel disease (Crohn's disease and ulcerative colitis)
- lactose intolerance
- malabsorption syndromes (celiac and Whipple's disease)
- other (alcohol, microscopic colitis, radiation, surgery).

Complications

The major effects of diarrhoea are dehydration, malnutrition, and weight loss. Signs of dehydration can be hard to notice, but increasing thirst, dry mouth, weakness or lightheadedness (particularly if worsening on standing), or a darkening/decrease in urination are suggestive. Severe dehydration leads to changes in the body's chemistry and could become life-threatening. Dehydration from diarrhoea can result in kidney failure, neurological symptoms, arthritis, and skin problems.

Diagnosis

Most cases of acute diarrhoea never need diagnosis or treatment, as many are mild and produce few problems. But patients with fever over 102 °F (38.9°C), signs of dehydration, bloody bowel movements, severe abdominal pain, known immune disease, or prior use of antibiotics need prompt medical evaluation.

When diagnostic studies are needed, the most useful are stool culture and examination for parasites; however these are often negative and a cause cannot be found in a large number of patients. The earlier cultures are performed, the greater the chance of obtaining a positive result. For those with a history of antibiotic use in the preceding two months, stool samples need to be examined for the toxins that cause antibiotic-associated colitis. Tests are also available to check stool samples for microscopic amounts of blood and for cells that indicate

severe inflammation of the colon. Examination with an endoscope is sometimes helpful in determining severity and extent of inflammation. Tests to check changes in blood chemistry (potassium, magnesium, etc.) and a complete blood count (CBC) are also often performed.

Chronic diarrhoea is quite different, and most patients with this condition will receive some degree of testing. Many exams are the same as for an acute episode, as some infections and parasites cause both types of diarrhoea. A careful history to evaluate medication use, dietary changes, family history of illnesses, and other symptoms is necessary. Key points in determining the seriousness of symptoms are weight loss of over 10 lb (4.5 kg), blood in the stool, and nocturnal diarrhoea (symptoms that awaken the patient from sleep).

Both prescription and over-the-counter medications can contain additives, such as lactose and sorbitol, that will produce diarrhoea in sensitive individuals. Review of allergies or skin changes may also point to a cause. Social history may indicate if stress is playing a role or identify activities which can be associated with diarrhoea (for example, diarrhoea that occurs in runners).

A combination of stool, blood, and urine tests may be needed in the evaluation of chronic diarrhoea; in addition a number of endoscopic and x-ray studies are frequently required.

Signs of Dehydration

Dehydration in infants is a serious problem and one should always watch his/her baby from not getting dehydrated. Here are some signs that baby is dehydrated.

- **decreased urination:** If your infant has no wet diapers for 4 to 5 hours. Fewer wet infant diapers than usual in a 24 hour period;
- infant has dry eyes and crying with few tears or no tears;
- high fever;
- sunken abdomen, eyes and cheeks;
- infant is less active than usual;
- dry skin, dry mouth and tongue;
- fatigue.

Possible Causes of Infant Diarrhoea

1. **Bacterial infections:** Several types of bacteria consumed through contaminated food and water can cause diarrhoea. Common bacteria include Salmonella, Escherichia coli(E.coli), Campylobacter.
2. **Many viruses cause infant diarrhoea:** Some of them are Rotavirus, Herpes simplex virus, Cyptomegalovirus. Rotavirus is the most common

cause of acute diarrhoea in babies and young children. It usually affects children between the ages of 6 months and 2 years. When children have rotavirus, their stools contain large numbers of germs. Rotavirus can spread easily. It could spread by coming in contact with an infected diaper and not washing hands properly afterward by touching a toy that has germs on it.

3. **Parasites:** Parasites can enter the body through foods and water and settle in the digestive system. Parasites that cause infant diarrhoea include Giardia lamblia, Cryptosporidium and Entamoeba histolytica.
4. **Reaction to medicines:** Antibiotics, blood pressure medications, antacids containing magnesium and cancer drugs can cause infant diarrhoea.
5. **Bowel disorders:** Infant diarrhoea can be a symptom of irritable bowel syndrome.
6. Intestinal diseases like crohn's disease, infalmmatory bowel disease and celiac disease often lead to diarrhoea.
7. Teething and change in mother's diet if the baby is breastfed.

Treatment of Infant Diarrhoea

Treatment in infant diarrhea is to give infant baby a lot of fluids to prevent dehydration. Oral rehydration solution (ORS) can be given to infant to replace infant body fluids that is lost during diarrhoea. Follow the following diet plan for infant during diarrhoea.

Diet plan for babies suffering from diarrhoea:

1. Strict oral rehydration solution like Pedialyte every 4-6 hours
2. Infant babies 4 months to 9 months: Bland foods can be given to infants. If infant is on solid foods, then give them apple sauce, strained banana, saltines, strained carrots, strained squash, mashed potatoes(no additives), rice cereal and oat meal.
3. Over 9 month infant baby: Infants can be given toast, crackers, breads, pretzels, rice, mashed potatoes(no additives), noodles(no additives), bananas, apple sauce, carrots, squash, rice krispies, cheerios, oatmeal and yogurt with active cultures.
4. No milk products.
5. No oils or butter.
6. No spicy foods or sauces until the infant diarrhea subsides.

NOTES

2.11 BREASTFEEDING EFFECTS

Children's intellectual development is influenced by both genetic inheritance and environmental experiences. Breastfeeding is one of the earliest such postnatal experiences. Breastfed children attain higher IQ scores than children not fed breast milk, presumably because of the fatty acids uniquely available in breast milk. Here we are going to discuss the benefits of feeding to infant and mother both.

Benefits for the Infant

Scientific research, such as the studies summarized in a 2007 review for the U.S. Agency for Healthcare Research and Quality (AHRQ) and a 2007 review for the WHO, has found many benefits to breastfeeding for the infant. These include:

Less Necrotizing Enterocolitis in Premature Infants

Necrotizing enterocolitis (NEC) is an acute inflammatory disease in the intestines of infants. Necrosis or death of intestinal tissue may follow. It is mainly found in premature births. In one study of 926 preterm infants, NEC developed in 51 infants (5.5%). The death rate from necrotizing enterocolitis was 26%. NEC was found to be six to ten times more common in infants fed formula exclusively, and three times more common in infants fed a mixture of breast milk and formula, compared with exclusive breastfeeding. In infants born at more than 30 weeks, NC was twenty times more common in infants fed exclusively on formula. A 2007 meta-analysis of four randomized controlled trials found "a marginally statistically significant association" between breastfeeding and a reduction in the risk of NEC.

Greater Immune Health

During breastfeeding antibodies pass to the baby. Breast milk contains several anti-infective factors such as bile salt stimulated lipase (protecting against amoebic infections), lactoferrin (which binds to iron and inhibits the growth of intestinal bacteria) and immunoglobulin a protecting against microorganisms.

Fewer Infections

Among the studies showing that breastfed infants have a lower risk of infection than non-breastfed infants are:

- In a 1993 University of Texas Medical Branch study, a longer period of breastfeeding was associated with a shorter duration of some middle ear infections (otitis media with effusion) in the first two years of life.
- A 1995 study of 87 infants found that breastfed babies had half the incidence of diarrhoeal illness, 19% fewer cases of any otitis media infection,

and 80% fewer prolonged cases of otitis media than formula fed babies in the first twelve months of life.

- Breastfeeding appeared to reduce symptoms of upper respiratory tract infections in premature infants up to seven months after release from hospital in a 2002 study of 39 infants.
- A 2004 case-control study found that breastfeeding reduced the risk of acquiring urinary tract infections in infants up to seven months of age, with the protection strongest immediately after birth.
- The 2007 review for AHRQ found that breastfeeding reduced the risk of acute otitis media, non-specific gastroenteritis, and severe lower respiratory tract infections.

Less Tendency to Develop Allergic Diseases (Atopy)

In children who are at risk for developing allergic diseases (defined as at least one parent or sibling having atopy), atopic syndrome can be prevented or delayed through exclusive breastfeeding for four months, though these benefits may not be present after four months of age. However, the key factor may be the age at which non-breastmilk is introduced rather than duration of breastfeeding. Atopic dermatitis, the most common form of eczema, can be reduced through exclusive breastfeeding beyond 12 weeks in individuals with a family history of atopy, but when breastfeeding beyond 12 weeks is combined with other foods incidents of eczema rise irrespective of family history.

More Easily aroUsed from Sleep

Breastfed babies have better arousal from sleep at 2–3 months. This coincides with the peak incidence of sudden infant death syndrome.

Higher Intelligence

Studies examining whether breastfeeding in infants is associated with higher intelligence later in life include:

- Horwood, Darlow and Mogridge (2001) tested the intelligence quotient (IQ) scores of 280 low birthweight children at seven or eight years of age. Those who were breastfed for more than eight months had verbal IQ scores 6 points higher (which was significantly higher) than comparable children breastfed for less time. They concluded "These findings add to a growing body of evidence to suggest that breast milk feeding may have small long term benefits for child cognitive development."
- A 2005 study using data on 2,734 sibling pairs from the National Longitudinal Study of Adolescent Health "provide[d] persuasive evidence of a causal connection between breastfeeding and intelligence."

NOTES

- In 2006, Der and colleagues, having performed a prospective cohort study, sibling pairs analysis, and meta-analysis, concluded that "Breastfeeding has little or no effect on intelligence in children." The researchers found that "Most of the observed association between breastfeeding and cognitive development is the result of confounding by maternal intelligence."
- The 2007 review for the AHRQ found "no relationship between breastfeeding in term infants and cognitive performance."
- The 2007 review for the WHO concluded "Subjects who were breastfed experienced higher performance in intelligence tests."
- Two initial cohort studies published in 2007 suggest babies with a specific version of the FADS2 gene demonstrated an IQ averaging 7 points higher if breastfed, compared with babies with a less common version of the gene who showed no improvement when breastfed. FADS2 affects the metabolism of polyunsaturated fatty acids found in human breast milk, such as docosahexaenoic acid and arachidonic acid, which are known to be linked to early brain development. The researchers were quoted as saying "Our findings support the idea that the nutritional content of breast milk accounts for the differences seen in human IQ. But it's not a simple all-or-none connection: it depends to some extent on the genetic makeup of each infant." The researchers wrote "further investigation to replicate and explain this specific gene–environment interaction is warranted."
- In "the largest randomized trial ever conducted in the area of human lactation," between 1996 and 1997 maternity hospitals and polyclinics in Belarus were randomized to receive or not receive breastfeeding promotion modeled on the Baby Friendly Hospital Initiative. Of 13,889 infants born at these hospitals and polyclinics and followed up in 2002-2005, those who had been born in hospitals and polyclinics receiving breastfeeding promotion had IQs that were 2.9-7.5 points higher (which was significantly higher). Since (among other reasons) a randomized trial should control for maternal IQ, the authors concluded in a 2008 paper that the data "provide strong evidence that prolonged and exclusive breastfeeding improves children's cognitive development."

Diabetes

Infants exclusively breastfed have less chance of developing diabetes mellitus type 1 than peers with a shorter duration of breastfeeding and an earlier exposure to cow milk and solid foods. Breastfeeding also appears to protect against diabetes mellitus type at least in part due to its effects on the child's weight.

NOTES

Obesity

Breastfeeding appears to reduce the risk of extreme obesity in children aged 39 to 42 months. The protective effect of breastfeeding against obesity is consistent, though small, across many studies, and appears to increase with the duration of breastfeeding.

Other Longterm Health Effects

In one study, breastfeeding did not appear to offer protection against allergies. However, another study showed breastfeeding to have lowered the risk of asthma, protect against allergies, and provide improved protection for babies against respiratory and intestinal infections.

A review of the association between breastfeeding and celiac disease (CD) concluded that breastfeeding while introducing gluten to the diet reduced the risk of CD. The study was unable to determine if breastfeeding merely delayed symptoms or offered life-long protection.

An initial study at the University of Wisconsin found that women who were breastfed in infancy may have a lower risk of developing breast cancer than those who were not breastfed.

Breastfeeding may decrease the risk of cardiovascular disease in later life, as indicated by lower cholesterol and C-reactive protein levels in adult women who had been breastfed as infants. Although a 2001 study suggested that adults who had been breastfed as infants had lower arterial distensibility than adults who had not been breastfed as infants, the 2007 review for the WHO concluded that breastfed infants "experienced lower mean blood pressure" later in life. Nevertheless, the 2007 review for the AHRQ found that "the relationship between breastfeeding and cardiovascular diseases was unclear".

Benefits for Mothers

Breastfeeding is a cost effective way of feeding an infant, and provides the best nourishment for a child at a small nutrient cost to the mother. Frequent and exclusive breastfeeding can delay the return of fertility through lactational amenorrhoea, though breastfeeding is an imperfect means of birth control. During breastfeeding beneficial hormones are released into the mother's body. and the maternal bond can be strengthened. Breastfeeding is possible throughout pregnancy, but generally milk production will be reduced at some point.

Bonding

Breastfeeding helps to strengthen the maternal bond. The hormones released during breastfeeding strengthen the maternal bond. Teaching partners how to

NOTES

manage common difficulties is associated with higher breastfeeding rates. Support for a mother while breastfeeding can assist in familial bonds and help build a paternal bond between father and child.

If the mother is away, an alternative caregiver may be able to feed the baby with expressed breast milk. The various breast pumps available for sale and rent help working mothers to feed their babies breast milk for as long as they want. To be successful, the mother must produce and store enough milk to feed the child for the time she is away, and the feeding caregiver must be comfortable in handling breast milk.

Hormone Release

Breastfeeding releases oxytocin and prolactin, hormones that relax the mother and make her feel more nurturing toward her baby. Breastfeeding soon after giving birth increases the mother's oxytocin levels, making her uterus contract more quickly and reducing bleeding. Pitocin, a synthetic hormone used to make the uterus contract during and after labour, is structurally modelled on oxytocin. Some women experience orgasm during breastfeeding due to the release of oxytocin.

Weight Loss

As the fat accumulated during pregnancy is used to produce milk, extended breastfeeding—at least 6 months—can help mothers lose weight. However, weight loss is highly variable among lactating women; monitoring the diet and increasing the amount/intensity of exercise are more reliable ways of losing weight. The 2007 review for the AHRQ found

> "The effect of breastfeeding in mothers on return-to-pre-pregnancy weight was negligible, and the effect of breastfeeding on postpartum weight loss was unclear."

Natural Postpartum Infertility

A breastfeeding woman may not ovulate, or have regular periods, during the entire lactation period. The period in which ovulation is absent differs for each woman. This Lactational amenorrhoea has been used as an imperfect form of natural contraception, with a greater than 98% effectiveness during the first six months after birth if specific nursing behaviours are followed. It is possible for some women to ovulate within two months after birth while fully breastfeeding.

Long-term Health Effects

For breastfeeding women, long-term health benefits include:

NOTES

- Less risk of breast cancer, ovarian cancer, and endometrial cancer.
- A 2009 study indicates long duration of lactation (at least 24 months) is associated with a reduced risk of heart disease.
- Although the 2007 review for the AHRQ found "no relationship between a history of lactation and the risk of osteoporosis", mothers who breastfeed longer than eight months benefit from bone re-mineralisation.
- Breastfeeding diabetic mothers require less insulin.
- Reduced risk of post-partum bleeding.
- According to a Malmo University study published in 2009, women who breastfed for a longer duration have a lower risk for contracting rheumatoid arthritis than women who breastfed for a shorter duration or who had never breastfed.

STUDENT ACTIVITY

1. Outlines the possible causes of infant diarrhea.

2. Point out the benefits of breast feeding.

NOTES

2.12 SUMMARY

- A balanced, nutritious diet is an important aspect of a healthy pregnancy. Eating a healthy diet, balancing carbohydrates, fat, and proteins, and eating a variety of fruits and vegetables, usually ensures good nutrition.
- During the early stages of pregnancy, the placenta is not formed yet, so there is no mechanism to protect the embryo from the deficiencies which may be inherent in the mother's circulation, so it is critical that the correct amount of nutrients and energy are consumed.
- Lactation describes the secretion of milk from the mammary glands, the process of providing that milk to the young, and the period of time that a mother lactates to feed her young. The process occurs in all female mammals, and in humans it is commonly referred to as breastfeeding or nursing.
- Many developing countries including India have initiated massive food supplementation programmes aimed at improvement of maternal and child nutritional status among poorer segments of the population.
- "Infant" is derived from the Latin word, "infans," meaning "unable to speak." Thus, many define infancy as the period from birth to approximately 2 years of age, when language begins to flourish.
- The weaning is a transitional period and process of introducing foods other than breast milk to an infant and gradually increasing the amount, so that eventually the infant becomes accustomed to the full adult diet.
- Treatment in infant diarrhea is to give infant baby a lot of fluids to prevent dehydration. Oral rehydration solution (ORS) can be given to infant to replace infant body fluids that is lost during diarrhoea.

2.13 GLOSSARY

- **Lactation:** The secretion of milk from the mammary glands, the process of providing that milk to the young.
- **Breastfeeding:** The feeding of an infant or young child with breast milk directly from human breasts rather than from a baby bottle or other container.
- **Infant:** It is derived from the Latin word, "infans," meaning "unable to speak." Thus, many define infancy as the period from birth to approximately 2 years of age, when language begins to flourish.
- **Weaning:** It is a transitional period and process of introducing foods other than breast milk to an infant and gradually increasing the amount, so that eventually the infant becomes accustomed to the full adult diet.

2.14 REVIEW QUESTIONS

1. What are the beneficial factors against pre-pregnancy nutrition?
2. What is lactation? Discuss the current trends.
3. What are the effects of food suplementation during lactation?
4. Discuss the physical changes and growth of infant.
5. How is infant introduced supplementary foods?
6. What are the benefits of breastfeeding?
7. Discuss the treatment of infant diarrhoea.

2.15 FURTHER READINGS

- *Breastfeeding and Natural Child Spacing : How Ecological Breastfeeding Spaces Babies* by Sheila K. Kippley.
- *Pregnancy : What The Indian Woman Always Wanted To Know But Was Afraid To Ask* by Nutan Pandit, Published at Rupa & Co. (1991).
- *The Womanly Art of Breastfeeding* by Le Leche League, Published at Couple to Couple League International; 2nd edition (1989).
- *Pregnancy Diet & Nutrition* by Gloria Tsang, RD of HealthCastle.com, Published in Sep 2005; Updated in May 2008.
- *Social Cognition During Infancy: A Special Issue of the European Journal of Developmental Psychology*, Edited by Vincent Reid, Tricia Striano, Willem Koops, Published at Psychology press.
- *Infants, Children, And Adolescents* by Laura E. Berk, Published at Allyn & Bacon.
- Vidya Ratan, *Handbook of Human Physiology*, Jain Brothers, VIIth edition.

UNIT—III

PRE-SCHOOL, SCHOOL AND ADOLESCENT CHILD

NOTES

OBJECTIVES

After going through this unit, students will be able to:

- state the nutritional requirements of child;
- explain the danger of malnutrition on the growth and development of the child;
- discuss the importance and necessity of school feeding;
- describe the importance of school lunch programms with special reference to Andhra Pradesh;
- understand the effect of nutrition on the growth and development of adolescent.

STRUCTURE

3.1 Introduction
3.2 Eating Pattern of Pre-school Children
3.3 Nutritional Demands of Pre-school Childrens
3.4 Effect of Under-nutrition and Dangers of Malnutrition on the Growth and Development of Child
- People at Risk
- Necessary Nutrients
- Symptoms and Effects of Malnutrition

3.5 Maintenance and Importance of the Growth Chart
3.6 Supplementary Foods for Pre-school Child
3.7 School Child
- How School Feeding Programs can Educational Quality and Efficiency
- School Lunch Programm in India
  - Andhra Pradesh (A Case Study)
  - Other States

3.8 The Pre-adolescent and Adolescent
- Effect of Poor Nutrition on the Growth of Pre-adolescent and Adolescent

3.9 A case Study of South and South-East Asian Nations
3.10 Summary
3.11 Glossary
3.12 Review Questions
3.13 Further Readings

NOTES

3.1 INTRODUCTION

The ages between 2 and 5 are often called the preschool years. During these years, children change from clumsy toddlers into lively explorers of their world. A child develops in these main areas:

- **Physical development.** In these years, a child becomes stronger and starts to look longer and leaner. Physical growth is slower than in the first 2 years of life, but the outward changes can be dramatic.
- **Cognitive development.** A child this age makes great strides in being able to think and reason. In these years, children learn their letters, counting, and colours. Their play becomes more creative as they learn to imagine.
- **Emotional and social development.** Between the ages of 2 and 5, children gradually learn how to manage their feelings. They begin to feel ashamed or guilty when they do something wrong. By age 5, friends become important.
- **Language.** The ability to use words grows quickly in these years. By age 2, most children can say at least 50 words. By age 5, a child may know thousands of words and be able to carry on conversations and tell stories.
- **Sensory and motor development.** By age 2, most children can walk up stairs one at a time, kick a ball, and draw simple strokes with a pencil. By age 5, most can dress and undress themselves; draw a person with a head, body, arms, and legs; and write some small and capital letters.

The years between a child's 2nd and 5th birthdays represent a period of rapid social, intellectual and emotional growth. At the same time, overall physical growth is decelerating while motor skills are being fine-tuned. Preschoolers are busy exploring the environment. They have tested their independence and are now ready to learn.

Preschoolers have two common preferences. Firstly, they have a preference for routine in daily life. Most children need some structure and routine to their day. Generally, they prefer meals and snacks at regular times, as governed by the family's lifestyle.

Secondly, they have a preference for simplicity. Many children may like simply prepared, mild tasting foods that they can easily identify. They prefer foods they can manage, for example, cut-up vegetables they can eat with their fingers and soups they can drink from a cup.

In the preschool years, food takes on more complex meanings. Preschoolers have an association with food of more than eating. Foods have specific meanings

determined by a child's associations with them. For example, sweets may mean a reward for good behaviour in the supermarket. Additionally, caregivers should be aware that early impressions associated with various uses of food, affect food-related attitudes and practices that can last throughout life.

Food preferences can now be influenced; parents and friends as well as television advertising will affect food consumed.

3.2 EATING PATTERN OF PRE-SCHOOL CHILDREN

Once children commence child care, school, life takes on a new routine. A regular intake of food is needed throughout the day to keep children active and to help their concentration while learning.

Some children in this age group are still fussy, so encourage parents to offer a wide variety of foods and regular meals and snacks, and allow children to eat to appetite without force or arguments.

Developmental Characteristics of Preschoolers

Generally in preschoolers there is :

Progressive acquisition of new skills: Preschoolers are striving for independence and gaining competence in such activities as tying their shoelaces, brushing their teeth and pouring milk. A preschooler's oral motor development and manual dexterity should be considered, so that foods of appropriate texture, consistency and ease of eating are chosen for them.

Energy: Sitting still for more than a few minutes might be difficult. Preschoolers need plenty of time for active play and opportunities to develop gross motor coordination.

More effective communication: Language is important. Peers become increasingly important. Most preschoolers enjoy sharing food with friends and carers.

A keen curiosity: 'Why' has usually replaced 'no' as the favourite spoken word. The kitchen provides an opportunity for experiments, crafts, and participation in food preparation.

Comfort with the familiar but willingness to try new challenges: Food fads are common at this time. Preschoolers might insist on having a particular food prepared in a particular way for several days then, once it has been experienced to the full, become infatuated with another food. This has been called 'fussiness', but it is actually characteristic of normal development. Although variety may be limited while the fad persists, the preschooler is gradually expanding their food choices.

TABLE 1. TYPICAL PHYSICAL AND SOCIAL/PERSONAL CHARACTERISTICS RELATED TO EATING DURING THE PRESCHOOL YEARS

Age	*Physical characteristics*	*Social/ personal characteristics*
3 – 4 years	– Holds handle on cup – Pours from a small jug – Uses fork – Chews most foods – Able to choose between 2 alternate foods – Influenced by television commercials – Likes to copy food preparer – Imaginative play	– Improved appetite and interest in food – Favourite foods requested – Likes shapes, colours, ABCs
4 – 5 years	– Uses knife and fork – Good use of cup – Good self-feeder	– Rather talk than eat – Food fads continue – Motivated to eat by incentives – Likes to help – Interested in nature of food and where it comes from – Peer influence increasing
5 – 6 years	– Independent at feeding	– Conforming – Less suspicious of mixtures but still prefers plain foods – Social influence outside home increasing – Food an important part of special occasions

3.3 NUTRITIONAL DEMANDS OF PRE-SCHOOL CHILDRENS

All parents want their pre-school children, ages two to five, to be healthy and grow normally. Without a healthy lifestyle, children, like adults, can develop health problems such as obesity, diabetes, and heart disease. It is the responsibility

of parents to establish healthy eating and physical activity habits while child is young.

NOTES

Required Nutrients

Preschoolers should get adequate nutrients for their growth and development. They need:

- Carbohydrates for energy. The Grain Group is an excellent source. Vegetables and fruit also supply carbohydrates along with essential vitamins and minerals.
- Protein for growth and repair of body tissues. Food from the Meat and Bean Group along with the Milk Group are good sources of protein.
- Fat for energy, proper growth and development. Limit food high in saturated fats, cholesterol and trans fats. Eat lean meat and avoid high-fat cooking methods.
- Vitamin A to help eyes adjust to changes in light. Dark green and orange vegetables are good sources.
- Vitamin C for wound healing and a healthy immune system. Citrus fruits and juices are the best sources.
- Calcium for strong bones and teeth. It is mainly found in milk and milk products.
- Iron for healthy red blood cells. The Meat and Bean Group is a good source of iron.
- Water to regulate body functions and prevent dehydration.
- Fiber to prevent constipation. Whole grain breads and cereals, fruit, vegetables and dried beans, peas and lentils are good sources of fiber.

How much food is eaten at this age varies from child to child and from day to day and is influenced by growth and activity levels. The following serving sizes and amounts can be used as a guide to feeding 4 – 7 year old children each day. Some serve sizes are different to those commonly used for adults.

Every child is different, and their activity and growth rate changes from day to day. The main focus should be on the introduction of a healthy eating pattern and family meal acceptance rather than on serves.

Suggested Meal Plan for a 4—7 Year Old

Breakfast	— 1 cup cereal with 1 cup milk — 1 slice toast with polyunsaturated margarine with spread *e.g.*, Vegemite, jam, peanut butter, cheese, egg

Snack	— Water — Fruit *e.g.*, 1 apple/banana, orange OR 2 apricots OR 1 cup canned fruit OR 4 dried apricot halves
Lunch	— Meat, chicken, fish, cheese or egg with 1 cup pasta/ rice OR 2 slices of bread — ½ cup cut up vegetables OR 1 cup salad vegetables — ½ cup custard or yoghurt — Water to drink
Snack	— 1 cup milk — 1 slice bread with baked beans OR — fruit and vegetable platter OR — savoury vegetable muffin
Evening meal	— Chicken, meat, fish, cheese or egg *e.g.*, 2 small chops, slice of roast meat, piece of fish — 1 potato and ½ cup other vegetables — ½ cup pasta OR rice OR 1 piece of bread — ½ cup custard/yoghurt with ½ cup diced fruit

Eating Habits

A number of strategies can be adopted to encourage good eating habits and monitor food intake

- Establish routines where the child and caregiver sit down together and talk during meal times and snacks.
- Establish habits such as milk with a meal and water at bedtime that will help ensure variety and nutritional adequacy.
- Keep a 'snack-box' in the fridge or on the kitchen bench containing healthy snack foods such as pieces of fruit, vegetables, cheese and small sandwiches, that the child can either use independently or have offered to them. This helps to monitor what the child is eating between meals.
- Introduce the practice of having the child at the table for meal times as soon as he or she is able to sit up and grasp foods.
- Do not give the child too large a serving. It is better to offer small amounts and have more available if they want it.
- Provide foods the child likes, plus a new food to try. Be accepting if the child does not like particular foods, but remember that likes and dislikes change over time.

Growth

Children grow at a steady rate during the early school years. 'This slower growth rate is reflected in a decrease in appetite and less interest in food.

Paradoxically, while parents worry that their preschooler may not be eating enough, the incidence of childhood obesity continues to rise'. Strict or low fat diets are not recommended because children's energy and nutrient needs are high. For parents who are concerned about excessive weight gain, a good approach to discuss with them is to:

- develop healthy eating habits for the whole family;
- encourage regular physical activities for everyone;
- limit television time.

3.4 EFFECT OF UNDER-NUTRITION AND DANGERS OF MALNUTRITION ON THE GROWTH AND DEVELOPMENT OF THE CHILD

Undernutrition during any period of childhood can have detrimental effects on a child's health and cognitive development. A recent Scientific American article notes that poor nutrition in early childhood can continue to hinder intellectual performance into adulthood. A child does not have to be starving for these potentially long-lasting effects to occur. Even mild undernutrition, if it occurs over an extended period of time or reoccurs frequently, compromises a child's physical, social, and emotional development. Undernutrition results in a slower rate of growth, more susceptibility to illness, increased risk for lead poisoning and anemia, compromised brain growth, and lack of energy to explore surroundings, play with peers, and be actively involved in learning.

The nutritional requirements of the human body reflect the nutritional intake necessary to maintain optimal body function and to meet the body's daily energy needs. Malnutrition (literally, "bad nutrition") is defined as "inadequate nutrition," and while most people interpret this as undernutrition, falling short of daily nutritional requirements, it can also mean overnutrition, meaning intake in excess of what the body uses. However, undernutrition affects more than one-third of the world's children, and nearly 30 percent of people of all ages in the developing world, making this the most damaging form of malnutrition worldwide.

The etiology of malnutrition includes factors such as poor food availability and preparation, recurrent infections, and lack of nutritional education. Each of these factors is also impacted by political instability and war, lack of sanitation, poor food distribution, economic downturns, erratic health care provision, and by factors at the community/regional level.

People at Risk

Certain people are more susceptible to malnutrition than others. For example, individuals in rapid periods of growth, such as infants, prechool, school childrens and adolescents.

NOTES

In developing nations, more than half of all deaths among children under five years old are due to malnutrition. Malnourished children who survive may experience stunted growth, illness, and lifelong malnourishment.

Infants and pregnant women, have higher nutritional needs than others, and are therefore more susceptible to the effects of poor nutrition. Those living in deprived socio-economic circumstances or that lack adequate sanitation, education, or the means to procure food are also at risk. Most importantly, individuals at risk for systemic infections (particularly gastrointestinal) and those who suffer with a chronic disease are at greatly increased risk because they require additional energy to support their immune system and often have decreased absorption of nutrients.

In fact, the relationship between malnutrition and infection is cyclical—infection predisposes one to malnutrition, and malnutrition, which impairs all immune defenses, predisposes one to infection. The World Health Organization (WHO) identifies malnutrition as "the single most important risk factor for disease" (WHO). Some research has identified malnourished children as being more likely to suffer episodes of infectious disease, as well as episodes of longer duration and greater severity, than other children. In particular, hookworm , malaria , and chronic diarrhoea have been linked with malnutrition. These conditions are more prevalent in the developing world than in the industrialized world, though malnutrition exists worldwide, particularly in areas of poverty and among patients with chronic disease or who are hospitalized and on enteric feeding.

All over the world, people who are poor or who live in poverty-stricken areas are at the greatest risk for hunger and malnutrition. In poor countries, wars and natural disasters such as droughts and earthquakes may also contribute to hunger and malnutrition by disrupting normal food production and distribution.

In the United States, food manufacturers fortify some common foods with vitamins and minerals to prevent certain nutritional deficiencies. For example, the addition of iodine to salt helps prevent some thyroid gland problems (such as goiter), folic acid added to foods can help prevent certain birth defects, and added iron can help prevent iron-deficiency anemia.

Malnutrition affects people of every age, although infants, children, and adolescents may suffer the most because many nutrients are critical for growth and development. Older people may develop malnutrition because aging, illness, and other factors can lead to a poor appetite, so they may not eat enough. Alcohol can interfere with nutrient absorption, so alcoholics might not benefit from the vitamins and minerals they consume. People who abuse drugs or alcohol can be malnourished or underweight if they don't eat properly.

NOTES

Children and teens on special diets — such as vegetarians — need to eat balanced meals and a variety of foods to get the right nutrients. Vegetarians and vegans should make sure they get enough protein and vitamins like B12.

Necessary Nutrients

The WHO's Department of Nutrition for Health and Development is responsible for formulating dietary and nutritional guidelines for international use. Adequate total nutrition includes the following nutrients: protein , energy (calories), vitamin A and carotene, vitamin D , vitamin E, vitamin K, thiamine, riboflavin, niacin , vitamin B6, pantothenic acid, biotin , folate , vitamin C, antioxidants , calcium , iron , zinc , selenium, magnesium, and iodine. Most important are protein and the caloric/energy requirement needed to utilize protein. If these elements are inadequate, the result is a protein-energy malnutrition (PEM), or protein-calorie malnutrition (PCM), which affects one in every four children worldwide, with the highest concentration in Asia. Chronic deficiencies of protein and calories result in a condition called marasmus , while a diet high in carbohydrates but low in protein causes a condition called kwashiorkor .

Malnutrition and Growth

Malnutrition from any cause retards normal growth. Growth assessments are therefore the best way to monitor a person's nutritional status. While there are a variety of methods used to measure growth, the most common are known as anthropometric indices, which compare an individual's age, height, and weight, each of which is measured against the others. The values are expressed as percentages, or percentiles, of the normal distribution of these measurements. So, for example, a child with a given height and age might rank in the 90th percentile for height based on all children of that particular age, meaning that 90 percent of children that age are shorter than this particular child. Through anthropometric studies, researchers have found that particular measurements correlate with specific growth trends, based on how the body normally changes over time. Abnormal height-forage (stunting) usually measures long-term growth faltering. Low weight-for-height (wasting) correlates with an acute growth disturbance.

Malnutrition can have severe long-term consequences. Children who suffer from malnutrition are more likely to have slowed growth, delayed development, difficulty in school, and high rates of illness, and they may remain malnourished into adulthood.

Limited growth patterns are distributed unevenly across the globe. Eighty percent of children affected by stunting or wasting live in Asia, with 15 percent in Africa and 5 percent in Latin America. Low weight-for-age (underweight) is

NOTES

usually used as an overall measurement of growth status. More than 35 percent of all preschool-age children in developing countries are underweight. There are differences, however, across regions. "The risk of being underweight is 1.5 times higher in Asia than in Africa, and 2.3 times higher in Africa than Latin America" *(Onis, p. 10)*. In some ways, these indices also enable an indirect understanding of the societal factors in these regions that contribute to malnutrition as mentioned above.

An acutely malnourished Liberian boy is weighed at a therapeutic feeding center. Such centers, operated by international relief organizations, provide intensive care and a specialized diet to rehabilitate severely malnourished children.

Malnutrition remains one of the world's highest priority health issues, not only because its effects are so widespread and long lasting, but also because it can be eradicated. Given the multifactorial causes of malnutrition, interventions must be focused on both acute and broad goals. Current efforts are targeted at high-risk groups, particularly infants and pregnant women, for it is "in these populations and during these ages that nutritional interventions have the greatest potential for benefit" *(Schroeder, p. 46)*. Even the simple supplementation of vitamin A or beta-carotene supplements during pregnancy can decrease maternal mortality by 40 percent. Interventions include direct food supplementation, food access, agricultural enrichment , nutritional education, and improved infrastructure related to hygiene , sanitation, and health care delivery. Each of these programs "must be tailored to the particular problems, cultural conditions, and resource constraints of the local context" *(Schroeder, p. 417)*. Strategies for reducing the prevalence of malnutrition must effectively address its many causes.

Symptoms and Effects of Malnutrition

Malnutrition harms both the body and the mind. The more malnourished someone is — in other words, the more nutrients that are missing — the more likely he or she is to have physical problems. A child who is slightly to moderately malnourished may show no outward physical symptoms.

Indications of malnutrition depend on which nutritional deficiencies a child has, although they can include:

- fatigue and low energy
- dizziness
- poor immune function (which can hamper the body's ability to fight off infections)
- dry, scaly skin
- swollen and bleeding gums

NOTES

- decaying teeth
- slowed reaction times and trouble paying attention
- underweight
- poor growth
- muscle weakness
- bloated stomach
- osteoporosis, or fragile bones that break easily
- problems with organ function

If a pregnant woman is malnourished, her child may weigh less at birth and have a lower chance of survival. Vitamin A deficiency from malnutrition is the chief cause of preventable blindness in the developing world, and kids with severe vitamin A deficiency have a greater chance of getting sick or dying from infections such as diarrhoea or measles. Iodine deficiency, another form of malnutrition, can cause mental retardation and delayed development. Iron deficiency can make kids less active and less able to concentrate. Teens who are malnourished often have trouble keeping up in school.

3.5 MAINTENANCE AND IMPORTANCE OF THE GROWTH CHART

Look at any class picture, and you'll see kids of the same age in all shapes and sizes. Some kids look tiny next to their peers, while others literally stand head and shoulders above their classmates.

As easy as it is to make these comparisons and to draw conclusions about what you see, the reality is that kids grow at their own pace. Big, small, tall, short – there is a wide range of healthy shapes and sizes among children.

Genes and lifestyle factors like nutrition and physical activity play big roles in kids' growth and development. And those issues can vary widely from family to family.

So how does a doctor figure out whether a child's height and weight measurements are "normal"? Whether he or she is developing on track? Or whether there are any health problems that are affecting growth?

A doctor uses growth charts to help answer those questions. Here are some facts about growth charts and what they say about child's health.

Why Do Doctors Use Growth Charts?

Growth charts are a standard part of any checkup, and they show health care providers how kids are growing compared with other kids of the same age

NOTES

and gender. They also allow doctors and nurses to see the pattern of kids' height and weight gain over time, and whether they're developing proportionately.

Let's say a child was growing along the same pattern until he was 2 years old, then suddenly started growing at a much slower rate than other kids. That might indicate a health problem. Doctors could see that by looking at a growth chart.

What Factors Affect a Child's Growth?

Genetics, gender, nutrition, physical activity, health problems, environment, and hormones all influence a child's height and weight.

If a Growth Chart Shows a Different Pattern, Is There a Problem?

Not necessarily. The doctor will interpret the growth charts in the context of the child's overall well-being, environment, and genetic background. Is the child meeting other developmental milestones? Are there other signs that a child is not healthy? How tall or heavy are the child's parents and siblings? Was the child born prematurely? Has the child started puberty earlier or later than average? These are all factors that the doctor will use to help understand the numbers on the growth chart.

Are All Kids Measured on One Growth Chart?

No. Girls and boys are measured on different growth charts because they grow in different patterns and at different rates.

And one set of charts is used for babies, from birth to 36 months. Another set of charts is used for kids ages 2 to 20 years old. Also, special growth charts are used for children with certain conditions, such as Down syndrome.

Commonly used standard growth charts include:

- Ages birth to 36 months (3 years):
  - Boys' length- and weight-for-age
  - Girls' length- and weight-for-age
  - Girls' head circumference-for-age and weight-for-length
  - Boys' head circumference-for-age and weight-for-length
- Ages 2 to 20 years:
  - Girls' stature- and weight-for-age
  - Boys' stature- and weight-for-age
  - Girls ' weight-for-stature
  - Boys' weight-for-stature

NOTES

What Measurements Are Put on Growth Charts?

Up until the time babies are 36 months old, doctors measure weight, length, and head circumference.

With older kids, doctors measure weight, height, and body mass index (BMI). It's important to look at and compare weight and height measurements to get a full picture of a child's growth.

Why is Head Circumference Measured?

In babies, head circumference (the distance around the largest part of the head) can provide clues about brain development. If a baby's head is bigger or smaller than most other kids', or the head circumference stops increasing or increases quickly, it may indicate a problem.

For example, an unusually large head may be a sign of hydrocephalus, a buildup of fluid inside the brain. A head that's smaller than average may be a sign that the brain is not developing properly or has stopped growing.

What are Percentiles?

Percentiles are measurements that show where a child is compared with others. On the growth charts, the percentiles are shown as lines drawn in curved patterns. When doctors plot a child's weight and height on the chart, they see which percentile line those measurements land on. The higher the percentile number, the bigger a child is compared with other kids of the same age and gender, whether it's for height or weight; the lower the percentile number, the smaller the child is. For example, if a 4-year-old boy's weight is in the 10th percentile, that means that 10% of boys that age weigh less than he does and 90% of 4-year-old boys weigh more.

How are Percentiles Determined?

Being in a high or a low percentile does not necessarily mean that a child is healthier or has a growth or weight problem. Let's say that 4-year-old boy, who is in the 10th percentile for weight, is also in the 10th percentile for height. So 10% of kids are shorter and weigh less than he does, and most kids — 90% — are taller and weigh more. That just means that he's smaller than average, which usually doesn't mean there is a problem. If his parents and siblings are also smaller than average, and there are other signs that he's healthy and developing well, doctors would likely conclude that there's no cause for concern.

What's the Ideal Percentile for My Child?

There is no one ideal number. Healthy children come in all shapes and sizes, and a baby who is in the 5th percentile can be just as healthy as a baby who

is in the 95th percentile. Ideally, each child will follow along the same growth pattern over time, growing in height and gaining weight at the same rate, with the height and weight in proportion to one another. This means that usually a child stays on a certain percentile line on the growth curve. So if our 4-year-old boy on the 10th percentile line has always been on that line, he is continuing to grow along his pattern, which is a good sign.

What Could Signal a Problem?

A few different growth chart patterns might signal a health problem, such as:

- When a child's weight or height percentile changes from a certain pattern it's been following. For example; If height and weight consistently are on the 60th percentile line until a child is 5 years old, then the height has dropped to the 30th percentile at age 6, that might indicate that there's a growth problem because the child is not following his or her previous growth pattern. Many kids may show changes in growth percentiles at certain points in development, when it's normal for growth rates to vary more from child to child. This is particularly common during infancy and puberty.
- When kids don't get taller at same rate at which they're gaining weight. Let's say a boy's height is in the 40th percentile and his weight is in the 85th percentile. (So he's taller than 40% of kids his age, but weighs more than 85% of kids his age.) That might be a problem. On the other hand, if he's in the 85th percentile for height and weight and follows that pattern consistently over time, that usually means that he's a normal child who's just larger than average.

3.6 SUPPLEMENT FOODS FOR PRE-SCHOOL CHILD

Breastfeeding should be continued till how long? This question is easily answered. Continue until the child can take adequate quantity of regular food. Beyond this continuation of breastfeeding depends on mother's wish and child's nature. Most of mothers in India are housewives and hence we see children being breastfeed till the age of 1 to 3 yrs. Mothers who are working wish to stop breastfeeding early. Start supplementary foods from 7th month onwards. Before that, they are not required but merely serve to replace breast milk, which leads to reduced immunity in the child.

"Don'ts"

- Do not give ready-made food from the market, *e.g.*, tinned foods or biscuits, etc.

- Do not give bottle-feeding.
- Do not satisfy hunger with fruit juices. Do not cook fruits
- Do not give thin rice water or dal (pulses) water. Give as much dense dal which child can drink
- Do not use mixer-grinder to make food thinner
- Do not give tonics to a healthy child.

Points to Remember While Starting Food Supplements:

Give only breast milk until the age of 6 months. Start supplementary foods from 7th month but DO NOT stop breastfeeding. Continue it until 2 years of age. Give nighttime breastfeeds.

When and why?

Around age of 6 to 7 months most of children start playing while breastfeeding, usually during morning. This is the right time to start other foods, when acceptance to it will be high. They breastfeed more avidly in the evening or nighttime. Important thing to remember is to avoid bottle-feeding.

How much and how frequently?

Initially start with 1 to 2 feeds a day and gradually increase to 3 to 4 times a day. Frequency can be 5 times after stopping breastfeeding. 6 to 9 month old child can be fed 2 to 3 time and at 12 month 4 to 5 times.

Suggested Supplementary Foods for Children Aged 4 –7 years

Food group	Serves per day	1 serve
Bread and cereals, rice, pasta and noodles	3 - 4	2 slice of bread OR 1 medium bread roll OR 4/3 cup ready to eat cereal OR 1 cup cooked porridge OR 1 cup cooked rice, pasta or noodles
Fruit	2	1 medium piece of fruit OR 2 small pieces of fruit OR 1 cup diced fruit OR ½ cup fruit juice 1 glass of fruit juice per day is enough. Fresh fruit is best but frozen, canned and dried are also good alternatives

NOTES

Vegetables, legumes	4	½ cup cooked vegetables OR 1 cup salad vegetables OR 1 small potato ½ cup legumes
Meat, fish, poultry, eggs, nuts and legumes	½ - 1	65-100g cooked meat or chicken (2 small chops, ½ cup mince, 2 slices roast meat) OR 80-120g cooked fish OR 1/2 cup legumes OR 40-60g cooked fish OR 2 eggs OR 1/3 cup nuts. For safety reasons never give nuts to children under 5 years of age – always use paste
Dairy Milk, yoghurt, cheese	3	250ml (1 cup) milk OR 250ml (1 cup) custard OR 200g tub yoghurt OR 40g cheese

Extra foods:

These are foods that do not fit into the five food groups. They are not essential to provide the nutrients the body needs. NO more than 1 – 2 extra foods per day for 4 – 7 year olds.

Some examples are:

- 1 (40g) donut
- 4 plain sweet biscuits
- 1 (40g) slice cake
- 1 tablespoon butter, margarine, oil
- 1 (375mL) soft drink
- 1 small packet (30g) potato crisps
- 12 hot chips
- 1½ scoops of ice cream
- 60g jam and honey (1 tablespoon)
- 25g (1 fun size or half a regular)
- chocolate bar

3.7 SCHOOL CHILD

NOTES

Nutritional and health status are powerful influences on a child's learning and on how well a child performs in school. Children who lack certain nutrients in their diet (particularly iron and iodine), or who suffer from protein-energy malnutrition, hunger, parasitic infections or other diseases, do not have the same potential for learning as healthy and well-nourished children. Weak health and poor nutrition among school-age children diminish their cognitive development either through physiological changes or by reducing their ability to participate in learning experiences or both.

Contrary to conventional wisdom, nutritional status does not improve with age. The extra demands on school-age children (to perform chores, for example, or walk long distances to school) create a need for energy that is much greater than that of younger children. Indeed available data indicate high levels of protein-energy malnutrition and short-term hunger among school-age children.

Moreover, deficiencies of critical nutrients such as iodine, vitamin A and iron among the schoolaged are pervasive. It is estimated that 60 million school-age children suffer from iodine deficiency disorders and that another 85 million are at risk for acute respiratory disease and other infections because they are deficient in vitamin A. The number suffering from iron deficiency anemia is greater still – 210 million.

Parasitic worms that infect the intestines or the blood are a major source of disease and malnutrition in school-age children. An estimated 320 million school-age children are infected with roundworm, 233 million with whipworm, and 239 million with hookworm. Schistosomiasis affects an estimated 200 million people throughout the world, approximately 88 million of whom are under 15 years old.

Poor nutrition and health among schoolchildren contributes to the inefficiency of the educational system. Children with diminished cognitive abilities and sensory impairments naturally perform less well and are more likely to repeat grades and to drop out of school than children who are not impaired; they also enroll in school at a later age, if at all, and finish fewer years of schooling. The irregular school attendance of malnourished and unhealthy children is one of the key factors in poor performance. Even temporary hunger, common in children who are not fed before going to school, can have an adverse effect on learning. Children who are hungry have more difficulty concentrating and performing complex tasks, even if otherwise well nourished. Research and program experience shows that improving nutrition and health can lead to better performance, fewer repeated grades and reduced drop out.

NOTES

How School Feeding Programs Can Improve Educational Quality and Efficiency

School feeding programs (SFPs) are one of several interventions that can address some of the nutrition and health problems of school-age children. SFPs, and other school-based nutrition and health programs, can also motivate parents to enroll their children in school and to see that they attend regularly. Experience shows that properly designed and effectively implemented SFPs can:

- Alleviate short-term hunger in malnourished or otherwise well-nourished schoolchildren. This helps to increase the attention and concentration of students producing gains in cognitive function and learning.
- Motivate parents to enroll their children in school and have them attend regularly. When programs effectively reduce absenteeism and increase the duration of schooling, educational outcomes (performance, dropout, and repetition) improve.
- Address specific micronutrient deficiencies in school-age children. Most important of these are iodine and iron, which directly affect cognition. Meeting the iron and iodine needs of school-age children can translate into better school performance.
- Increase community involvement in schools, particularly where programs depend on the community to prepare and serve meals to children. Schools with their communities behind them are more effective than schools with less community involvement.

Alleviate Short-term Hunger and Improve Cognition

The number of hungry school-age children is unknown, but is likely to be a significant problem in various circumstances. Many factors contribute to hunger in schoolchildren : the long distances children have to travel to school, cultural meal practices that include no or small breakfasts or a lack of family time or resources to provide adequate meals to children before and/or during the school day. Simply alleviating this hunger in schoolchildren helps them to perform better in school.

- In Jamaica providing breakfast to primary school students significantly increased attendance and arithmetic scores. The children who benefited most were those who were wasted, stunted, or previously malnourished.
- A US study showed the benefits of providing breakfast to disadvantaged primary school students. Before the start of a school breakfast program, eligible (low-income) children scored significantly lower on achievement testes than those not eligible. Once in the program, however, the test scores of the children participating in the program improved more than the scores

NOTES

of non-participants. The attendance of participating children also improved.

- In Peru 23 malnourished and 29 well-nourished 9 to 11 year old boys were studied to assess the effects of breakfast on cognitive performance. Each boy served as his own control in a manner comparable to the Jamaica study cited above. Breakfast was a nutritionally fortified beverage and a baked grain product fortified with iron, similar to the meal provided in the government-sponsored school breakfast program. A series of cognitive tests were administered in an experimental setting. Speed in performing a short-term memory test and discrimination of geometric patterns were improved under the breakfast condition in both groups. The effect was more pronounced in the nutritionally disadvantaged children.

Increase Enrollments and Imptove Attendance

Children in poor health start school later in life or not at all. A study in Nepal found that the probability of attending school was 5% for stunted children versus 27% for children of normal nutritional status. In Ghana malnourished children entered school at a later age and completed fewer years of school than better nourished children. The number of days that a child attends school is related to cognition and performance . SFPs can have a positive effect on rates of enrollment and attendance.

- A recent evaluation of an on-going school feeding program in Burkina Faso found that school canteens were associated with increased school enrollment, regular attendance, consistently lower repeater rates, lower dropout rates in disadvantaged provinces, and higher success rates on national exams, especially among girls.
- A small pilot school feeding program in Malawi was evaluated for its effect on enrollment and attendance. Over a three month period there was a 5% increase in enrollment and up to 36% improvement in attendance/ absenteeism compared to control schools over the same period.
- Niger has one of the five lowest school enrollment rates in the world; the school feeding program is intended to enhance attendance of nomad and transhumant families, particularly of girls. Beneficiaries receive the equivalent of the total daily recommended food intake (2,079kcal) in three meals per day. In addition, as an incentive for girls' participation in schools, some families receive an additional take-home ration. Evidence from past experience with the SFP shows that it contributes to its objectives: whenever canteens have been closed, even provisionally, immediate and high absenteeism follows and children are withdrawn from school. In areas with nomadic and transhumant populations, the school year cannot commence until food stocks arrive.

NOTES

Although not a school feeding program in the traditional sense, school-based food distribution has also been used successfully to improve enrollment and attendance among school-age children, particularly girls.

- In Bangladesh a program of school-based food distribution increased enrollment by 20% versus a 2% decline in non-participating schools.
- In Pakistan, a program provides an income transfer in the form of one or two tins of oil to families whose girls attend school for 20 days per month. In its pilot phase the oil incentive program demonstrated that it could make a significant contribution to full attendance. In participating schools enrollment improved by 76% compared to 14% in the province overall. Attendance increased from 73% to 95% among participants. The program also claims to put additional food into the hands of mothers and to serve as a contact between mothers and teachers on distribution days.

These food transfer mechanisms do not offer the same potential benefits, for example, meeting short-term hunger and specific nutritional needs, as programs that deliver food directly to beneficiaries. These kinds of programs should therefore be assessed within the context of other food and resource transfer programs.

Address Micronutrient Deficiencies and Improve Learning

Deficiencies of iron and iodine are among the most harmful types of malnutrition with regard to cognition. Iron deficiency renders children listless, inattentive and uninterested in learning. The research literature suggests a causal link between iron deficiency anemia and less than optimal behaviour for learning. Poor performance on a wide range of achievement tests among iron deficient children in school has been consistently documented. Remediation of iron deficiency through supplementation has eliminated the differences in school performance and IQ scores between schoolchildren previously deficient in iron and those without iron deficiencies.

In the case of iodine, most studies have focussed on the differences in cognitive test performance between children who lived in communities with and without endemic goiter. The results show differences in favour of the non-goiter areas. In Sicily, for example, the proportion of children with below-normal cognitive scores was 3% in areas with sufficient iodine, 18.5% in areas where iodine was inadequate, and 19.3% where iodine was inadequate and cretinism was endemic. Studies in Indonesia and Spain have documented similar effects on children in areas with insufficient iodine.

Fortification of school rations is the most efficient and effective route to alleviating micronutrient deficiencies in schoolchildren where SFPs are in operation.

NOTES

- In South Africa, soup fortified with iron and vitamin C was provided to 350 schools in an area of low socio-economic development on the Cape Peninsula. Results showed that initially 12% of six to seven year old and 20% of 8 to 12 year old children had low weight-for-age, and 49% and 31% had low serum ferritin (a measure of iron deficiency) respectively. At follow-up, after 15 weeks of intervention, iron status improved significantly; falling from 49% to 28% in 6 to 7 year old children and 31% to 21% in 8 to 12 year old children.
- A relatively new breakfast program in Peru, which includes an iron-fortified ration, was evaluated for its short-term impact on diet, amongst other factors. The program significantly increased dietary intakes of energy by 25%, protein by 28% and iron by 46%.
- A case-control study of the impact of providing heme-fortified cookies to school children in Chile found higher concentrations of hemoglobin among children receiving the fortified cookies through the school lunch program. The impact was most significant among children with greater demands for iron such as post-menarchial girls and pubertal boys.

Promote Community Participation

Schools that depend on the community to organize and implement SFPs offer certain advantages. These advantages include: increasing the contact, and hence communication, between parents and teachers, officials and others; giving parents the opportunity to become more aware of what goes on at schools; and serving to raise the value of education/the school for parents and the whole community. For example, school canteens are viewed as an important feature of education policy in Morocco. Since 1978 WFP and the government have supported school feeding. The programs have strong government and community support and are viewed as part of a necessary package of inputs for improving education. The feeding program is credited with helping to maintain high enrollment and attendance and encouraging community participation in education. School cooperatives support the school canteens and parents associations assist with the transportation of food aid.

Seven Steps in Developing School Feeding Programs that Improve Education

The research and program literature on SFPs shows the potential that school feeding has to contribute to improving education. These guidelines provide seven recommendations for improving the design and implementation of programs in order to meet some of this potential. The first recommendation, which calls for the establishment of a policy and objectives for school feeding programming,

NOTES

will provide the framework for implementing the subsequent recommendations. These focus on the most critical aspects of school feeding programming including targeting, cost and financing issues, ration composition and meal delivery, program implementation, and monitoring and evaluation, and on the integration of feeding with other interventions that address the nutrition and health needs of schoolchildren.

Specifically, it is recommended that program managers and policy makers:

1. Build a consensus on a policy and objectives that focuses on how school feeding can effectively contribute to improving education and to meeting the nutrition and health needs of school-age children.

Program managers and policy-makers need to agree on what 'problems' or 'situations' the school feeding program will to address, who the program will serve, and which program models are feasible for implementation. School feeding programs are highly visible and as a result often have a significant political dimension, particularly since they can represent a considerable income transfer. This reality should not inhibit establishing a policy and objectives that will take advantage of the substantial potential for improving the impact of SFPs on education.

2. Develop targeting criteria and mechanisms that concentrate program resources on high risk children and communities.

There is a built-in tendency toward universal coverage providing meals for all schoolchildren since all children in school throughout the day will require food. Furthermore, program coverage and targeting is always subject to a series of political, logistical, technical and informational constraints. In view of the fact that resources are finite, particularly in the poorest countries, and that providing food is expensive, targeting is a critical element of any effort to improve the impact of a SFP on education. Targeting is essential if the program is to reach families and communities that lack the resources to adequately provide for their school-age children or those that need to be motivated to enroll their children in school and to have them attend more regularly.

3. Analyze and identify alternative financing and cost options for SFPs.

The cost of school feeding programs is a major issue for both governments and donors. Feeding programs of any kind are expensive. Financing may include international assistance, but in all cases available public resources, or the potential to draw on them, are required. Cost alone can indicate little about the value of a SFP but, unfortunately, cost-effectiveness analyses, which assess costs relative to impact on nutrition and education outcomes are for the most part unavailable. Nonetheless, implementing the recommendations in this guide should help to

ensure that the benefit-side of the program is enhanced while controlling the cost side.

NOTES

4. Elaborate appropriate guidelines for ration composition and the timing of school meals.

To establish appropriate ration guidelines, program managers and policy makers need to analyze the nutrition and health needs of school-age children. Conditions in the education sector, such as levels of school enrollment, attendance, and performance, the availability of infrastructure and the capacity to implement different kinds of SFPs also need to be assessed. Information is also required on the community's perceptions and capacity to participate in school feeding programs.

5. Identify and address any potential bottlenecks in implementation: such as the availability of supplies and other resources, the appropriateness of cooking practices and the management of private sector inputs.

This recommendation is particularly relevant for a program manager who is already operating a program. Once school feeding programs are in place, altering them can meet strong resistance, however, a range of new experiences is now available that has the potential to alleviate some of the common obstacles to efficient and effective programming. Where a school feeding program already exists, a wealth of information is readily accessible; a critical step towards a better program is to thoroughly analyze this on-going experience.

6. Develop monitoring systems that focus on program processes, that is, how a program is functioning, and institute an evaluation system to assess the impact of the program on specific outcomes.

The need to monitor and evaluate programs is not unique to SFPs, but this recommendation is critical to increasing the impact of SFPs. Despite decades of experience there is a dearth of concrete information on the functioning and effectiveness of school feeding programs. This guide provides a general framework for establishing monitoring and evaluation systems for SFPs.

7. Integrate feeding programs with other interventions that address the primary nutrition and health problems of the school-age population.

Last, but by no means least, the past decade has shown the added value of integrating other nutrition and health interventions with feeding. Specifically recommended are deworming, micronutrient fortification or supplementation, and health nutrition and hygiene education.

SCHOOL LUNCH PROGRAMME IN INDIA

Since 1925, supplementary school feeding programmes have been in operation in different parts of India. Midday meal programmes are now provided to poor children on a modest scale in several states. The coverage in 1978 was 13 million children in the country. This is likely to increase by 4 million by the end of 1983. The total cost of both the midday meals programme and the supplementary nutrition programme is estimated to be Rs. 174.5 crores during 1978-83.

There is no uniformly organised system of school meals programme in most of the states. Even in the states where school meals are served, they are restricted to certain districts.

The Government of Tamil Nadu was the first to give momentum to the scheme by coming forward with a substantial grant in 1957, after observing the good results of people's participation and contributions to the midday meals programme in many centres.

This scheme is in operation in all the 34,000 primary schools throughout Tamil Nadu. Over two million children are now being served by this programme, which is the largest in India.

The origin and development of school lunch programme in the different states of India are reviewed below:

Andhra Pradesh (A Case Study)

The midday meal programme was initiated in Andhra Pradesh in August 1962 and included both rural and urban areas. In the urban areas, about 25,000 children attend over 300 primary schools. About 40 to 60 per cent of these children are included as beneficiaries of the school lunch programme. The selection of a school for feeding programme is based on the backwardness or the needs of the area. CARE is assisting the scheme from 1962 onwards with supplies of Corn-Soya Meal (CSM), vegetable oil, beans and milk powder to cover 9,60,000 children throughout the state.

Social Audit of Mid-Day Meal in Andhra Pradesh

Towards increasing community monitoring of the midday meal scheme, a social audit was initiated by the Government of Andhra Pradesh in partnership with civil society organisations, in five districts of the state. Andhra Pradesh is one of the states that immediately responded to the order of the Supreme Court by introducing cooked midday meals in all government and government-aided primary schools and even extended this scheme to children enrolled under the

Education Guarantee Scheme (EGS) and Alternative and Innovative Education (AIE) Centers. About 55 lakh children in primary schools are beneficiaries of the midday meal programme in Andhra Pradesh and Rs.240 crores was allocated by the state towards the MDMS in 2006-07 (Government of Andhra Pradesh, 2007).

In the social audit process initiated by the state government, the M.V.Foundation facilitated the social audit of the Mid-Day Meal Scheme in Adilabad and Kurnool districts. The social audit was conducted in 111 schools during the period January to April 2008. [54 schools in Adilabad (spread over the three mandals of Narnoor, Ichoda and Boath) and 57 schools in Kurnool (spread over the four mandals of Sajamula, Uyyalavada, Halaharvi and Alur).] A team of resource persons was formed in each mandal to mobilise the local community and train them to conduct the social audit. The mandal resource persons conducted the social audit along with a village social audit team in each village. Through an initial gram sabha, the mandal resource persons formed a village social audit team of 5-8 members in each village. The village social audit teams had as members parents of school children, gram panchayat members, local leaders, youth, women's group members etc. The village social audit team members were then given training at the mandal level on the conduct of social audit of the mid day meal scheme. On the whole, 799 village social audit team members (on an average about 7 members in each village) and 40 mandal resource persons (who moved from village to village in teams of two) participated in this process.

The team of resource persons and the village social audit team members visited the school and examined the records related to the midday meal scheme. They observed the mid day meal process, spoke to the cooks, the headmasters, teachers and children. The entries in the official records were compared with actual verification of attendance, rice stock, quality of meal and so on. Further, the provisions made for the midday meal in the form of a kitchen shed, storage space, plates, cooking gas, systems of payment for the cooks etc., were also examined.

At the end of the social audit the team prepared a village social audit report and presented it in a gram sabha. The gram sabhas were specially convened for this purpose by the gram panchayat (usually the sarpanch) on the request of the social audit team. The gram sabha was attended by parents, gram panchayat members, other interested persons of the village and the school headmaster and the cooking agency persons were also called for the gram sabha. On average about 80 – 150 people attended each gram sabha. A detailed report on all the findings of the social audit was reported in the gram sabha.

The community participated very enthusiastically in the gram sabha and in most villages questioned the headmaster and cooking agency when any

discrepancy was revealed. At the same time many positive decisions were also taken, such as immediately shifting the rice from the cook's house to the school, minimising the role of the ration dealer, arranging for water facility in the school, contributing for plates and/or glasses for the children, and in some villages even major decisions such as changing the cooks. Since the community was now aware of the official provisions of the midday meal they also decided to be more vigilant encouraging the social audit team to monitor the mid day meal in a continuous manner.

This section presents the process and findings of the social audit and presents some of the policy recommendations for the improvement in the quality and implementation of the scheme that emerged.

Attendance Verification

The social audit team visited the schools (unannounced) during lunch time and did a physical verification of the number of children eating the mid day meal (headcount). This was then compared with the number that was recorded as having the meal in the attendance register. While on the day of the social audit 6755 children were found to be having the midday meal, the attendance registers showed that 8016 children as eating the midday meal, *i.e.*, 1277 children did not actually eat but were accounted for. On tracking the names of those children who were marked present but were not seen at the mid day meal, it was seen that most were in fact not even present in school. On investigating the reasons for over-reporting of attendance, it was seen that while some of it might have been straight-forward corruption, many explained that they were forced to show higher attendance because of shortage of funds for cooking, anganwadi children eating in the school and so on.

In Akkampalli village, Sanjamula mandal, Kurnool district the team found that on an average while about 70-80 children attend school everyday, attendance was marked for about 100 children and bills for midday meal are presented accordingly. However, it was seen that about 20 anganwadi children eat at the school everyday and they are not shown in any records. Therefore even if the records are wrong, in this case, they are benefiting the community. On the other hand in Bollagutta village, Halaharvi mandal, Kurnool district while on an average only 25-30 children come school, 70-80 children are marked present. Even the rice stock register shows that 9kgs of rice is cooked whereas the headmaster gives only 3-4 kgs to the cook each day. When this was reported in the gram sabha, the headmaster confessed to committing fraud and immediately gave the sarpanch money for 50kgs of rice. This money was put in the school fund account.

Utilisation of Rice

The rice used for the midday meal is provided by the Government of India. The AP Civil Supplies Corporation is the Nodal Agency for lifting the food grains from the Food Corporation of India depots. The AP Civil Supplies Corporation then transports the grain to its own godowns and from there to Fair Price Shops. The implementing agencies (cooks) lift the food grains from the Fair Price shops. Storage of food grains, at the school level, is the responsibility of the Headmaster and the Implementing Agency. The Headmaster certifies the attendance of the children and the quantity of rice utilized (Government of Andhra Pradesh, 2007). In the schools visited it was found that because the rice does not come to the school directly and also due to lack of storage facilities, in many schools the rice was stored at the cook's or dealer's house, with no accountability to the school. Only in about 40% of the schools visited (45 out of 111 schools) was the rice stored in the school.

It was also seen that the headmasters in many schools were not properly monitoring the utilisation of rice. The stock registers were filled out at the end of the month based on prescribed norms without any check on the actual number of children eating or the actual amount of rice cooked. Release orders (ROs) were not available in most schools, stock registers were filled only at the end of the month and rice was not stored in the school; making it almost impossible to verify whether the rice supplied for the midday meal was being properly utilized. However, in many schools the social audit team conducted enquiries by visiting the dealer, the implementing agency (cooks), the school and talking to all concerned, uncovering leakages in the rice supplied for midday meal.

In Puchchakayilapalli village, Uyyalawada mandal, Kurnool district the social audit team found that there was a leakage of 50kgs of rice. The rice was stored with the cooks and they were dealing with it completely. This issue was reported in the gram sabha. The cooks were called and questioned. They confessed that there was indeed a diversion of some of the rice that came for the midday meal. They apologized and asked for a month's time to return the rice. The gram sabha also decided that rice should be stored in the school and the headmaster should monitor its usage. In Dannoor village, Boath mandal, Adilabad district the rice that comes for midday meal is stored in the cook's house. When the social audit team visited the school the headmaster reported that there was a shortage of rice and they had to take rice on loan from the ration dealer to feed the children. However, the social audit team found that ten bags of rice which belonged to the midday meal was in the cook's house. This issue was brought to the gram sabha. It was decided that the ten bags of rice (500 kgs) should be shifted to the school immediately. In Sonala village of the same mandal, it was

found that the dealer takes 10 kg of rice per quintal as a commission for transporting the rice to the school. This was raised in the gram sabha. The dealer, cooks and headmaster attended the gram sabha. It was decided that the headmaster must closely monitor the allocation of rice, and that the dealer should take the responsibility of delivering the rice at the school. For this he cannot take any commission but he can take the empty gunny bags.

In Kokasmannoor, Ichchoda mandal, Adilabad district, the rice is stored at the cook's house. She cooks the same quantity everyday irrespective of the attendance. On the day the social audit team visited the school, there were 115 children, and the register showed that the rice allocated was 13.8kgs, as per the norm. However, it was seen that only 10kgs was cooked on that day and 30 children had to go hungry as the rice was over. When this was discussed in the gram sabha, the headmaster assured the community that he would monitor the midday meal in future.

After the social audit, in many schools, the storage of rice was shifted to the school and the headmaster began monitoring the utilization of rice on a day to day basis.

Implementing Agency/Cooks

The implementing agency in most of the schools is given to a women's self help group (SHG). Usually one or two women took on the responsibility of cooking and the bank account was opened in their name. Although, these women were normally also members of a SHG there was no formal relation between the self help group and the cooking agency as such. In some places, it was also seen that while the agency was in one person's name they had employed another person to do the cooking and were paying him/her a daily or monthly wage. In Narnoor mandal, Adilabad district in all the schools although the agency is in the name of local women, it is completely under the control of the headmaster, who pays the women a wage of Rs. 500 a month. In many schools, such as in Kurnool, the agency was with persons close to those in power, the factional leaders or sarpanchs, making it difficult for the community to monitor them.

In Peddamunnuru village, Uyyalawada mandal, Kurnool district there are two schools and both have the same cooking agency. This agency is with the sarpanch's family and the ration dealer is also related to them. The rice is stored with them and they cook in their own house. Children go and carry food in baskets to the school. Even though there is a kitchen in the school they are not willing to come so far. It was found that there are no vegetables in the meal and eggs are not given. Although this was raised in the gram sabha no action was taken. In Injedi village in the same mandal, the dealership is with the mandal

parishad president's (MPP) family. The ration dealership is also with this family. They have appointed an old man for Rs.1500 per month who does the cooking in the school. The headmaster has no control over the meal and the MPP's family is in control of the rice, the accounts and everything.

The state government states that "SHGs, like the DWCRA, DWCUA, Mahila Mandal Samakhyas and charitable trusts are participating in the implementation, voluntarily. Only conversion costs are allocated to them" (emphasis added) (Government of Andhra Pradesh, 2007). During the social audit it was seen that most of the cooking agencies were given to poor illiterate women for whom this was the main source of livelihood. There was no system of account maintenance by these women although government guidelines state that implementing agencies maintain a cashbook and stock register. They spent some amount on the cooking costs such as pulses, vegetables, oil etc. and saved some for themselves. Many felt that the present allocations were not enough to provide a good quality meal, including eggs twice a week, while also making a decent living for themselves. Little did they know that they were expected to be cooking in the school on a 'voluntary' basis.

Another problem was the delay of about four months in the payment of bills. Because of this the cooking agency had to take a cash loan to buy ingredients for the meal or buy ingredients on credit, sometimes at high interest rates. While the cooking agencies made all arrangements to ensure there is no disruption in the meal, the delay in payment affected the quality of the meal. Since the social audit was conducted only at the village level, the team was not able to analyse the reasons for this delay in payment. While this was reported in the mandal meetings, the MEO blamed higher levels such as the district and the state for the delay. However, what was puzzling was that payments were not uniformly delayed all over, with some places actually making the payments on time.

An important aspect linked to this is the lack of training and guidance to the cooking agency. Neither the cooks nor the headmaster were aware of what the guidelines for the menu were, how the cooking costs was to be allocated among different ingredients and so on. But again, it must be mentioned that the efforts of the cooking agency in not interrupting the meal in spite of great delays in payment cannot be undermined. Many were taking loans, investing from their own pockets just to ensure that children don't go hungry even on a single day.

Infrastructure

A kitchen shed was available in only about 40% of the schools (45 out of 111 schools) visited and only in 19% of the schools (21 out of 111 schools) was the cooking done in the kitchen shed. Even in schools where kitchens were

available, they were of bad quality with poor ventilation. In rest of the schools, the cooking was done either out in the open or in the cook's house. 52% of the schools (58 of 111 schools) had drinking water available in the school premises. In none of the schools were utensils provided by the government. In fact the government policy is that the cooking agency must buy the cooking utensils by investing themselves or taking a loan from the bank (Government of Andhra Pradesh, 2007). This was indeed the case in most schools, while in some someone from the community had donated the utensils. In most schools children were not even provided with plates for the meal.

Children had to go home during lunch time to bring their plates and this wasted a lot of time. In many villages when this was reported in the gram sabha, members of the community came forward to donate plates for the children. In Sarvayapalli village, Uyyalawada mandal, Kurnool district the midday meal was being implemented quite well. The food was very tasty, the children were given vegetables every other day and also bananas and eggs once a week. The only problem was that there were no plates in the school for children. When this came up in the gram sabha the vice-sarpanch immediately donated Rs.1000 for plates for the children. Members of a women's SHG came forward and said they would buy glasses. In some schools such as Thadihatnoor in Adilabad and J'hosalli in Kurnool the community made arrangements in the form of drums or tanks to make drinking water available for children in the school itself.

Quality and Hygiene

The team paid special attention to the quality of the midday meal. Investigations were made into whether children were being served a varied menu, whether the food being given was nutritious including adequate quantities of pulses, oils and vegetables. The issue of whether eggs and fruits were being given was also checked. The opinion of the children on the taste of the meal was also taken. In most of the schools in all the villages, children were only being served rice and either dal or sambar without any vegetables. Providing eggs once or twice a week was also seen in less than 5% of the schools. In schools that provided eggs to children, it was done once in two weeks or once a month. There was no weekly menu followed. In some schools the quality of the meal was so poor that many children did not eat. In Kanala village, Sanjamula mandal, Kurnool district no eggs were given in the last six months. In R'lingamdinne in the same mandal eggs haven't been given in the last three months. In Gunjala village, Narnoor mandal, Adilabad district children reported that they had never been given eggs as part of the midday meal. Same was the case in Narnoor village. In Malepur village in the same mandal half an egg was given once in ten days.

This was discussed thoroughly in the gram sabha. Menus were drawn up with the cooks taking into account the vegetables available locally and their prices. These menus were then displayed in all the schools. In Adilabad, members of the social audit team even took on the responsibility of ensuring that the menu was followed by allocating one member of the team for each day of the week. Alongside the menu for the day, the name of the social audit member who was responsible to monitor this was also painted on the walls.

Further, in most schools there was no organised way of serving the midday meal. Usually the cook sat in one place and served the meal while the children stood in a line with their plates taking turns. Once their plates were filled the children sat in small groups in the open ground and came back individually if they wanted second helping. This system resulted in a lot of food being dropped while the children walked up and down, dirtying the place, and also a lot of mud getting into the food because of all the movement while other children were sitting and eating. In some schools (about 15%), especially in those where the teachers took an active interest in the meal, it was more organised with all the children sitting in a line in the veranda, and cooks serving the meal. In these schools the verandas were also cleaned after the meal, by the cooks.

As mentioned earlier in almost half the schools, there was no access to water in the school. In these schools the cleanliness also suffered because of difficulty in washing plates (children took back dirty plates to wash in their homes or in one case washed in a dirty stream nearby). Issues related to hygiene were also reported in the gram sabha. In Kakaravada village, Uyyalwada mandal, Kurnool district, there is water in the school, but available only if there is current supply. When there is no electricity (which is most of the time), very dirty water is used to clean the plates. The cooking is done at the cook's house because of water problem and the food is brought in open vessels to the school. In Boremunnuru village in the same mandal children eat under trees on mud. There are dogs around. In the gram sabha this was discussed and decided that children should sit in the veranda and eat. There is no water supply, so children drink water from a nearby stream which is very dirty. This was also discussed in the gram sabha but no solution emerged.

Social Discrimination

The midday meal scheme also aims at generating livelihood opportunities for women from vulnerable communities, and at the same time by giving preference to women from backward communities as cooks, it is also a process of breaking caste norms. The Supreme Court order dated 20 April 2004, also states that preference should be given to Dalits, Scheduled Castes and Scheduled Tribes in the appointment of cooks. While in Adilabad 29 (54%) of the cooking

agencies were with those belonging to the ST community, 13 (24%) were with BCs, 8 (15%) with SCs and 4 (7%) with OCs. On the other hand, in Kurnool 39 (68%) of the cooking agencies were given to BCs, 4 (7%) to SCs, 12 (21%) to OCs and 2 (4%) to OCs. There is clearly a violation of the norm of selecting cooks from SC/ST groups.

When the issue of selection of cooks came up in the gram sabha women from the SC communities in many villages reported that they were also willing to cook only if the payments came on time and were sufficient. In the present system where the amounts are not enough to provide a quality meal and the cooks are expected to advance money for ingredients, many SC women felt that they would rather not take on this work. Therefore while there was a resistance to appoint SC cooks initially, the implementation related issues that continue to exist also discourage SC women from taking on the task.

Although in most schools there was no evidence of any caste based discrimination during the serving of the meal, this was seen in a few schools in each district. For instance, in Viripapuram village, Halaharvi mandal, Kurnool district it was seen that children of the Reddy caste were not eating the midday meal in school because the cook belonged to a backward caste. In Halur village, Uyyalawada mandal, Kurnool district about 24 children belonging to the forward caste do not eat the midday meal because the cook belongs to the SC community. Overall, the social audit team found any kind of overt caste discrimination in the serving of midday meals in less than 10% of the schools.

Further, it was seen that more often caste played a role in the form of upper caste children not eating food cooked by lower caste cooks rather than lower caste children being made to sit separately or treated badly during the serving of the meal.

The impression of the social audit teams based on discussions with parents and children was that while initially there were issues related to all children sitting together and eating, over time these had been resolved. In fact, many reported that even those children who did not eat would begin eating if the quality of the meal improved, irrespective of who the cooks were.

In schools where it was noticed that some children were not eating because of reasons related to caste, it was not as if all children of that particular caste were not eating, rather it was only some. Therefore while caste continues to be an issue in different forms, the midday meal scheme seems to have overcome many of the initial differences and is probably moving towards serving one of its important objectives *i.e.*, instilling values of social equality among children.

MID-DAY MEAL IN OTHER STATES

NOTES

BIHAR

Bihar, runs a midday meal scheme for its schools, in which two slices of bread or three biscuits and butter weighing 7 to 15 grams and fruit are provided per child per day. CARE started assisting the midday meal programme in Bihar from the year 1968. The number of beneficiaries covered in 1969 was 6,10,000. The CARE supplements in 1969–70 consisted of 85 g of Balahar/ CSM and 14 g vegetable oil per child per day yielding 425 Kcals and 17.1 g protein.

GOA, DAMAN AND DIU

The school lunch programme was launched in 1965-66. The Department of Education is in charge of implementing this programme. The feeding is being conducted for 200 days in the year. The number of pupils covered in 1979-80 was 21,674 through 317 schools. The food items provided are locally available foods such as biscuits, bread, cake and bananas. 'Thirty paise per child are sanctioned for the food supply.

Total outlay for school lunch programme for the year 1979-80 was 5.4 lakhs.

GUJARAT

The midday meal programme in Gujarat is sponsored by the Department of Education. Children in the age group of 6 to 11 years are fed in the programme. The total number of midday meal centres in Gujarat State is 4,784 and 2,37,000 children are participating in this programme. The cost of a meal per child per day is 18 paise and the non-feeding cost comes to 5.5 ps/child per day. The prepared items such as Uppuma, Sheera, Sukhadi and Vada are served in the school lunch.

HARYANA

The midday meal scheme is Haryana was started in 1961 with the help of CARE and the Department of Education. In 1979–80 the programme covered 4,23,000 children from 3,900 schools. The CARE food distributed consists of 80 grams of grains (soy fortified corn/corn soya meal) and seven grams of oil per beneficiary per day. Through this programme 320 calories and 12 grams of protein are supplemented to each child for a period of 180 days in a year. The total cost of the programme accounted to Rs. 34 lakhs in the year 1979–80.

HIMACHAL PRADESH

In Himachal Pradesh, midday meal scheme has been run by its Directorate of Education. The scheme is in effect from the year 1974–75 with the objective of

NOTES

providing midday meals to the needy and poor school going children who are undernourished, As approved by the Government of India, this scheme is meant for the children belonging to backward classes and Scheduled Castes/Scheduled Tribes and studying in first and second primary classes.

The meal costs 20 paise per child per day. Children are fed for 200 working days in a year. It is run with the help from the District and Block level Education Officers and teachers of the schools. The purchases are made by the District Education Officer for the whole district under his control and then distributed amongst the Block Education Officers, who in turn, transport the material to the selected schools where midday meal is provided to the children through the teachers concerned. This is a hilly area. Due to non-availability of proper transport facilities it is very difficult to provide the materials, well in time.

In spite of the hurdles, the scheme is found to be beneficial to the children. During the period 1979–80, from tribal and other areas 22,500 children constituting 4 percent of the total population of children going to the school benefited by this programme. The financial commitment for the year 1979-80 for this programme was Rs. 9,00,000.

Karnataka

A midday meal scheme was introduced in Bangalore city in 1946 to provide meals consisting of eight ounces of cooked rice and four ounces of curds. It was introduced in the rest of the state in 1957–58 by the state government. The government contributes five paise per child for 24 days in a month, and the school authorities match an equal sum. Preference is given to children coming from distant places. The CARE started assisting the midday meal programme from the year 1964. The number of beneficiaries was 1,62,000 covered during the year 1969. The lunch is served for five days in a week. This programme in villages is supported and directed by the Village School Betterment Committee which included representatives of the village council (Gram Panchayat) as members.

Kerala

The school lunch programme in Kerala was started in 1941. During the year 1961-62, the state had midday meal programme operating in all the schools, departmental and aided, in the entire state. The meals ordinarily consist of rice or wheat kanji with a side dish of pulses or cooked tubers. There is an executive committee for every school or a group of schools to administer the scheme. The non-recurring expenditure was borne by the executive committee, while the recurring expenditure was shared by the community, the state and the central government in the ratio 1: 1: 1.

In 1962-63, this scheme was superseded by the CARE feeding programme which covered 1,70,000 children daily. The CARE feeding consisted of 240 ml of liquid milk prepared from 28 grams of full cream milk powder and 240 ml of water, and uppuma prepared out of 56 grams of cornmeal and 14 g of vegetable oil or alternatively 240 ml of milk made from 28 grams of milk powder and rice flakes with coconut and jaggery. The CARE organization supplies the state under an agreement, 22,000,000, pounds of milk, 43,000,000 pounds of cornmeal and 6,350,000 pounds of vegetable oil. The Education Department of the state has appointed a Special Officer to cooperate with the CARE Kerala Administrator based in Trivandrum. The CARE office is set up to coordinate with the education department. CARE field observers visit schools constantly to review the storage of foods supplied by CARE and to report on the preparation of the commodities entrusted to them by CARE.

The fuel and the condiments necessary must be obtained as local contribution by the Head Master of the school. The state department supplies all the necessary cooking utensils required for the school feeding programme. It also pays the cooking charge incurred at each school. The cooking is done under the supervision of the school. It has been found that the midday meals given to children with the materials supplied by CARE, are four times more nutritious than the gruel supplied by the government in earlier years.

A modified scheme is in operation in Alleppey and Kozhikode districts, in which only children who are in need, or suffer from lack of food are provided with the meals. The cost of the meal is 6 ps per child, 80 percent of which is met by the state government. During the year 1970-71 the number of children covered was 20,84,000.

Lakshadweep

The midday meal scheme was launched in the year 1956 and has been run by the Department of Education of Union Territory of Lakshadweep. The main objective of this programme is mainly to feed all the children of the islands coming under this territory, studying from first to seventh standards. The target number of feeding days is 180 per year. No other agency helps this programme other than the U.T. Department. The children are fed 130 g of rice and curry in the midday meal programme. The meal usually costs around 35 to 50 paise per child per day.

Madhya Pradesh

In the State of Madhya Pradesh, the feeding programme which commenced during the drought period in 1965 continues in the schools in the tribal areas as

NOTES

an important nutritional and attendance stabilization programme. The main aim of the midday meal programme has been to supplement the home food of school children, particularly those belonging to the lower socio-economic classes.

The State Department of Tribal and Harijan Welfare is responsible for implementing the programme. CARE-India assists the State Government by providing the required food commodities free of cost. The state government has the necessary administrative and the fiscal control states over this programme.

Under the programme, a child receives a meal prepared from 80 grams of grains and 7 grams of oil providing 312 calories and 14 grams of protein per day for 180 days in a year. During 1977–78 the Tribal and Harijan Welfare Department (TWD) budgeted Rs. 36,35,000 for this programme. CARE's input was 4,140.64 metric tonnes of food valued at Rs. 13,453,290 to cover 264,322 children. The TWD also budgeted Rs. 14,400,000 for its own indigenous grain input and operational costs to cover an additional 310,857 school children. Thus over the years, the programme has expanded and it now covers 575,179 children in 10,463 schools in 21 districts. In fact, all the accessible Tribal welfare schools in these districts have been covered.

For the storage of the commodities in the state, 40 godowns have been constructed at 38 storage locations with a government grant and CARE assistance. The commodities from these godowns are despatched to 671 pay-centre godowns at the block level. The organiser, headmaster, or a senior teacher collects the allocated nation for his centre. Transport consists mainly of cycle rickshaw, head load, horse back and bullock-cart.

The educational and nutritional benefits of the midday meal programme which have accrued over the years in the Tribal Wel fare primary schools in the 21 districts have been evaluated by a study. Data were collected by interviewing school midday meal programme organisers, the programme participants, and their mothers by seven teams each consisting of a CARE field officer. two female home science or social science graduates and one male medical graduate.

The study has gathered sufficient evidence that the food actually reached the target group and having done so the supplementary feeding has had its desired effect. The meal provided in the school leads to an increase in the intake of food. The children have a better diet on the days they receive food in the school. Additionally, the major portion of the school meal supplements the home food. The home calorie intake of the children is well below the recommended allowance. The school meal given thus help to narrow the gap between the home meal, and the recommended standards.

NOTES

MAHARASHTRA

A free midday meals scheme was started in Bombay in the year 1942 to encourage the attendance of children. The distribution of UNICEF skim milk powder through organised centres had been one of the main items of ameliorative measures for undernourished children below 14 years, and expectant and nursing mothers. In the earlier period, there was prejudice against the use of skim milk powder. With the passage of time, more and more persons particularly, those in charge of charitable institutions and social workers began to accept the measure as practical and beneficial to supplement the inadequate diets usually consumed by the poor.

The Bombay-CARE school feeding programme was inaugurated in February 1963. It covered about 250,000 children in municipal schools daily, involving the distribution of 4,500,000 pounds of milk each year.

At present the school feeding programme in this state is sponsored by the Maharashtra State Rural Development Department and Maharashtra Small Scale Industrial Development Corporation. Through this programme, 2,38,000 children 6 to 11 years of age, are benefiting in the state. CARE supplies sukhadi, corn soya milk, corn soy blend, soy fortified bulgar and salad oil for the programme. Hundred grams of food is supplied per beneficiary per day for 300 days in a year. The feeding cost is 12 ps/child/day.

With the CARE Commodities, the midday meal consists, of a glass of milk and a plate of uppuma, from the daily rations of 2 ounces of cornmeal, 1/2 ounce of oil and an ounce of milk powder per child. It is served for five days in a week. This programme is supported directly by a "Village School Betterment Committee" which includes representatives of the village council (Gram Panchayat) as members.

ORISSA

The school lunch is an integral part of the "Expanded Nutrition Programme" (ENP) in the state of Orissa. The ENP was sponsored in 1959, jointly by the FAO, the WHO, the UNICEF and the Government of India for a two-year period. It included 80 villages during the first year, and 240 villages during the succeeding year in selected National Extension Services (NES) Blocks. The overall objective of the Expanded Nutrition Programme (ENP) was to help the people develop local leadership for promoting activities which would result in the production of an adequate food supply, and a willingness to include the necessary variety of foods in family diets, specially for the vulnerable groups.

The specific objectives of the ENP were (1) increasing village, school and home production of nutritionally valuable foods such as, poultry, eggs, fish, fruits

and vegetables; (2) nutrition education through schools, mothers' clubs, health services, Community Development and National Extension Service Blocks; (3) improvement of the nutritional status of needy, pregnant and nursing women and young children, and (4) training local personnel. For increasing food production, land, seeds, saplings, equipment and technical help were made available for the school gardens free of cost. Pupils were required to look after the gardens as a part of school activities, and the produce was used in the midday meals. Children were encouraged through class room activities to eat the available nutritious foods. During vacations, the gardens were tended by volunteers from the villagers.

School teachers, mukya sevikas, gram sevikas (Home science extension workers), doctors, nurses, social education organisers, and local leaders were trained to participate in the programme. Encouraging results of this programme prompted the sponsoring organisations to initiate similar programmes in the other states under the name, 'Applied Nutrition Programme'.

Student Activity

1. Point out the essential nutrients required for well-being of pre-school childrens.

2. Discuss the importance of school feeding programs.

3.8 THE PRE-ADOLESCENT AND ADOLESCENT

NOTES

Preadolescence is a stage of human development through childhood that occurs in a child's years before adolescence.

The point at which a child becomes an adolescent is usually defined by the onset of puberty. However, in some individuals (particularly females), puberty begins in the preadolescence years, and adolescence may extend a few years beyond the teenage years in others (typically males).

Adolescence is a transitional stage of physical and mental human development that occurs between childhood and adulthood. This transition involves biological (*i.e.*, pubertal), social, and psychological changes, though the biological or physiological ones are the easiest to measure objectively.

Historically, puberty has been heavily associated with teenagers and the onset of adolescent development. In recent years, however, the start of puberty has had somewhat of an increase in preadolescence (particularly females), and adolescence has had an occasional extension beyond the teenage years (typically males). This has made adolescence less simple to discern.

The teenage years are from ages 13 to 19. However, the end of adolescence and the beginning of adulthood varies by country and by function, and furthermore even within a single nation-state or culture there can be different ages at which an individual is considered to be (chronologically and legally) mature enough to be entrusted by society with certain tasks. Such milestones include, but are not limited to, driving a vehicle, having legal sexual relations, serving in the armed forces or on a jury, purchasing and drinking alcohol, voting, entering into contracts, completing certain levels of education, and marrying.

Adolescence is usually accompanied by an increased independence allowed by the parents or legal guardians and less supervision, contrary to the preadolescence stage.

Effect of Poor Nutrition on the Growth Support and Feature of Adulthood

Poor nutrition starts before birth, and generally continues into adolescence and adult life and can span generations.

Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood, and when pregnant, are more likely to deliver low birth-weight babies.

Epidemiological evidence from both developing and industrialized countries now suggests a link between foetal under-nutrition and increased risk of various adult chronic diseases. Nutrition challenges continue throughout the life cycle, particularly for girls and women (Fig. 1).

NOTES

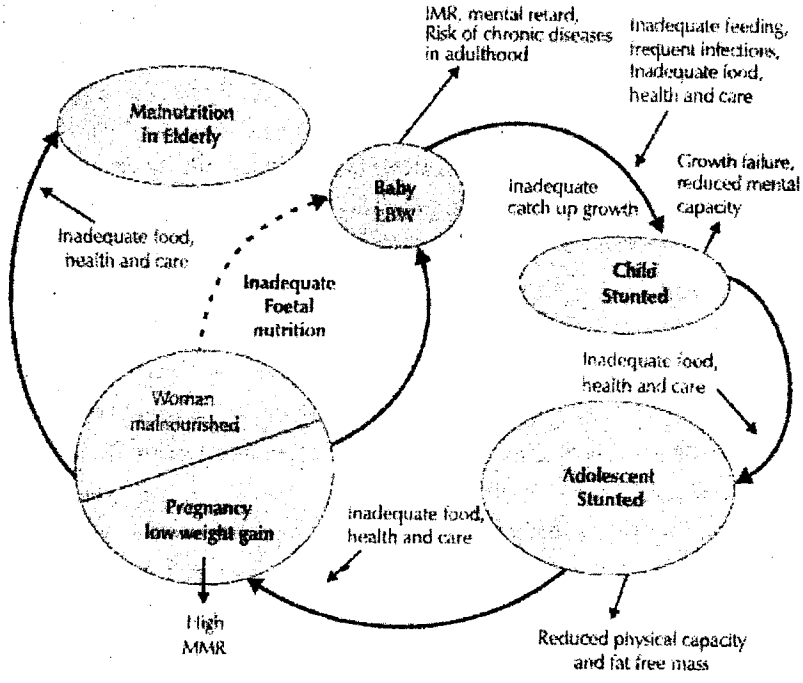


FIGURE 1. NUTRITION THROUGH OUT THE LIFE CYCLE

It is thus imperative to prevent malnutrition at every stage of the life cycle. Investing in nutrition throughout the life cycle will have both short term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity, and increased adult productivity. So far, most of the interventions have either focused on children aged 0-5 years or on pregnant women, and, to some extent on lactating women. However, not much attention has been paid to adolescents by nutrition-related programmes in developing countries. WHO defines adolescence as the segment of life between the ages of 10-19 years. Adolescents are an in between group, with some nutrition problem commonalities with children and some with adults. In addition, there are adolescent-specific issues that call for specific strategies and interventions.

EFFECT OF POOR NUTRITION ON THE GROWTH OF PRE-ADOLESCENT AND ADOLESCENT

During adolescence there is a high incidence of nutritional deficiencies and poor eating habits. This may lead to consequences in later years including

osteoporosis, obesity, hyperlipedemia, sexual maturation delays, and final adult height. In addition, the development of eating disorders is very prominent during this period. Nutritional surveys have incicated that the highest prevalence of nutritional deficiencies occur during adoleschence.

Inappropriate dietary intakes during adolescence can have several consequences. For example, it can :

- potentially retard physical growth, reduce intellectual capacity and delay sexual maturation, as rapid physical growth creates an increased demand for energy and nutrients.
- affect young people's risk for a number of immediate health problems such as iron deficiency, undernutrition, stunting, bone health, eating disorders and obesity (CDC, 1996). It may also affect concentration, learning and school performance in schoolgoing adolescents.
- also have long-term implications. For example, low calcium intake during adolescence is associated with low bone density and an increased risk for osteoporosis later in life; being overweight as an adolescent is associated higher risk for diabetes as an adult; and high fat intake during adolescence and into adulthood is associated with an increased risk of heart disease.

Further, stunting and underweight among girls during adolescence, continuing into adulthood, and early pregnancies, increases the obstetric risk for women. Thus, the compromised nutritional status and poor growth in adolescent years affects the reproductive role.

Increased Nutritional Needs

The physical changes of adolescence have a direct influence on a person's nutritional needs. Teenagers need additional calories , protein , calcium , and iron.

In adolescence, a second period of rapid growth may serve as a window of opportunity for compensating for early childhood growth failure, although the potential for significant catch-up is limited. Adult size, measured by height and weight, also reflects an entire range of physiological measurements that determine work capacity, safety, ease of childbirth and decreased obstetric risk to mother and decreased incidence of low birth weight. Survival itself, for both mother and child is affected by maternal body size. Research evidence suggests that optimal nutrition during the brief period of pre-pubertal growth spurt, some 18 to 24 months immediately preceding menarche, results in catch up growth from nutritional deficits suffered earlier in life.

During adolescence, the relatively uniform growth of childhood is suddenly altered by an increase in the velocity of growth (Fig. 2). The graph shows the

NOTES

height attained and velocity curves of a boy and a girl. Growth is faster than at any other time in the individual's life except the first year. Over 80% of adolescent growth (attained weight and height) is completed in early adolescence (10-15 years), with a marked deceleration in weight and height velocity in the post-pubertal phase. This adolescent growth spurt is also associated with cognitive, emotional and hormonal changes. An important feature is the great variability that exists in the timing and magnitude of the growth spurt both between genders and among individuals. The girl begins her adolescent growth spurt at an average of about 10 years and grows at peak velocity at about 12 years. These ages vary from country to country, being lowest in developed countries and highest in poorest countries. The boy starts his adolescent growth spurt around 12 years of age and in a year or two overtakes the girl. The girl attains her adult height at about 16 years, the boy at 18 years. Adolescents of a given chronological age usually vary widely in physiological development. Because of this variability among individuals, age is a poor indicator of physiological maturity and nutrition needs.

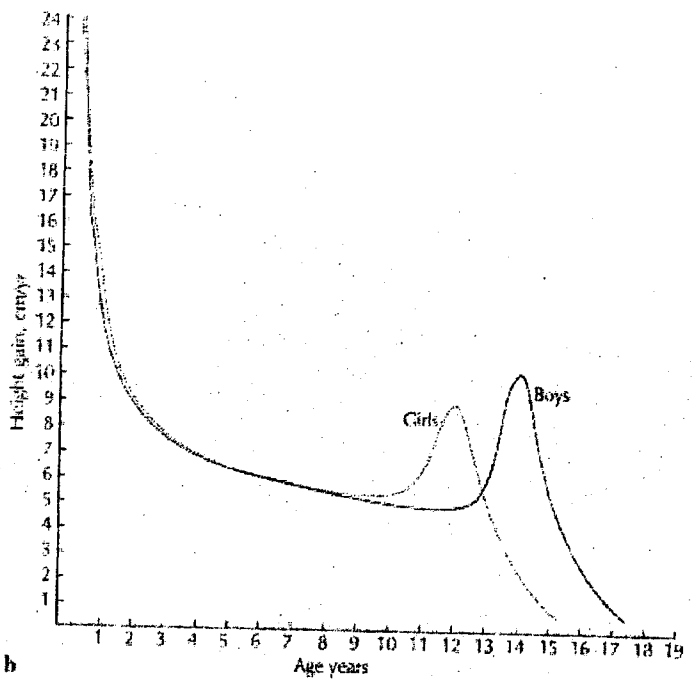


FIGURE 2. VELOCITY CURVE FOR HEIGHT IN BOYS AND GIRLS, FROM BIRTH TO 18 YEARS

The hormones mediating the pubertal growth spurt are sex steroids and growth hormone, which are modulated to a great extent by nutritional factors.

All these changes create special nutrition needs. The requirement of some of the nutrients is as high as, or higher in adolescents than in any other age groups (WHO, 2000), and therefore many micronutrients, including vitamin A, thiamine, riboflavin, niacin, folic acid, vitamin B 12, vitamin C, and iodine, reach levels required by adults.

Adolescence is considered as a nutritionally critical period of life for several reasons.

- Firstly, the dramatic increase in physical growth and development puts greater pressure on the need for nutrients. During this period, adolescents will experience a weight gain equivalent to 65% of their weight at the beginning of the period or 40% of their final weight, and a height gain equivalent to 15% of their adult height.
- Secondly, there may be socio-cultural factors or change of lifestyle and food habits of adolescents that can affect both nutrient intake and needs.
- Thirdly, growing adolescents have increased nutrient requirements during pregnancy and illness.
- Fourth, adolescence can be the second opportunity to catch up growth if environmental conditions, especially in terms of nutrient intake are favourable.
- Finally, psychological changes and development of their own personality can impact on their dietary habits during a phase when they are very influence-able.

The box shows the major changes in height, weight and body composition during adolescence.

Adolescence can be the second opportunity to catch up growth if environmental conditions, especially in terms of nutrient intake, are favourable.

Are Nutritional Needs of Boys and Girls the Same?

The nutritional needs of males and females of the same age differ little in childhood but diverge after the onset of the pubertal growth spurt. After puberty, the differences in nutrient needs persist. The reason for the sex differences in nutrient recommendations after the age of 10 include earlier maturation of females (protein requirements of 11-14 year old girls are higher than the boys of the same age group but are much less for 15-18 year old girls as compared to their male counterparts), and variations in physiological needs for some nutrients by sex *e.g.*, difference in the requirement of iron. Besides differences in height and weight, boys gain proportionately more muscle mass than fat as compared to girls. They experience increased linear growth to produce a heavier skeleton and develop

NOTES

greater red blood cell mass than girls. Girls on the other hand have more fat than muscle tissues. These differences in body composition have important implications for nutritional needs of male and female adolescents.

Changes in height, weight and body composition during adolescence

The time and tempo of changes in height, weight and body composition can vary greatly between and among adolescents.

Changes in height

- 15-20% of adult height is gained during adolescence.
- Growth spurt starts later in boys than girls and has a higher peak velocity than in girls. Linear growth can be slowed or delayed in adolescence if diet is severely restricted in energy or energy expenditure is increased as in highly competitive athletes.

Changes in weight

- 25-50% of final adult ideal weight is gained during adolescence.
- The timing and amount of weight gain can be greatly affected by energy intake and energy expenditure.

Changes in body composition and skeletal mass

- In the pre-pubertal period the proportion of fat and muscle in boys and girls is similar, and lean body mass is equal in both sexes.
- Growing boys gain proportionately more muscle mass than fat, and more lean body mass as compared to girls.
- As adults the normal percentage of body fat is about 23% for women and 15% for men.
- Approximately 45% of skeletal mass is added during adolescence. By the end of the second decade of life, 90% of total bone mass is gained.
- Females with delayed puberty fail to gain bone mass at a normal rate and show lower mineral density as adults. Nutrition is one of the environmental factors that determines onset of puberty.
- The pubertal growth can be monitored by using height-for-age, weight-for-age and body mass index (BMI)-for-age (weight/ height).

Energy and Protein Requirements

Adolescence is an important time for gains in height as well as weight. While both muscle and fat increase, girls gain relatively more fat, and boys gain relatively more muscle. Thus, the requirement of energy as well as proteins increases considerably during this period. Energy and protein needs correlate more closely with the growth pattern than with the chronological age. The peak in energy and

NOTES

protein requirements coincides with the peak in growth of adolescents. Actual needs also vary with physical activity. Therefore, monitoring weight and height and body mass index [BMI (weight/height)] is essential to determine the adequacy of energy intake for individual adolescents. Generally, the requirement of protein is met even in economically disadvantaged populations if caloric intake is sufficient. However, if energy intake is limited, dietary protein may be used to meet energy needs and be unavailable for synthesis of new tissues or for tissue repair. This may result in reduction of growth rate and muscle mass despite an apparent adequate protein intake.

Mineral and Micronutrient Requirements

Minerals play a crucial role in adolescent nutrition. Adolescents, at the peak of their growth velocity, require large quantities of nutrients. The increment in skeletal mass, body size and body density, associated with pubescence, highlights the role of minerals in the growth process. The role of iron, calcium, iodine and zinc in the growth and nutrition of adolescents is explained briefly below.

Iron requirements

Iron requirements peak during adolescence due to rapid growth with sharp increase in lean body mass, blood volume and red cell mass which increases iron needs for myoglobin in muscles and haemoglobin in blood. In boys, there is a sharp increase in the iron requirements from approximately 10 to 15 mg/day. After the growth spurt and sexual maturation, there is a rapid decrease in growth spurt and need for iron. As a result, there is an opportunity to recover from an iron deficiency that might have developed during this peak growth. In girls, however, the growth spurt is not as great, but menstruation typically starts about one year after peak growth and some iron is lost during menstruation. The mean requirement for iron reaches a maximum of approximately 15 mg/day at peak growth but settles to approximately 13 to 15 mg/day because of the need to replace menstrual iron losses.

Iron requirements in adolescence are greater in developing countries because of infectious diseases and parasitic infections that can cause iron loss, and because of low bio-availability of iron from diets.

Other benefits of iron for adolescents: Iron helps in improving cognition which leads to better academic performance that may be an incentive for girls to remain in school.

Calcium requirements

Dietary calcium has been identified as a nutrient of great potential concern for adolescents (Haddad and Johnston, 1999). The adolescent years are a window of opportunity to influence lifelong bone health. Because of the accelerated

muscular, skeletal and endocrine development, calcium needs are greater during puberty and adolescence than in any other population age group except pregnant women *(Spear, 2002)*. At the peak of the growth spurt, the daily deposition of calcium can be twice that of the average between 10 to 20 years. In fact, 45% of the skeletal mass is added during adolescence. By the end of the second decade of life, 90-95% of the total body peak bone mass is attained *(Cadogan et al., 1997)*. Bone mineral content must be maximized during puberty to prevent osteoporosis (risk of fracture in later life).

Low calcium intake in early life may account for as much as 50% of the difference in hip fracture rates in postmenopausal years *(Matkovic et al., 1995)*. Consumption of calcium rich products with every meal goes a long way towards ensuring that requirements are met for calcium and many other nutrients *e.g.*, phosphorus, magnesium and vitamin D needed for bone health *(Weaver et al.,1999, Weaver, 2000)*.

Zinc requirements

Zinc is known to be essential for growth and sexual maturation during puberty. It enhances bone formation and inhibits bone loss. Limited intake of zinc-containing foods may affect physical growth as well as development of secondary sex characteristics.

Iodine requirements

Iodine is important during adolescence for two reasons. These are the high growth velocity of adolescents, and the increased iodine requirements during pregnancy. As a large percentage of adolescent girls get married early and bear children during adolescence, their requirements for iodine increase to provide for their own growth as well as for the needs of the foetus. Severe iodine deficiency in children results in learning disability and lowered achievement. In fact, even moderate iodine deficiency can lead to loss of 10-13 IQ points. Iodine deficiency during pregnancy has been associated with increased incidence of miscarriages, still births, birth defects and mental retardation, and if severe, may result in cretinism in the offspring.

Other minerals

Although the roles of other minerals in the nutrition of adolescents have not been studied extensively, the importance of magnesium, phosphorus, copper, chromium, cobalt and fluoride is well recognized. The possibility of interactions among these nutrients cannot be overlooked.

Vitamins

The requirements for vitamins are also increased during adolescence. Because of higher energy demands, more thiamine, riboflavin and niacin are necessary

for the release of energy from carbohydrates. The increased rate of growth and sexual maturation increases the demand for folic acid and vitamin B-12. With increasing evidence of the role of folic acid in the prevention of birth defects, all adolescent girls of childbearing age should be encouraged to consume the recommended amount of folic acid from supplements in addition to intake of food folate from varied diet. The rapid rate of skeletal growth demands more vitamin D. Vitamins A, C, and E are needed in increased amount for new cell growth. Adolescents' vitamin needs are also associated with the degree of maturity rather than chronological age because of demands of growth.

NOTES

Student Activity

1. Outline the importance of growth chart.

2. Discuss the nutritional requirements of pre-adolescent and adolescent.

EATING AND SNACKING PATTERNS

Adolescents tend to eat differently than they did as children. With after-school activities and active social lives, teens are not always able to sit down for three meals a day. Busy schedules may lead to meal skipping, snacking throughout the day, and more eating away from home. Many teens skip breakfast, for example, but this meal is particularly important for getting enough energy to make it through the day, and it may even lead to better academic performance. When teens skip meals, they are more likely to grab fast food from a restaurant, vending machine, or convenience store. These foods are high in fat and sugar and tend to provide little nutritional value. In addition, eating too many fast foods can lead to weight gain and, in some cases, diabetes and heart disease .

Dietary decisions made in adolescence may have lasting health effects. For example, in the United States, more than 85 percent of teen girls and about 65 percent of teen boys do not include enough calcium in their diets. Such deficiency increases their chances of developing osteoporosis as adults.

Eating meals and snacking away from home puts the responsibility for good food choices right in adolescents' hands. Snacks should be low in both fat and added sugar. Some healthful snack ideas include fresh fruit, sliced vegetables with low-fat dip, low-fat yogurt, low-fat string cheese, peanut butter and crackers, baked chips, granola bars, and graham crackers. Juices, fruit drinks, and sodas are usually very high in calories from natural or added sugar, so they should be consumed in moderation. The Food Guide Pyramid is an appropriate guide for adolescents' food choices, even when snacking.

POTENTIAL NUTRITION-RELATED PROBLEMS

Adolescents are at risk for obesity , obesity-related chronic diseases, and eating disorders.

Obesity, Diabetes, and Heart Disease

All over the world, adolescent obesity is on the rise. This has led to an increase in obesity-related diseases like diabetes and heart disease. Experts believe this rise in obesity is due to lack of physical activity and an increase in the amount of fast food and "junk food" available to adolescents. Staying active and eating foods that are low in fat and sugar promote a healthy weight for teens.

Eating Disorders

Adolescents tend to be very conscious of appearances and may feel pressure to be thin or to look a certain way. Fear of gaining weight may lead to overly restrictive eating habits. Some teens resort to self-induced vomiting or laxative use to control their weight. Both boys and girls are affected by eating disorders.

Teens who suspect they have a problem with body image or eating habits should talk to a trusted adult.

NOTES

High-Risk Groups

Certain groups of adolescents may be at risk for nutritional inadequacies.

Pregnant Teens

When a teenager becomes pregnant, she needs enough nutrients to support both her baby and her own continued growth and physical development. If her nutritional needs are not met, her baby may be born with low birth weight or other health problems. For the best outcome, pregnant teens need to seek prenatal care and nutrition advice early in their pregnancy.

Athletes

Adolescents involved in athletics may feel pressure to be at a particular weight or to perform at a certain level. Some young athletes may be tempted to adopt unhealthful behaviors such as crash dieting, taking supplements to improve performance, or eating unhealthful foods to fulfill their hearty appetites. A balanced nutritional outlook is important for good health and athletic performance.

Vegetarians

A vegetarian diet can be a very healthy option. However, adolescents who follow a vegetarian diet, whether for religious or personal reasons, need to carefully plan their intake to get the protein and minerals they need. Strict vegetarians (those who do not eat eggs or dairy products), also known as vegans , may need nutritional supplements to meet their needs for calcium, vitamin B_{12}, and iron.

3.9 A CASE STUDY OF SOUTH AND SOUTH-EAST ASIAN NATIONS

If adolescents are well nourished, they can make optimal use of their skills, talents and energies today, and be healthy and responsible citizens and parents of healthy babies tomorrow. To accomplish such a task, and in order to break the intergenerational cycle of malnutrition, a special focus for overcoming adolescent malnutrition is needed.

Mortality Levels

Adolescence is generally a period of life free from both childhood diseases and the ravages of ageing. Thus, as in other regions, mortality rates among adolescents in this Region are generally lower than those observed at younger and older ages. Data on mortality rates of adolescents by sex and age group was

available for five countries, Bangladesh, India, Nepal, Sri Lanka and Thailand. An examination of age-specific mortality rates by sex reveals interesting differences across countries of the Region. In Bangladesh and India, mortality rates for females were higher than males in the older age group *i.e.*, in the reproductive years. However, in India the pattern remained the same in the younger age group as well. In Sri Lanka and Thailand, mortality rates for females were less than or equal to that for males in both age groups.

Nutrition and Adolescent Pregnancy: Why are Adolescents at Higher Risk?

Early pregnancy not only focus major health risks for the adolescent girl and her child, but also disrupts the physiological, social and intellectual development of young girls. When the adolescent becomes pregnant, her needs for energy and nutrients may be in direct competition with those of her foetus. The risk of anaemia is greater for girls during pregnancy *(Jolly et al., 2000; Konje et al., 1993)*. Recent research has shown that growth during pregnancy does occur in adolescent females and that it can have negative effects on pregnancy outcome if additional dietary and weight gain allowances are not made.

The risk of LBW and preterm delivery increases among iron-deficient anaemic adolescents. As pregnant adolescents often receive inadequate antenatal care, their anaemia during labour and the postpartum period may be worse than in older women (WHO, 2003). Severe anaemia is an important cause of maternal mortality among adolescents.

Adolescents' Nutrient and Dietary Intake: The Gap

Adolescent growth and development is closely linked to the diet they receive during childhood and adolescence. Adequate nutrition of any individual is determined by two factors. The first is the adequate availability of food in terms of quantity as well as quality, which depends on socio-economic status, food practices, cultural traditions, and allocation of the food. The second factor is the ability to digest, absorb, and utilize the food. This ability can be hampered by infection and by metabolic disorders. Poverty is considered the prime factor determining food consumption; however, some researchers suggest that cultural factors play a stronger role than socio-economic conditions in determining allocation of food and nutritional adequacy. Even where food resources are adequate, the mean caloric intake of individual family members can fall below requirements. The most vulnerable are children under two, and adolescents. In some countries of the Region, gender discrimination plays an important role in intrahousehold food allocation. Because of the preference for sons, girls may receive less food and/or food inferior in quality. In some parts of India, girls' food

consumption is limited for the fear that they will grow too rapidly and will have to be given in marriage soon. An adolescent girl in India may need to observe a series of fasts once or twice a week for getting a good husband. Therefore, girls are probably more exposed than boys to inadequate intakes because of social discrimination, dieting or lower energy intake and pregnancy.

The role of education/literacy of adolescents which empowers them to take care of their nutritional needs has been discussed in the General Information section of this document.

Indian study

An assessment of the current diet and nutritional status of 12,124 adolescents was carried out in villages of 10 states of India in 1996 by the National Nutrition Monitoring Bureau (NNMB), India, and compared with the data of an earlier survey conducted in 1975-79 in the same villages. The average daily food and nutrient intake of different groups were studied and compared with the recommended dietary intake for Indians (RDI, 1981), whereas the average intake of nutrients was compared with the Recommended Dietary Allowances (RDA) for Indians (1990).

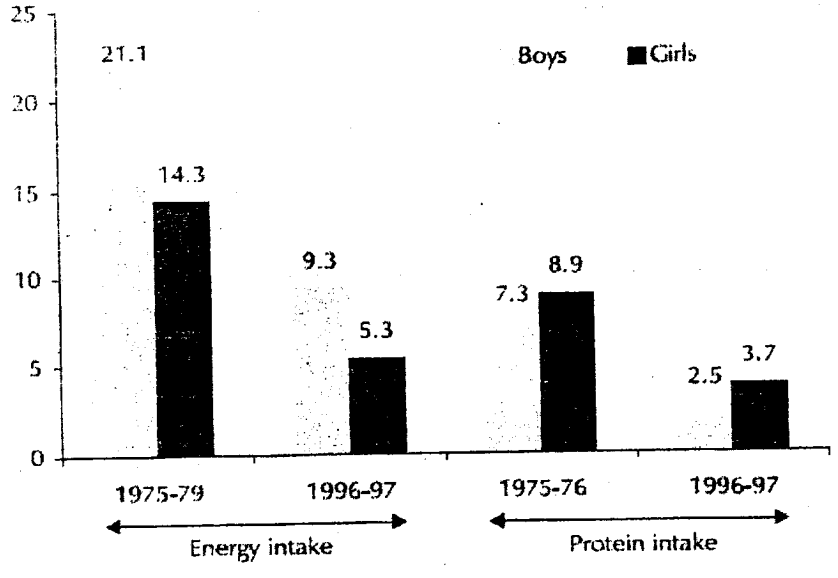


FIGURE 3: PROPORTION OF ADOLESCENTS WITH ENERGY AND PROTEIN INTAKES BELOW 50% OF THE RECOMMENDED DIETARY ALLOWANCE (INDIA)

Source: Vijayraghavan et al., NNMB.2000

The results revealed that intake of most foods, except cereals, millets, roots and tubers, were below the RDI in all ages of adolescence. Consumption of green leafy vegetables, fruits, pulses and milk was grossly inadequate. The mean nutrient intakes were below the RDA in all adolescent age groups irrespective of sex. In both the sexes, the proportion of adolescents consuming inadequate amounts was higher in case of micronutrients *i.e.*, iron and vitamin A than that of protein, energy and total fat.

Almost half of the adolescents of both sexes were not getting even 70% of their daily requirements of energy and a quarter of them were getting less than. 70% of RDA of proteins. However, the extent of severe deficit with respect to energy intake (<50%) decreased from 21% to 9% in boys and 14% to 5% in girls during 1996-97 as compared to 1975-79 *(Fig. 3)*. Similarly, the deficit in protein intake also decreased. Low energy and protein intake by adolescents in India can explain to some extent the high proportion of undernourished and stunted adolescents and adults.

During the periods 1975-79 and 1996-97, the intake of micronutrients, namely iron and vitamin A was very low. More than 75% of adolescents were consuming <50% of RDA of vitamin A, and 41% of boys and 11% girls were getting <50% of RDA of iron *(Fig. 4)*. The extent of decline in case of iron and vitamin A was lower compared to other nutrients. Although the nutrient intakes have improved, the extent of deficit even now is very high and needs intervention.

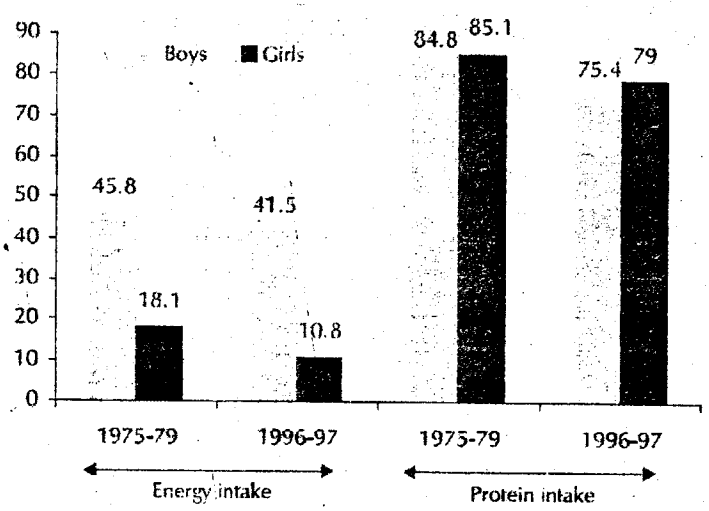


FIGURE 4: PROPORTION OF ADOLESCENTS WITH IRON AND VITAMIN INTAKES BELOW 50% OF THE RECOMMENDED DIETARY ALLOWANCE (INDIA)

Source: Vijayraghdvan et al., NNMB.2000

NOTES

Eating

Adolescent eating is conceptualized as a function of individual and environmental influences. Four levels of influence are described: Individual or intrapersonal [psychosocial, biological]; social environmental or interpersonal [*e.g.*, family and peer]; physical environmental or community settings [*e.g.*, schools, fast food outlets] and macro system or societal [*e.g.*, mass media, marketing and advertising, social and cultural norms]. The search for identity, the struggle for independence and acceptance, and concern about appearance, tend to have a great impact on lifestyle, eating patterns and food intake among adolescents *(Spear, 2002)*. The meal pattern of adolescents becomes more disorganized, and they tend to miss their meals at home as they get older, often skipping breakfast. Some dietary patterns like snacking, usually on energy dense foods, wide use of fast foods that are low in iron, calcium, riboflavin, vitamin A, folic acid and fibres, low consumption of fruits and vegetables and faulty dieting are more common among the adolescents of industrialized countries *(Dennison et al., 1995, Spear, 2000)*. In developing countries also, particularly in cities, some of these patterns are also common, and yet very little has been documented.

Factors influencing food choices of adolescents:

Appeal of food; craze for trendy foods; mood; body image; habit; media and association of food with famous people; convenience foods; food from outside home; peer influence; benefits of food (including health); vegetarian beliefs; parental influence on eating behaviours (including the culture and religion of the family).

Findings from Group Discussion with adolescents at WHO Regional Meeting on "Improvement of Nutritional Status of Adolescents", Chandigarh, India, 16-17 September, 2002

A study in Nepalese schoolchildren showed that fast foods (ready to eat snacks, chips etc.) were preferred by more than two-third of adolescents. Advertising, probably TV and magazines, influenced preferences in 80% of these Nepalese adolescents (Sharma, 1998).

PREVALENCE OF THINNESS (LOW BMI) AND STUNTING

The pubertal growth spurt involves gain in weight as well as height. A prepregnancy weight of about 45 kg and height of 145 cm has been agreed upon as the minimum standard. Research has shown that better-nourished girls have higher pre-menarcheal growth velocities and reach menarche earlier than

undernourished girls, who grow more slowly but for a longer, as menarche is delayed (Kulin et al., 1982). Because underweight girls are growing for longer duration, they may not finish growing before their first pregnancy. In India, for example, up to 67% of girls were classified to be at obstetric risk (by weight and height criteria) in their 15th year as compared with about 20% in their 19th year.

The rate of weight gain during adolescence corresponds to the height spurt. In boys, the peak height velocity coincides with the peak weight velocity. In contrast, peak weight velocity occurs 6 to 9 months before height rate changes in girls (Gong and Heald, 1998). Weight gain during this period accounts for approximately 50% of the ideal adult weight. Because peak weight occurs before the peak height in girls, many parents and teens become concerned about teenage girl's weight. Some girls may try losing weight. Any weight loss during this period may affect ultimate adult height (Spear, 2002). This fact needs to be publicized and girls need counselling to discourage this practice.

Can undernourished children catch up on incomplete childhood growth during adolescence? There is little evidence to suggest that growth retardation suffered in early childhood can be significantly compensated for in adolescence. Some spontaneous catch-up growth in adolescence may be possible in chronically malnourished children since the growing period is thereby extended (Golden, 1994). Studies on effects of adoption show that some catch-up growth may be possible, but is not complete for those who remain in the same adverse environment.

As good diet forms part of an individual's improved environment, care should be taken to focus attention on improvement of their diet. The gained height is beneficial in reduction of obstetric risks in girls, and in improving physical work capacity in adolescent boys.

Stunting: In children and young adolescents, chronic undernutrition leads to stunting. Stunting is defined as height-for-age <3rd percentile of the National Centre for Health Statistics (NCHS) – Annexure 6. In adolescents, chronic undernutrition also delays normal maturation and is an important and widespread problem with multiple adverse health outcomes. Stunting among adolescents is of interest for several reasons. First, a short woman tends to have a small pelvis and, therefore, is more likely to have obstructed labour during childbirth. Second, 25% of an individual's attained height is achieved during adolescence, which marks the end of growth in height and the attainment of adult height.

Thinness: Thinness is of particular interest because it results in poor pregnancy outcomes, in particular low birth weight. Thinness may also limit school achievement and work productivity. Thinness is defined as Body Mass Index (BMI) less than 5th percentile of the NCHS *(Must et al., 1991)* and World

NOTES

Health Organization (1995) reference data. BMI (weight/height) for age was recommended as the best indicator for use in adolescence. It has been validated as an indicator of total body fat at the upper percentiles. However, BMI has not been fully validated as an indicator of thinness or undernutrition in adolescents. Nonetheless, it provides a single index of body mass, applicable at both extremes (Himes and Bouchard, 1989). The relationship between BMI and body fatness is dependent on maturation state, race and gender in children and adolescents. Can NCHS BMI reference data (from adolescents in USA) be used internationally? WHO (1995) recommends that in the absence of other data specifying optimum cut off values of BMI in adolescence, BMI-for-age data for US children may be used until country-specific reference data are available.

Surveys done in rural and urban areas and in schools and communities in the Region show high prevalence of stunting and thinness.

Among four countries of the Region, rural Bangladesh has the highest prevalence of thinness and stunting (67% and 48% respectively) among adolescents. At the same time, the lowest prevalence was observed in school-going girls of urban Bangladesh (16% and 10%). Although stunting was similar in boys and girls, the prevalence of thin boys was more than the girls (75% vs 59%) in rural Bangladesh.

The prevalence of thinness was 32% and stunting was 39% in Myanmar. Both stunting and thinness were more prevalent in the 16-18 years age group (40.6% and 44.1% respectively) as compared to the younger adolescents and were more common in rural areas and among adolescent boys.

Prevalence of Obesity in Adolescence

Adolescents with a BMI above the 85th percentile are at risk for overweight. Weight gain is the result of a positive energy balance (consuming more energy than is expended). Energy expenditure, as assessed through levels of physical activity, declines in children as they reach adolescence, particularly in adolescent girls. There is evidence that children and adolescents of urban families are more overweight than in the past, possibly because of decreased physical activities, sedentary lifestyle, altered eating patterns and increased fat content of the diet. Increase in sedentary activities, such as television viewing and computer games, is suspected to be responsible for the decline in physical activity levels.

Overweight and obesity during adolescence has some immediate consequences, particularly as they relate to body image and self-esteem, and becomes a risk factor for overweight and obesity as an adult. One quarter to one-half of the individuals who are obese in adolescence remain obese in adulthood. However, many factors come into play while predicting adult obesity from adolescent obesity, which includes age of onset, degree of overweight and how long overweight persists in adolescence.

NOTES

There is very little data on obesity in adolescence, particularly in this Region. In the absence of consistent cut-off points and reference values comparisons are also not easy.

Longitudinal tracking studies show that adolescent weight-related risk carries into adult cardiovascular risk. Data from Bogalusa (USA) show that adolescents with a BMI >75th percentile were more than eight times as likely to have hypertension in adulthood as compared with leaner adolescents. Similarly, overweight adolescents, particularly boys, are more likely to have high serum cholesterol and abnormal lipoproteins levels in adulthood. In the Bogalusa Heart Study, 2.4% of the overweight adolescents developed type 2 diabetes by the age of 30 years, whereas none of the normal weight adolescents developed the disease.

A study conducted in India showed the prevalence of obesity in affluent adolescent schoolchildren was 7.4%, and higher in males than in females. The maximum prevalence of obesity was found during the pubertal period (between 10 to 12 years).

Iron Deficiency and Iron Deficiency Anaemia in Adolescents

Adolescents, particularly girls, are especially vulnerable to iron deficiency due to low intake and absorption of iron, and increased iron requirements for growth and replacement of menstrual blood losses. Anaemia can be associated with other nutrient deficiencies (folic acid, vitamin A, B 12), as well as with infectious diseases like malaria, intestinal parasitic infestations, and chronic infections such as HIV.

Mild to moderate iron deficiency, even without anaemia, has adverse functional consequences, although the effects are less obvious. Anaemia has a serious negative impact on growth and development during adolescence, and decreases the ability to concentrate and learn. Iron deficiency was shown to be associated with impaired cognitive processes in adolescents, as suggested by improved performance following supplementation in South-East Asia. Similarly, anaemia was independently associated with lower school achievements in adolescent girls. Iron deficiency decreases energy and physical strength resulting in reduced physical capacity and work performance, both in men and women. Physical performance may be compromised even at mild levels of anaemia. In addition, anaemia in adolescence may also impair the immune response thus making them more prone to infections. A study of Indian children aged 1-14 years indicated that the immune response was significantly depressed in those with haemoglobin concentrations below 10g/dl.

As physical growth slows down in late adolescence, the iron status of boys improves (Dallmon, 1989). Adult men are therefore less at risk of anaemia than women, who lose blood (and as a result, iron) through menstruation.

During adolescence, women's bodies develop and prepare for future childbearing. Low iron stores in young women of reproductive age makes them susceptible to iron deficiency anaemia because dietary intake alone is insufficient in most cases to meet the iron requirements of pregnancy (Beard, 2000). Anaemia in adolescence puts a young woman and her future child at risk of premature birth, low birth weight, and increased peri-natal mortality. Infants born to iron-deficient mothers also have higher prevalence of anaemia in the first six months of life. Maternal mortality is increased in women whose haemoglobin levels fall below 6-7 g/dl.

Vitamin A Deficiency

Vitamin A deficiency affects millions of children in developing countries around the world. The major cause of this deficiency is inadequate dietary intake of vitamin A. Though the risk of severe deficiency declines with age, vitamin A deficiency frequently extends into adolescence and further into early adulthood. Reports have shown that vitamin A deficiency is also prevalent among adults, especially in women of reproductive age (Bloem et al., 1994 and Katz et al., 1995). Studies conducted in different settings in Bangladesh (Ahmed et al., 1996, 1997, 2001) showed that there is a high prevalence of sub-clinical vitamin A deficiency among adolescents.

Adolescent Pregnancy

Teenage mothers bear a double (physiological) burden: one involving their own growth and development, and another involving the intra-uterine growth and development of their offspring. Teenage mothers in India, on the other hand, carry a triple burden – the added (pathological) burden of their under-nutrition and underdevelopment with its inevitable mutually aggravating effect on the other two burdens (Gopalan, 1989). This is probably true in many countries in the Region.

Adolescent females who are considered biologically immature (less than 2 years past menarche) or who are less than 16 years old, may continue to experience linear growth and changes in weight and body composition. They show gains in linear height during pregnancy and accrue additional body fat, almost exclusively during the third trimester, which is the period of most rapid growth by the foetus. These pregnant adolescents deliver infants of lower birth weight than the comparable non-growing adolescents, suggesting that the mother and foetus may compete for energy and nutrients. Calcium status is a particular concern, as the bones of adolescents still require calcium for growth at a time when foetal needs for bone growth are also high. The overlap of the increase in iron requirement due to growth, onset of menses and costs of pregnancy suggests that there is a

limited opportunity to acquire sufficient iron before pregnancy to acquire a storage iron pool of sufficient size to meet the demands of pregnancy. Controlled studies in several sites have shown that adolescent mothers have higher incidence of prematurity, low birth weight and complicated labour (Kurz, 1997, Scholl et al., 1992, Scholl and Hediger, 1994). Poor pregnancy outcomes are more often observed in pregnant adolescents who have poor nutritional and low socio-economic status. Maternal mortality ratios for 15-19 years-olds in Bangladesh are twice as high as those for 20 to 24-years-olds (WHO, 1989). These grave risks are further heightened by the fact that pregnant adolescents are less likely to use antenatal and obstetric services (Scholl et al., 1994). Pregnant adolescents from poor families are at exceptionally higher risk.

The growth pattern of rural and poor girls continues for a longer time than in the well-to-do, and it is the poor rural girls that are married off at a much younger age and have to start their reproductive role much earlier than the well-to-do ones. Furthermore, since menarche is delayed in the poor girls and they grow for a longer time, it is more important that conception is delayed till about the 18th year.

The average age of marriage for women has a significant effect on the teenage birth rate. In rural areas of some countries of this Region, tradition is strongly in favour of early marriage for females. Often, the stress is on marriage soon after the onset of menstruation. About 60% of marriages in Nepal involve adolescent brides (UNFPA, 1998). Table 16 shows that the majority of women marry as adolescents in Bangladesh, India and Nepal. Large surveys have found that almost half of all women aged 20-24 are married by the age of 15 in Bangladesh, as are nearly one-fourth in India (24%) and one-fifth (19%) in Nepal.

In Nepal, the median age at first marriage amongst girls is 16.4 years (Nepal Family Health Survey, 1996). In India, 24% of girls below 18 years are married. Here, among the married adolescent girls, the proportion of girls considered 'at risk' due to short stature (<145 cm) was 24.1% and due to underweight (<38 kg) was 18.6% (NNMB, 2000).

3.10 SUMMARY

- Malnutrition (literally, "bad nutrition") is defined as "inadequate nutrition," and while most people interpret this as undernutrition, falling short of daily nutritional requirements.
- Undernutrition results in a slower rate of growth, more susceptibility to illness, increased risk for lead poisoning and anemia, compromised brain growth, and lack of energy to explore surroundings, play with peers, and be actively involved in learning.

- Adequate total nutrition includes the following nutrients: protein , energy (calories), vitamin A and carotene, vitamin D , vitamin E, vitamin K, thiamine, riboflavin, niacin , vitamin B6, pantothenic acid, biotin , folate , vitamin C, antioxidants , calcium , iron , zinc , selenium, magnesium, and iodine.
- Growth charts are a standard part of any checkup, and they show health care providers how kids are growing compared with other kids of the same age and gender.
- School feeding programs (SFPs) are one of several interventions that can address some of the nutrition and health problems of school-age children. SFPs, and other school-based nutrition and health programs, can also motivate parents to enroll their children in school.
- Adolescence is a transitional stage of physical and mental human development that occurs between childhood and adulthood. This transition involves biological (*i.e.*, pubertal), social, and psychological changes, though the biological or physiological ones are the easiest to measure objectively.
- Adolescents, particularly girls, are especially vulnerable to iron deficiency due to low intake and absorption of iron, and increased iron requirements for growth and replacement of menstrual blood losses. Anaemia can be associated with other nutrient deficiencies (folic acid, vitamin A, B 12), as well as with infectious diseases like malaria, intestinal parasitic infestations, and chronic infections such as HIV.

3.11 GLOSSARY

- **Pre-school child:** A child of ages between 2 and 5 is called the pre-school child.
- **Malnutrition/Undernutrition:** It is refered as bad nutrition, is defined as "inadequate nutrition,".
- **Growth Chart:** It is a part of a checkup, to assess that a kid is growing compared with other kids of the same age.
- **Adolescence:** A child of age group 13-19. it is a transitional stage of physical and mental human development that occurs between childhood and adulthood.

3.12 REVIEW QUESTIONS

1. Name the nutrients essential for pre-school child growth.
2. What is malnutrition? How does it affect child development?

3. Which are those foods to be given as supplement to a pre-school child?
4. Discuss the status of midday meal programm in Andhra Pradesh.
5. Name the important nutrients needed for well-being of adolescent.
6. What is the impact of poor nutrition on adolescent?
7. Outline the status of adolescent in India.

3.13 FURTHER READINGS

- *The Adolescent: Development, Relationships, And Culture* by F. Philip Rice, Published at Allyn & Bacon.
- Rani Reddy, *Dental Anthropology Applications and Methods*, Inter-India Publications, 1985.
- Rhodes, PM, *Sloyburupt genetics*, Tata Mc-Graw hill publications Pvt. Ltd., Vth edition, 1985.
- Roy, RN, *Physiology, Bio-chemistry and Bio-Physics*, Books and Allied, Pvt. Ltd., 1998.

UNIT—IV

THE MIDDLE AGED

NOTES

OBJECTIVES

After going through this unit, students will be able to:

- explain the psychological effects leading degenerative/biochemical changes;
- discuss the participating diseases during middle age;
- describe the health status in the mid-adult years;
- state the dietary modifications during middle age.

STRUCTURE

4.1 Introduction
4.2 Psychological Effects Leading to Degenerative/Biological Changes
– Physical Changes during Adulthood and Aging
– Cognitive Changes during Adulthood Aging
– Psychological Interventions for the Aged
4.3 Health in the Mid-adult Years and Dietary Modifications
4.4 Summary
4.5 Glossary
4.6 Review Questions
4.7 Further Readings

4.1 INTRODUCTION

Between the ages of 35-60, we find vast changes in many areas of our lives. The most obvious changes related to our lifestyle include: physical development and health, career and finances, marraige, and leisure activities. For many, midlife is a time when they start to think about "how much time they have left". Individuals begin to reexamine their lives, their relationships, their work, and even to question the meaning of it all. This process has been referred to as a mid-life crisis. Clearly, middle adulthood is a time change and development.

The middle adult is concerned with forming and guiding the next generation. The middle adult who fails to develop generativity experiences stagnation, or self-absorption, with its associated self-indulgence and invalidism.

NOTES

4.2 PSYCHOLOGICAL EFFECTS LEADING TO DEGENERATIVE/BIOCHEMICAL CHANGES

Middle adulthood is best known for its infamous midlife crisis: a time of reevaluation that leads to questioning long-held beliefs and values. The midlife crisis may also result in a person divorcing his or her spouse, changing jobs, or moving from the city to the suburbs. Typically beginning in the early or mid-40s, the crisis often occurs in response to a sense of mortality, as middle adults realize that their youth is limited and that they have not accomplished all of their desired goals in life. Of course, not everyone experiences stress or upset during middle age; instead they may simply undergo a midlife transition, or change, rather than the emotional upheaval of a midlife crisis. Other middle adults prefer to reframe their experience by thinking of themselves as being in the prime of their lives rather than in their declining years.

During the male midlife crisis, men may try to reassert their masculinity by engaging in more youthful male behaviors, such as dressing in trendy clothes, taking up activities like scuba diving, motorcycling, or skydiving.

During the female midlife crisis, women may try to reassert their femininity by dressing in youthful styles, having cosmetic surgery, or becoming more socially active. Some middle adult women try to look as young as their young adult children by dying their hair and wearing more youthful clothing. Such actions may be a response to feelings of isolation, loneliness, inferiority, uselessness, nonassertion, or unattractiveness.

Middle-aged men may experience a declining interest in sexuality during and following their male climacteric (male menopause). Fears of losing their sexual ability have led many men to leave their wives for younger women to prove to others (and to themselves) that they are still sexually capable and desirable. In contrast, middle-aged women may experience an increasing interest in sexuality, which can cause problems in their primary relationship if their significant other loses interest in sexual activity. This leads some middle-aged women to have extramarital affairs, sometimes with younger sexual partners.

The field of life-span development seems to be moving away from a normative-crisis model to a timing-of-events model to explain such events as the midlife transition and the midlife crisis. The former model describes psychosocial tasks as occurring in a definite age-related sequence, while the latter describes tasks as occurring in response to particular life events and their timing. In other words, whereas the normative-crisis model defines the midlife transition as occurring exactly between ages 40 and 45, the timing-of-events model defines it as occurring when the person begins the process of questioning life desires, values, goals, and accomplishments.

NOTES

It is believed that most of the development ends with adolescence. Only wisdom continues to grow during adulthood. However, there are many specific development tasks during adulthood and old age requiring the grown up to engage in specific development and make special adjustments in life. In this respect the perspectives given by Havighurst and Levison are quite relevant.

Box 1: Havighurst's Development Tasks

Early Adulthood:

Selecting a mate, Learning to live with a married partner, Starting a family, Rearing children, Managing a home, Getting started in an occupation, Taking on civic responsibility and Finding a congenial social group

Middle Age:

Achieving adult civic and social responsibility, Establishing and maintaining an economic standard of living, Assisting teenage children to become responsible and happy adults, Developing adult leisuretime activities, Relating to one's spouse as a person, Accepting and adjusting to the physiological changes of middle age and Adjusting to aging parents

Old Age:

Adjusting to decreasing strength and health, Adjusting to retirement and reduced income, Adjusting to death of spouse, Establishing an explicit affiliation with members of one's own age group, Meeting social and civic obligations and Establishing satisfactory physical living arrangements.

Havighurst's developmental tasks are based on life situations. Another psychological perspective is that of Daniel Levinson who derived his data from clinical studies of men only. Levinson's stages are described in Box 2.

Box 2: Levinson's Stages

Leaving the family (20-24): A transitional period from adolescence to early adulthood that involves moving out of the family home and establishing psychological distance from the family, analogous to Erikson's stage of identity versus role diffusion.

Getting into the adult world (early 20s to 27-29): A time of exploration and provisional commitment to adult roles in occupational and interpersonal areas and of fashioning an initial "life structure".

Settling down (early 30s to early 40s): A period of deeper commitment, sometimes involving the expansion motif of Jung and Kuhlen.

Becoming one's own man (35-39): The high point to early adulthood.

The midlife transition (early 40s) : A developmental transition involving a sense of bodily decline and a vivid recognition of one's mortality, as well as an integration of the feminine aspects of the self as postulated by Jung.

Restabilization and the beginning of middle adulthood (middle 40s): A period in which some men make new creative strides but other lose their vitality.

If you look at the developmental tasks and also Levinson's analysis of stages of adult development, you can realize that the specific development tasks are related to the different social demands on a person at different stages of life. The need to take up an occupation or to enter into a marital relationship during early adulthood, for example, may be seen as leading to developmental tasks and challenges of seeking and succeeding in an occupational role or selecting a life partner in marriage.

The social demands of different stages of life and hence, the developmental tasks depend on the nature of the society and the cultural norms. In Indian joint family system, for example, the nature of marriage and mate selection are different and, therefore, the nature of developmental tasks are also different from what has been observed by Levinson or by Havinghurst. Similarly, moving out from the family home is a common feature of western societies or modern urban industrial economies. As such, the processes and problems of development during adulthood and old age are specific to the social context of the grown ups.

THE PERIOD OF ADULTHOOD

Young adulthood: The period of young adulthood begins from the age of twenty years onward. The major concerns of young adults in 20s are to establish themselves in life, job, and family. The young adult wants to seek social and economic security in preparing for a role of greater independence and responsibility in society.

Middle Age: From the period of his twenties and thirties, the individual arrives at middle age in the forties and fifties. Middle age is characterized by competence, maturity, responsibility and stability. These are the important characteristics for middle-aged adults. This is the time when one wants to enjoy the success of job, satisfaction derived from family and social life. The individual looks forward to the successes of children. Attention gets more focussed on health, the fate of children, aging parents, use of leisure time and plans for old age. For women, menopause occurs between the age of forty-five and fifty. Menopause is sometimes accompanied by some distressing physical and psychological symptoms in women. Men during this period show greater amount of concern towards their health, strength, power, and sexual potency.

Old Age: The period of old age begins at the age of sixty. At this age most individuals retire from their jobs formally. They begin to develop some concern and occasional anxiety over their physical and psychological health. In our society, the elderly are typically perceived as not so active, deteriorating intellectually, narrow-minded and attaching new significance to religion. Many of the old people lose their spouses and because of which they may suffer from emotional insecurity.

'Nobody has ever died of old age', is a true statement. Since old age is close to the end point of life, death has been associated with old age. Death is actually caused by disease, pollution, stress, and other factors acting on the body. In the biological sense, some organs and systems of the body may start deteriorating. In the psychological sense, there may be measurable changes in the cognitive and perceptual abilities. There are also changes in the way a person feels about him/herself.

You must have come across old people who are very active in life and socially very particiaptive. Such persons seem to be productive and stable and happy. Mental or physical decline does not necessarily have to occur. Persons can remain vigorous, active, and dignified until their eighties or even nineties. In fact, the older persons have vast reservoir of knowledge, experience, and wisdom on which the community can draw. In view of increase in life expectancy increasingly greater proportion of society is joining the group of aged people. Hence they need greater attention in national planning and making them feel as an integral part of society.

Physical Changes during Adulthood and Aging

Normally people see old age as a period of decline in physical and mental health. This section deals with physical and psychological aspects of aging. With advancing age, there are certain inevitable and universal changes such as chemical changes in cells, or gradual loss of adaptive reserve capacity. There are also certain cognitive changes taking place from middle adulthood onwards. These changes are slow and gradual. They become more prominent among the elderly people.

(a) Physical Changes

It has been found that the organ system of most persons show a 0.8 to 1 percent decline per year in functional ability after the age of 30. Some of this decline is normal, some is disease related and some are caused by factors such as stress, occupational status, nutritional status and various environmental factors.

Major physical changes with ageing are described as :

(1) external changes

(2) internal changes, and

(3) changes in sensory capacities.

1. External Changes

External changes refer to the outward symptoms of growing old. The more observable changes are those associated with the skin, hair, teeth, and general posture.

There are changes in the skin. The most pronounced change is wrinkling. Wrinkling process begins during middle years. Skin also becomes thick, hard and less elastic. It becomes brittle and dry.

With advancing age, the hair of the person continues to turn white and loses its luster. It continues to thin. By the age of fifty-five, about 65 percent of men become bald.

It is estimated that at age 65, fifty percent people have lost all their teeth. For many, dentures become a way of life. Over the time, the production of saliva is diminished. This increases the risk of tooth decay.

Physical strength begins to decline from age 30 to age 80 and above. Most weakening occurs in the back and leg muscles, less in the arm muscles. There is a progressive decline in energy production. Bones become increasingly brittle and tend to break easily. Calcium deposits and disease of the joints increase with age.

Muscle tissue decreases in size and strength. Muscle tone becomes increasingly difficult to maintain with age because of an increase in fatty substance within the muscle fibres. This is often caused by the relative inactive role thrust on the elderly in our society. Exercise can help maintain power and sometimes even restore strength to the unused muscles. Changes in the general posture become more evident in old age.

The loss of teeth, balding and greying of the hair, wrinkling of the skin, and lack of physical strength all have a potentially negative effect on an individual's self-concept and confidence.

2. Internal Changes

Internal changes refer to the symptoms of growing old that are not visible or obvious. We shall examine some of the changes taking place with increasing age in the respiratory system, gastrointestinal system, cardiovascular system, and central nervous system.

The Respiratory System: With increasing age, there is reduction in breathing efficiency. The lungs of an old person do not expand to take in as much air as the lungs of a young person. Decreased oxygen supply makes the old person less active, less aware and less strong. This decline seems to be part of normal aging process.

The Gastrointestinal System : With increasing age there is decreased capacity for biting and chewing, decrease in the production of digestive enzymes, decreased gastric and intestinal mobility and lack of appetite.

The Cardiovascular System: Cardiovascular system which includes the heart and the blood vessels show the effects of normal aging rather slowly. With the aging process there is a decrease in the elasticity of blood vessels and blood cell production also. Increase-in time required for heart to return to rest and arterial resistance to the passage of blood is also found. Many old individuals are found to be suffering from high blood pressure. However, healthy old individuals are found to have blood pressure similar to those of young healthy indiciduals.

The Central Nervous System (CNS) : The CNS shows certain universal changes as a function of age. There is decreasing rate of arterial and venous flow. Beginning at about age 60, there is a reduction of cerebral blood flow. There is also a decline in oxygen and glucose consumption. Number of cells and cell endings are found to be decreasing. The most definite change is the slowing down of responses.

3. ***Changes in Sensory Capacities***

With advancing age, there is gradual slow down in the sensory abilities. We communicate with the outer world through our senses. Losses in any senses can have profound psychological consequences.

Vision: Increasing age brings in several problems in vision. The lens continues to lose elasticity. The pupils become smaller, irregular in shape. The eyelids have a tendency to sag. Colour vision becomes less efficient. Cataract and glaucoma are commonly found among the elderly. People with cataracts have blurred vision. This also interferes with normal vision.

Hearing: Hearing seems to be at best around the age 20. From then onwards there is a gradual decline. Most hearing loss is not noticed. However, in the case of hearing problem, it can be improved by a hearing aid.

Other senses: The senses of taste and smell decline with old age. This decline affects appetite and nutritional requirements of the elderly. You must have noticed that many old persons demand food that is overly sweet or spicy. This is because the four basic tastes, sweet, bitter, sour, and salty, all generally diminish in sensitivity. Sensitivity to touch appears to increase from birth to about 45 and then decreases sharply.

Cognitive Changes during Adulthood and Aging

The term 'Cognition' refers to the processes by which information is acquired, stored, and used. In this section, four major aspect of cognition-memory, learning, attention and intelligence will be discussed in relation to adulthood and aging.

(a) Memory

Memory is one of the most central aspects of cognition. Memory has been defined as 'the mental processes of retaining information for later use and retrieving such information'.

No significant age differences may be found in short-term memory task like forward digit span or word span. Older subjects do not perform as well on the tasks that demand repeating numbers in reverse order. Old persons are found to perform poorer than young ones on long-term memory tasks which require processing of information and organization of material.

(b) Memory of the Elderly

Memory performance with advanced age is affected by several factors. Some of the important factors are given below.

(i) Beliefs about Memory

Old persons' beliefs and attitudes about their memory ability affect their memory performance. Research shows the role of beliefs, perceptions, attitudes, and knowledge in memory abilities. Questionnaires typically ask respondents how frequently they forget names and events, how anxious they are about forgetting, what they know about how to improve memory and what strategies they employ in remembering. Older adults have been found to have more difficulties with their memory than do younger adults. The common expression among elderly has been 'I am getting old'. Elderly persons are often found to be complaining about their memory failures.

(ii) Use of Memory Strategies

Memory requires the use of strategies. Memory performance would be better for those who can use effective memory strategies. An example of memory strategy is repeating to yourself over and over again the items you want to buy is connected with something that is familiar. For example, if you want to remember the name of somebody, you may associate that person with some popular figure. You can also use memory aids such as a diary or writing out a list of items you want to buy at the grocery store. Most of us use some such strategies every now and then but we are not aware of using them. In their everyday lives, the elderly persons are more likely to use diaries, making lists of things to buy, etc., than using rehearsal or association strategy.

(iii) Life Styles of Elderly

The type of daily activities in which elderly persons engage determines their memory performance. The elderly persons who engage in daily activities like playing chess or bridge, their performance on some of the memory and reasoning tasks is found to be better than elderly non-players. Another aspect of

lifestyle determining cognitive performance is regularity in the structure of daily life. Regularity of sleep patterns, daily exercise, following regular schedule of every day activities helps to maintain everyday cognitive functioning.

c. Learning

Learning involves formation of new association. It means acquisition of general rules and knowledge about the world. It is believed that learning performance tends to be poorer during late than early adulthood. Can older people acquire new information and skills? Can they try new careers? Such questions are difficult to answer. We must note that the ability to learn may be relatively unchanged in old persons. Factors such as poor motivation, lack of confidence, test anxiety, etc. may lower performance on learning tasks.

Old persons' learning performance may be very close to that of young persons if older persons are allowed more time or can self-pace the tests. They were found to perform better when there is no time pressure and the material is presented very distinctly and in a simplified manner.

d. Attention

The term attention refers to the manner in which we focus on what we are doing. People vary in how wide their attention span is. If attention span is too narrow, one looses a lot of information. Old people may not differ from young people in terms of their attention span as such. However, they get easily distracted by any kind of interference. With training, attention can be improved.

e. Intelligence

As has been pointed out earlier many of our impressions of old age originate from inaccurate knowledge or misconceptions. How do elderly persons perform on intelligence test? Most of the intelligence tests require speed of performance. We have already discussed that old persons are slower on reaction time. Thus lower performance on intelligence tests may be due to slower reaction time than due to a decline in intellectual functions. General knowledge does not decline with age. Among the elderly, we often find reduced abilities for complex decision making and slowing of performance. Hardly any losses in verbal comprehension, social awareness and the application of experience may be noticed among the older people.

Intelligence in adulthood and aging may be viewed as enabling the individual to cope with a variety of demanding everyday tasks and events. Everyday intelligence of the elderly maybe determined by their ability in reading road maps, understanding labels, filling out forms, understanding charts, conversations, TV programmes, doing shopping, driving during rush hours, and performing many other daily jobs.

You may remember that we have already discussed that elderly work best when they are away from pressure and can set their own pace. Moreover, the factor of general health is very important to be considered. Healthy individuals and those who lead happy and active life generally show no or little loss of intellectual abilities during old age.

Problems of Adjustment in Old Age

How does one adjust to the aging process? Different people adopt different coping strategies to adjust with their current life situations. Some aged people try to remain very active by engaging themselves in social roles, enjoy interpersonal relationships and happily participate in some type of occupational activities while others tend to remain socially isolated and withdrawn. The level of activity and nature of engagement is determined by health status, socio-economic status and family status of the elderly. Let us study about some of the related problems.

A. Poor Image Problems faced by Older People

Older people in general do not like themselves as much as younger people. Older men are generally found to have lower self-esteem than older women. This may be due to the fact that men's self-esteem is related to their occupational achievement while women tend to derive their feelings of self-worth from family circumstances. Thus when men retire in old age or loose their occupational status, their self-esteem goes down. Women, on the other hand, continue to derive self-satisfaction by their family involvements.

B. Happiness

When asked "Is your life exciting?" majority of elderly men and women report that they hardly had any feeling of excitement in their lives and that their life is very dull with nothing to look forward to. However, before we conclude that life gets duller as one goes along, we need to consider many factors towards one's own self as an old person and kind of expectations from life.

C. Economical Problems

Self-employed elderly persons or those having their family business continue to work until they die or became disabled. Those who work for others retire after a certain age. Individual's personal attitude toward retirement varies as a function of a number of factors such as income, educational level, and occupational level.

Adjustment to retirement is often difficult for individuals. Retirement requires adjustment to a new life-style characterized by decreased income, lesser activity level, and increased free time. Retirement causes extreme stress in males because in our society a significant part of men's identity depends on their jobs. Loss of job thus results in loss of self–esteem and self-worth. Retired people find

it difficult to adjust to retirement because of financial problems, illness, and feelings of loneliness. Retired individuals have to make several adjustments in their roles, personal and social associations, and in their sense of accomplishment and productivity. However, it does not necessarily mean that retirement results in negative consequences for every body. In case of some, it may not have any adverse effects on their self-esteem and life satisfaction. Health may even improve for some after retirement. Retired individuals may find more time for social and hobby-related activities especially if they have adequate economic resources and are healthy to engage in these activities.

D. Death

Elderly persons are not afraid of death per se. They do, however, fear to a great extent the dying process — the process of dying in pain or dying alone. Their feelings related to death may be due to specific occurrences in their lives such as being moved from home to nursing home, failing health, or the loss of one's spouse. Thus fear about death must be understood in light of current life circumstances, the individual's own value system, and what death personally means to a person.

E. Depression

Older persons often show two major symptoms of depression : depressive mood (sadness, guilt, hoplessness, helplessness) and reduced behaviour (giving up, apathy). Many elderly persons also represent their depression somatically by complaints (such as loss of appetite, sleep disturbances). Both biological factors (biochemical disturbances) and social/cultural factors (cultural views regarding the worth of the aged person, isolation, retirement, institutionalization) can contribute to depression in aged persons. Other factors such as perceived loss of sexuality, material possessions, and failures also contribute to depression.

Coping with the Problems

How does one cope with increasing age? Different people adopt different coping strategies to meet their life challenges. Some of the effective coping strategies may be summarized as follows:

(1) The elderly need to develop an attitude of flexibility so that they may adapt to life's pressures and problems of old age.

(2) They need to recognize that they have to explore new ways of coping with their life events.

(3) The elderly need to make greater use of information seeking and of problem solving rather than withdrawing or isolating.

(4) Increasing one's self-confidence, self reliance, developing healthy attitude about one's strengths and weaknesses, learning and maintaining effective

NOTES

coping skills and adopting an active approach toward the environment are some of the important ways of making healthy adjustments in old age.

(5) Enlarging social networks is another way of coping with life problems. Participating in various group activities such as joining clubs and certain organizations for informal social interaction is very helpful for the aged. Building a social network of people of their own age group in the neighbourhood or elsewhere provides them with greater opportunity to share their life circumstances and find emotional expression to their existing problems. Through such social networks, one can get an unconditional expression of approval, share secrets, provide new experiences to each other, and develop trusting relationships.

(6) Involvement in grand parenting helps elderly satisfy many of their personal and emotional needs. Grandparents can serve as important role models. Old people find these roles emotionally self fulfilling and tend to derive selfsatisfaction through achievement of their grandchildren.

Psychological Interventions for the Aged

All of us need to turn to others (friends, relatives, professionals) for help in times of severe stress. In this section we will examine what kinds of psychological interventions can be used for dealing with difficulties of elderly and enabling them to cope with life on a daily basis.

Our chief concern with elderly can be improving their quality of life. The attempt needs to be in the direction of building adaptive resources. The most important goals of psychological interventions are:

1. Insight into one's behaviour
2. Anxiety or depression relief
3. Adaptation to a present situation
4. Improving self-care skills
5. Encouraging activity
6. Facilitating independence
7. Accepting one's weakness and difficulties
8. Improving interpersonal relationships

There are several psychological interventions which are needed for the aged and have proved to be very useful. Some of the important ones are described below:

A. Seeking Help through Mental Health Services

Old persons can be provided help from professionals or from family, friends or neighbours to solve their personal or social problems. Many of their problems may be solved by joint family members. Depending on their resources, elderly

need to seek professional help for their personal and family matters. Counselling psychologists can help people prepare for and cope with potentially stressful life events like retirement, death of spouse and financial insecurity. They can be motivated to have an active orientation toward oneself and the world and to keep their options open.

B. Cognitive Behavioural Interventions

Elderly persons seem to be lacking realistic feedback about themselves from others, and thus make 'thinking errors'. Feelings of inadequacy about one self can lead to fear, anger, frustration and depression. Cognitive therapy is very effective in substituting irrational thoughts with rational thoughts. Relaxation training helps reducing anxiety and tension. Cognitive-behavioural interventions have been found to be useful in treating depression, anxiety, memory loss, and response speed in the aged.

C. Behavioural Interventions

Behavioural interventions are based on positive and negative reinforcing stimuli. Elderly persons for example can be given positive reinforcement such as verbal or material reward for the desired self-care behaviour and negative reinforcement (depriving of reward) for the undesirable aggressive behaviour. It is relatively brief and economical. However, it requires a great deal of expertise to use effectively.

D. Family Therapy

Family therapy aids in adjustment to various life problems such as retirement, family care giving role, grandparenthood, family conflicts between young and the aged, coping with illness of elderly, and family decision about institutionalization of the elderly people. If properly handled, family therapy can strengthen the feelings of love, closeness and interdependence.

E. Societal Intervention

In addition to changing the individual, we might like to change the environment or the context in which a person functions. Attention needs to be paid to home environment, activity programmes, as well as to neighbourhood and community in which the person lives. Societal intervention would involve altering attitudes towards the aged and increasing the older person's reliance on the community, family, and friends.

Adulthood and Other Associated Issues

One of the major aspects of middle adulthood are the physical and biological changes that occur in the body. Two of the most noticeable changes are seeing and hearing. Each of these begin to decline in the middle years. One of the physical

NOTES

changes that occur is in height. Most individuals get a little shorter through the years. Also, hair is graying, skin is wrinkling, bodies are sagging, and teeth are yellowing. Some adults strive to make themselves look younger by having plastic surgery, dying their hair, wearing wigs, joining excercise programs, or taking heavy vitamin doses.

While the adult years are generally a time of vitality and good health, their are health concerns. The main health problems of middle adulthood are cardiovascular disease, cancer, and menopause. Another major problem that effects health and behavior is stress. Overall this is a time of major change and development physically and mentally.

Career and Finances

During the middle adult years there is a noticable change in how adults view their careers. By this time most individuals have settled into their careers and between the ages of 40-45 have ceased to advance up the career ladder. In general, job satisfaction and commitment tend to be high and continue to increase into our sixties.

It is also at this time that adults adjust their idalistic hopes to realistic possibilities. This adjustment to attainable goals is dependent on how much time is left before retirement, with retirement planning being a major area of financial concern. These reassesments may lead to stress and sadness over unaccomplished goals, which for a small few may lead to a midlife career change.

Another financial adjustment that tends to take place for many midadults is the planning for college and setting aside the necessary funds for their children. In response to these growing financial needs and greater free time, due to their children getting older, many women enter or reenter the workforce. In short, this tends to be a time of career and financial readjustment and planning for both men and women.

Marriage and Family

Adults demonstrate much variation in their intimate lifestyles. Nearly all of us are married at least some time during our adult lives. Many marriages either improve or deteriorate during middle age. If a couple form a relationship appropriate to this new period of life, their marriage will likely grow stronger. But if they cannot adapt to the new conditions of their lives, their marriage may develop problems. Regardless, intimacy, marriage, and family concerns are a priority during middle adulthood. Some specific issues include the empty nest syndrome, late parenting, divorce, sexuality, remarriage, and grandparenting.

Leisure

Leisure holds an important place in helping adults to deal with life experiences. Not only does leisure enhance ones well-being it is also a buffer to the stresses of life.

4.3 HEALTH IN THE MID-ADULT YEARS AND DIETARY MODIFICATIONS

NOTES

It is important to maintain optimal nutrition during this period of life. The sequelae of chronic dietary deficiencies, nutritional excesses and imbalances, and other risk factors experienced during earlier stages begin to manifest during this stage. However, nutritional health behaviors targeted towards prevention are essential. Given the changing nutritional needs of males and females during this stage, healthy behaviors should be reinforced by nutritional education. The resiliency of the body creates opportunities to prevent and, in some cases, reverse some risk factors.

Quality of life and length of life are greatly influenced during this stage. Maintaining an appropriate weight and consuming a nutritionally adequate diet are essential throughout the adult years.

Excessive weight gain, and/or inadequate consumption of essential nutrients such as calcium, folic acid, and essential fatty acids significantly increase the risk for premature disability or death from heart disease, cancer, stroke, kidney disease, cataracts, and other acute or chronic conditions.

In addition to the benefits for children, studies have shown that breastfeeding for longer periods and among younger mothers may reduce the risk of premenopausal and possibly postmenopausal breast cancer. The consequences of poor nutrition during middle adulthood include:

- Increased risk of obesity and chronic diseases caused by unhealthy eating and sedentary lifestyles.
- Increased risk for osteoporosis for women during the peri-menopausal period and thereafter.
- Increased risk for heart disease, diabetes, cancer, and stroke for men and women.
- Reduced productivity and lowered resistance to acute infections.
- Risk of an inadequate diet, dehydration, lowblood sugar, and infertility, when coupled with alcohol.

Heart Disease

There are 2.5 times as many men as women that are victims of heart diseases. A heart attack occurs when parts of the heart fail. Many diseases can cause the heart to fail, which in turn, can cause a heart attack. Congestive heart failure is described as when blood is no longer being pumped from the heart to the rest of the body.

When the blood cannot be pumped to the body, due to any number of causes, it will soon over flow and start to swell parts of the body. These parts

include the heart itself, the liver ,the abdomen, the feet, the legs, and the lungs. When the lungs are affected, this leaves the body feeling weak and fatigued.

Hardening of the arteries or arteriosclerosis is described as inelasticity and thickening of the arterial walls. This will cause a lack of blood flow to the heart, brain, and other vital parts of the body. This occurs anywhere in the body. Coronary artery disease is where your arteries become clogged. The disease is called coronary atherosclerosis. This disease happens very slowly, over 20 to 30 years, however, it can begin at 20 year of age or even earlier. By the middle 40's, a person can have a sudden heart attack. In addition, coronary atherosclerosis may also severely weaken the persons heart leading to congestive heart failure.

Any one of the above can lead to a heart attack, or in themselves, cause death. A heart attack occurs when part of the heart fails, for any of the above reasons. When a heart attack occurs, for whatever cause, the heart will not get enough blood to itself. This causes the muscle in the heart to grow weak. When the muscle grows weak, it deprives itself of even more blood, and so on. Finally, the muscle can no longer operate. This leaves the heart unable to function. The consequence is death.

Reducing the risk of heart attack

- Quit smoking
- Reduce cholesterol
- Treat high blood pressure
- Maintain ideal weight
- Exercise
- Drink an occasional glass of wine
- Low-dose aspirin
- Reduce hostility and stress

CANCER

Cancer is not a single disease with a single cause. In fact, there are many forms of cancer with many different causes. Cancer begins at a person's cells. If a cell receives a cancer promoting stimulus from a virus, radiation, hormone imbalance or any multitude of other suspected carcinogenic,agents, it may begin to mutate. Cancer occurs when a cell reproduces or grows abnormally.

Smoking plays a considerable role in lung cancer. After a person has been smoking for a number of years, the lining of cells in the lungs and the bronchial walls will become damaged. This allows for the precancerous cells to begin their

malignant growth. The damage caused by cigaretts does not stop at lung cancer. A smoker can also develop cancer of the esophagus, cancer of the stomach, cancer of the pancreas, and so on. The child of a smoker, who smokes themselves, is 15 to 25 times more likely to develop lung cancer.

NOTES

Reducing incidence of cancer and cancer deaths

- Know the symptoms
- Self-exams
- Regular checkups and screening
- Avoid tobacco, sun exposure, pollutants, X-ray exposure
- Weigh the benefits of HRT
- Healthy diet

MENOPAUSE

One of the significant changes which occurs for women during middle adulthood is menopause. Menopause is the time in a woman's life when menstruation stops. This normally occurs between ages 45 and 60. In the United States, the average age is 51. The reason menstruation stops is that the ovaries begin to produce lower amounts of hormones, thus causing periods to become irregular and eventually to stop completely.

What are the symptoms?

There are many different symptoms of menopause. Some of the psychological symptoms may include: anxiety, depression, tearfulness, irritability, sleeplessness, less desire for sex, and/or lack of concentration. Some of the these symptoms could also be a result of other dramatic life changes one may go through during this time in their life. For example, usually at this time in a woman's life her children may leave home, may be a loss of parents, retirement, or becoming a grandparent.

Some of the physical signs of menopause are: irregular menstrual periods, hot flashes, night, sweats, disturbed sleep patterns, vaginal dryness or discomfort, dry skin. The previous symptoms may be apparent for only a matter of weeks, however they could go on for many years. They could be sporadic or they may occur regularly.

How to be Diagnosed?

Often times, menopause is diagnosed through your personal medical history. Usually, your physician will order blood tests and/or a pelvic exam will be administered.

NOTES

How to be treated?

First, we need to recognize that menopause is not a disease, it is a natural part of a woman's life cycle, and it isn't always neccesary to be treated. However, with menopause, estrogen levels in the body decrease. This increases certain health risks such as osteoporosis and heart disease. This is the reason why a lot of women choose to take estrogen supplements. These are sometimes refered to by ERT or HRT (estrogen or hormone relpacement therapy).

When making the decision to take ERT/HRT, we must take a look at the advantages as well as the negative consequences. Estrogen Replacement Therapy is prescribed in the form of tablets, patches or cream. The treatment time usually lasts for several months, however some women choose to stay on it indefinitely. Here are of the most important factors to consider:

PROS: prevent osteporosis, benefit heart, benefit blood vessels, steady/consistant hormone levels.

CONS: estrogen-related cancer

What should do?

It is reccomended to get a mammogram every 2 yrs between ages 35 and 55. Also, it is encouraged to eat foods high in calcium and low in saturated fats. Consistant cardiovascular activity/excercise is also very beneficial.

STUDENT ACTIVITY

1. Discuss the external physical changes take place during adulthood.

2. Point out the cognitive changes of adulthood.

NOTES

There are many factors that can cause obesity. Those causes can be divided into three main categories: genetic, environmental, and psychological. We most often tend to look at genetics as the main cause of obesity. If you look at the population of people that are overweight, it tends to run in their families. In fact, in one study, researchers found that children who were adopted had a weight closer to that of their biological parents as opposed to their adopted parents. This might suggest that we are predisposed to our weight.

Some research suggests that even though genetics play an important part in our life, we must also realize that our environment plays a significant role. Environmental factors include our eating habits, and how our activity level. We cannot change our genetic make-up, but we can choose what we eat, and how active we are. Learning how to choose more nutritional meals, recognizing when you are hungry or just craving food because you are bored, and becoming more physically active has allowed people to lose weight as well as keep off those unwanted pounds.

Still yet, some reasearch suggests that there are psychological causes. For example, they may have an eating disorder. One of the major eating dsisorders is called "binge eating disorder." It is when people eat large amounts of food and feel like they cannot control how much they are eating.

Another cause of obesity is illnesses such as hypothyroidism, Cushing's syndrome and depression. Certain nuerological problems can contibute to one's obesity. Some drugs may contribute to being overweight; anti-depressents and steroids have been know to result in weight gain. These conditions are known to cause about one percent of obesity in America.

What are the consequences of Obesity?

Health risks as well as psychological effects accompany obesity. Someone who is forty percent or more overweight is twice as likely to die a perematurе death than an average-weight person. Obesity is also seen to be correlated with some serious medical conditions. These include: diabetes, heart disease, high blood pressure, and strokes. It is also common for those who are obese to have certain types of cancer: colon, rectum, prostate, cancer, gallbladder, breast, uterus, cervix, and ovarian. Some other diseases include: gallbladder disease, gallstones, osteoarthritis, pulmonary problems, and sleep apnea. Doctors generally agree, that the more obese a person is, the more likely he or she is to have health problems.

Some other consequences of obesity are more psychological. For example, one who is obese may be suffer emotionally because of the emphasis society

places on physical appearance. Society also seems to relate attractiveness to slimness, especially in women. Many assume that those who are suffering from obesity are gluttonous, lazy, or perhaps both. However, more and more evidence contradicts this assumption. Still, feelings of rejection, shame and depression are common.

4.4 SUMMARY

- It is believed that most of the development ends with adolescence. Only wisdom continues to grow during adulthood. However, there are many specific development tasks during adulthood and old age requiring the grown up to engage in specific development and make special adjustments in life.
- The period of young adulthood begins from the age of twenty years onward. The major concerns of young adults in 20s are to establish themselves in life, job, and family. The young adult wants to seek social and economic security in preparing for a role of greater independence and responsibility in society.
- Middle age is characterized by competence, maturity, responsibility and stability. These are the important characteristics for middle-aged adults.
- It has been found that the organ system of most persons show a 0.8 to 1 percent decline per year in functional ability after the age of 30. Some of this decline is normal, some is disease related and some are caused by factors such as stress, occupational status, nutritional status and various environmental factors.
- Cognitive therapy is very effective in substituting irrational thoughts with rational thoughts. Relaxation training helps reducing anxiety and tension. Cognitive-behavioural interventions have been found to be useful in treating depression, anxiety, memory loss, and response speed in the aged.
- Two of the most noticeable changes are seeing and hearing which take place during middle age. Each of these begin to decline in the middle years.
- One of the significant changes which occurs for women during middle adulthood is menopause. Menopause is the time in a woman's life when menstruation stops.

4.5 GLOSSARY

- **Young Adulthood:** A period adulthood which begins from the age of twenty years onward.

- **Middle Age:** A period of twenties and thirties of an individual's life.
- **Cognition:** It refers to the processes by which information is acquired, stored, and used.
- **Menopause:** It is the time in a woman's life when menstruation stops.

4.6 REVIEW QUESTIONS

1. What are the changes in sensory capacities occure during adulthood?
2. Discuss the problems of adjustment of old age.
3. How does surrounding environment affect adult psychology?
4. What are the physical changes take place during adulthood.
5. What is menopause?
6. What are the symptoms of menopause?

4.7 FURTHER READINGS

- Rveenger, R.A. Michakas, M.N. Green, *Glossary of Genetics: Classical and Molecular*, narosa Publishing House, Vth edition, 1993.
- Mynoy Winick Willey, *Nutrition management of genetic disorders*, inter science publications 1979.
- *Sarin genetics*, Tata Mc Graw Hill publications Pvt. Ltd., Vth Edition, 1985.
- *Nutrition & Biochemistry For Nurses* by jacob Anthikad, Published at Jaypee.

NOTES

UNIT – V

GERIATRIC NUTRITION

OBJECTIVES

After going through this unit, students will be able to:

- state the concept of nutritional care of elderly;
- discuss the changes in body composition of elderly;
- explain the changes in the physiological requirements of elderly.

STRUCTURE

5.1 Introduction
5.2 Psychological Changes
5.3 Systemic Changes
5.4 K Calories, Protein and Water
5.5 The Diet
5.6 Problems Associated with Elderly
5.7 Sports Nutrition
5.8 Summary
5.9 Glossary
5.10 Review Questions
5.11 Further Readings

5.1 INTRODUCTION

Changes associated with normal aging increase nutritional risk for older adults. Aging is characterized by diminished organ system reserves, weakened homeostatic controls, and increased heterogeneity among individuals, influenced by genetic and environmental factors.

Nutritional needs of the older individual are determined by multiple factors, including specific health problems and related organ system compromise; an individual's level of activity, energy expenditure and caloric requirements; the ability to access, prepare, ingest, and digest food; and personal food preferences.

This topic will discuss assessment of nutrition in the older adult, as well as the etiology, evaluation, and treatment of weight loss, overnutrition and specific common nutrient deficiencies.

NOTES

5.2 PHYSIOLOGICAL CHANGES

While there are many physiological changes associated with aging, some affect nutrition status more than others. There is decreased total body protein. There is also a decrease in total body water. The older adult is more prone to dehydration in hot weather or if suffering from a urinary tract infection. Bone density loss is a problem, especially with small framed, thin women. Osteoporosis can develop along with the increased risk of broken bones and hospitalization.

Osteoporosis is not just found in women, men who are alcoholics or on long-term steroid use are also at risk. Body fat increases with redistribution of fat stores. More fat accumulates around the middle of the body. The fat in this area is more metabolically active and may increase risk of developing chronic diseases such at hypercholesterolemia and diabetes mellitus.

5.3 SYSTEMIC CHANGES

Enamel thins on the teeth. Teeth become more sensitive to hot and cold. Some older adults lose their teeth. Dentures can be ill fitting secondary to weight changes and shrinking gums. There is decreased saliva production. The mouth becomes dry (xerostomia). Food must be in solution for taste buds to work. More intense seasonings are needed in order to taste flavors.

Dysgeusia can be attributed to aging, but certain medications can have similar side effects. Esophageal motility decreases, and swallowing problems increase. Gastric acids are reduced. Emptying of the stomach is slower. Peristalsis is slower as well. There can be delayed fat absorption. Liver size decreases along with decreased protein synthesis. Fewer pancreatic enzymes can mean malabsorption including higher fecal fat losses.

Changes in bowel function are of great concern to the elderly. Constipation is a major complaint. This can be caused by poor overall intake, laxative abuse, medications, low residue diets, dehydration, fear of pain, and loss of gastro-colic reflex.

5.4 K CALORIES, PROTEIN AND WATER

K Calories (kcal)

The reduction in energy requirements is related to decreased protein mass rather than a reduction in the metabolic activity of aging tissue. Requirements are affected by physical activity: more activity equals more kcal needs. Generally, 25-30 kcal/ kg/ day equals weight maintenance, although the range can be 20-35

kcal/ kg. If a patient does not reduce kcal intake, he will experience a gradual weight gain. Sudden weight gain is a sign of changes in fluid status. The patient will need to be assessed for medical problems including low serum protein/ malnutrition. Inappropriate weight loss also should be investigated for medical or environmental causes.

Some chronic diseases increase kcal needs such as Chronic Obstructive Pulmonary Disease. Cancers and diseases causing malabsorption will also increase requirements. Women in general need fewer kcal than men.

Protein

There is NO decrease in protein needs. Requirements are actually higher than once thought. Some persons reduce their intake of red meats because of taste changes. Skin ulcers increase requirements. Those with malabsorption will also need more protein.

Water/Fluids

Some elderly have to be reminded to drink. Be alert to those who have motility problems or restrict fluids because of incontinence. Some will require a written prescription stating a definite amount to drink per day.

General calculations:

1 ml/kcal or 30 ml/kg actual body weight

minimum ~ 1500 ml/day (some fluids are available from solid foods in the diet)

exceptions: CHF or renal disease among others.

5.5 THE DIET

Healthy older persons can use the same guidelines as middle age: choose a variety of foods, maintain a healthy weight, choose a diet low in fat, saturated fat, and cholesterol. Eat plenty of vegetables, fruits, and grain products. Use sugars and sodium in moderation. Alcoholic beverages in small amounts.

Carbohydrates (CHO)

These should make up 55-60% of the diet. The emphasis should be on complex CHO. Complex carbohydrates will help meet fiber, vitamin and mineral needs. Energy needs may be less, but the requirements for other nutrient remain the same.

Protein

Protein sources should make up 15-20% of the diet. The elderly tend to reduce the amount of meat and dairy in the diet secondary to chewing and

digestive problems. Taste changes make meat very bland tasting. They will need to be encouraged to keep an adequate amount of protein sources in their diet.

NOTES

Fat

Fat should be in 10-30% range. Frail elderly require more fat. They will need small, frequent, kcal dense meals. Many complain of early satiety. Supplements may be needed or tube feedings. For older adults who are overweight, a low fat diet can be used for weight reduction in addition to heart disease prevention.

Fiber

High fiber diet has been shown to decrease risk of colon cancer and to help lower cholesterol. It helps prevent constipation. Unfortunately, the elderly limit the amount of fruits and vegetables in their diet because of chewing or digestive problems. Good choices to help increase fiber are whole grains, cereals, dry beans, fruits, and vegetables. Recommendations are for 20-35 g of fiber per day. Persons changing to a high fiber diet need to do so gradually to avoid gas formation and diarrhoea. Adequate hydration will help keep stools soft.

Sodium and Potassium

The Institute of Medicine released guidelines for sodium and potassium in 2004. Older individuals are especially sensitive to the blood pressure raising effects of sodium and should generally consume less than 4 grams of sodium per day. Those with hypertension should consume less than 2 grams of sodium per day. Potassium intake should be ~ 4.7 grams per day or greater unless renal disease is present. Patients should opt for fresh food instead of processed items whenever possible. They can also use herbs, peppers, spices, and salt substitutes to help lower sodium intake.

Vitamins and Minerals

Vitamin B6- deficiencies can cause people to feel tired or depressed. The immune response can be impaired. Vitamin B6 is found in a wide variety of foods including meat, fish, vegetables, and fruits.

Vitamin B12- Changes in the stomach and intestines reduce the ability to digest and absorb this vitamin. A deficiency can cause anemia and affect the nervous system. B12 is only found in animal sources such as meat, fish, dairy products, and eggs. The new dietary guidelines suggest that persons over the age of 50 consume vitamin B12 in its crystalline form (fortified foods or supplements).

Folate- This vitamin is important for cell renewal. A deficiency causes anemia. Folate is found in fruit and dark green leafy vegetables. Cooking can

NOTES

destroy the naturally occurring vitamin. Encourage steaming vegetables or eating raw as much as possible. Enriched grains are now supplemented with heat resistant folic acid.

Vitamin D- The elderly have increased needs if they have limited exposure to sunlight. Darker skin requires longer exposure to achieve benefit. Conversion to the final active hormone by the kidney decreases with age. Total needs are elevated to help reduce bone loss. Food sources include fortified milk, fish oils, and liver. A supplement may be beneficial for older adults, especially those who are housebound.

Calcium- Increased losses in the elderly, primarily women. There is less absorption secondary to decreased solubility from reduced gastric acids. The Dietary Reference Intake table suggests ~1200 mg/day for both men and women over the age of 51. The National Institutes of Health suggests 1500 mg for postmenopausal women not on estrogen replacement therapy and anyone over the age of 65. New fortified foods and calcium supplements are readily available.

Zinc- A deficiency can cause dermatitis and loss of taste. The immune function is also compromised. Delayed wound healing can be a problem in the hospitalized elderly. Increasing intake of eggs, seafood, and whole grains can prevent a deficiency. Supplements are sometimes necessary for patients with surgical wounds or skin ulcers.

5.6 PROBLEMS ASSOCIATED WITH ELDERLY

Cholestrol

Little research on optimal cholesterol (CHOL) levels in the elderly has been done. One large study now suggests that low CHOL diets are not necessarily effective for the prevention of heart disease for those over seventy. For older adults in their fifties and sixties, maintaining a healthy weight and choosing a low fat, low CHOL diet are still good recommendations. In some cases, CHOL lowering medications in combination with a low CHOL diet. For the very old, weigh the risk of malnutrition against the benefits of a low fat diet.

Anemia

Anemia is not a normal part of aging. Chronic anemia from chronic inflammation is the most common cause of anemia. Subtle nutritional deficiencies and possible blood losses need to be checked. The search for an underlying cause should begin when hemoglobin is less than 13 g/dl in males and 11 g/dl in females. For those over 90, 11 g/dl is appropriate. Encourage a diet that contains a variety of iron containing foods from both plant and animal sources.

NOTES

Aging Eyes

Age-related macular degeneration (AMD) is the leading cause of blindness in older Indians. This disease causes the gradual destruction of the macula. Older patients lose the clear, sharp central vision that they need for driving, reading, etc. A healthy diet may slow the development of AMD. Recommend a diet of fruits, vegetables, whole grains, nuts and seeds.

Alzheimer's Disease/Vascular Dementia

New research in the area of dementia prevention suggests that increased omega-3 fatty acid intake (EPA and DHA) may have a protective benefit. The American Heart Association recommends eating fish at least twice per week. Fatty fish such as mackerel, lake trout, albacore tuna, and salmon are good choices. Other preventive measures include eating leafy greens, nuts, whole grains, and using vegetable cooking oils. Keeping blood sugar under control and staying at a healthy weight can keeping the brain functioning at a normal level, too.

There is no evidence that Alzheimer's disease itself changes nutritional requirements. However, in those patients with agitation, calorie needs are increased and the diet should be adjusted accordingly. Food consistency should be modified as needed. Some patients will forget how to chew and will need liquid or pureed foods.

Osteoarthritis

Osteoarthritis (OA) affects ~21 million persons over the age of 40 years. Medical management of osteoarthritis includes pain medication, regular physical activity, and a wellbalanced diet. Weight reduction will improve quality of life in those patients who are overweight.

Polypharmacy

Polypharmacy can have an adverse affect on nutrition status. Medications can cause dry mouth, blurred vision, reflux, tremors, and delusions. They can also cause poor appetite, taste changes, nausea, vomiting, and constipation. Increases and decreases in gastro-intestinal transient time can affect nutrient absorption from foods. Change in fat and lean mass ratios, especially after the age of seventy can change the way medications are absorbed. Water-soluble drugs have higher serum levels and fat-soluble drugs have lower serum levels.

The use of diuretics and alcohol can cause depletion of potassium, magnesium, and zinc. Laxative abuse can deplete potassium and calcium. Chemotherapy can cause folate deficiency and anti-tuberculosis therapy can reduce vitamin B6 availability.

NOTES

Malnutrition among residents in longterm care facilities is unfortunately a common problem. These persons need aggressive care to avoid complications such as pressure ulcers, unintentional weight loss, and anorexia. Use the most liberal diet available and allow favorite foods. A therapeutic diet should only be used when it can used to achieve significant improvement in the health of the resident.

Palliative care is usually associated with Hospice and possible death within six months. This care should provide closeness, spiritual help (if wanted), diet as tolerated. If a person refuses to eat, it will take 1-3 weeks on average to starve to death with hydration. A dehydration coma can cause death within three to five days. The family should be prepared for this event. Ideally, the patient will have made a decision via a living will.

STUDENT ACTIVITY

1. Discuss the changes take place in elderly.

2. Outline the vitamine and mineral requirements of elderly.

5.7 SPORTS NUTRITION

NOTES

Sports nutrition is the study and practice of nutrition and diet as it relates to athletic performance. Although an important part of many sports training regimens, it is most commonly considered in strength sports (for example weight lifting and bodybuilding) and endurance sports (for example cycling, running, and triathlon). Sports nutrition is a science that produces or provides and maintains the food (or dietary ergogenic aids) necessary for health, growth and physical performance. It deals with nutrients such as vitamins, minerals, supplements and organic substances such as carbohydrates, proteins and sugars in serious athletes of all sorts who want to make use of nutrition for their benefit. An athlete's dietary regimen plays a vital part in accomplishing his/her goals because it allows the athlete to reach his/her maximum performance. This illustrates how an athlete should apply the necessary nutrition in order to benefit from training and to maximize his/her capability during exercise and activity. Thus, every sport and type of physical activity varies in its appropriate diet which benefits the athlete. Sports nutrition also consists of many different concerns such as the amount of certain foods and fluids one should consume that are specific to training. The goals of sports nutrition try to answer the questions such as: What types of foods and fluids should be consumed? What to eat and drink and when throughout the day?

Goals

Sports nutrition has many goals to enhance performance. First, it improves performance by improving body composition, which increases speed, quickness, mobility, and strength. Second, it will help the speed of recovery, which will in turn create more capacity for practicing and competition as the body is becoming more fit and adjusted to the coupling of the good nutrition incorporated into the workout regimen. Third, it will allow one to increase energy for both practice and competition, which will definitely help one's performance. Strategic diet will also increase immunity, allowing one to stay healthy and be able to continue and intensify practice and training. Most importantly, it will improve your overall health as proper health is essential to all aspects of life.

Description

The nutrients needed are similar to the healthy eater, they both need balanced quantities of all key nutrients. The sports person just needs them in higher amounts:

- **Calories** - The higher intake should be spread throughout the key nutrients. But in slightly different levels than the non-active person.

- **Carbohydrate** - Primary source of energy and part of a loading phase during some sports, this has the highest increase.
- **Protein** - The building blocks of muscle and particularly needed during a hard or peak phase for repairing and building muscle.
- **Fats** - Still required in slightly increased amounts due to fat soluble vitamins and their importance for the athlete.
- **Water** - Even a slight dehydration can have a negative impact on performance.
- **Sodium** - Secreted in sweat, a deficiency can affect concentration as well as performance.
- **Vitamins and minerals** - The extra calorie intake will supply most of the extra quantities needed however certain vitamins have evidence to show they can have a positive impact on performance in larger doses.

Calories

For a healthy eater the proportion of calories from each key nutrient should be as follows:

- 60% Carbohydrate (each gram has 4 calories)
- 30% Fats (each gram has 9 calories)
- 10% Protein (each gram has 4 calories)

In sports nutrition a slightly higher percentage of protein and a lower percentage of fats would be favourable. The sports person wants to carry no excess fats.

The following table shows the extra daily calorie intake required to stay at the same weight during normal training for different periods of time exercising (to the nearest 10 calories):

Total Calorie Intake

	Exercise time			
Weight (lb)	*0 (min)*	*30 (min)*	*60 (min)*	*90 (min)*
150	2 060	2 340	2 630	2 900
160	2 200	2 500	2 800	3 100
170	2 340	2 660	2 980	3 300
180	2 480	2 830	3 150	3 490
190	2 610	2 970	3 330	3 680

200	2 750	3 130	3 500	3 880
210	2 890	3 280	3 680	4 070

NOTES

Carbohydrate

The carbohydrate intake should come from complex carbohydrates. These provide energy to the body slowly and gradually unlike simple carbs which are sudden and short lived. Good sources of complex carbohydrates include:

- breads
- rice
- pasta
- cereals
- potatoes
- beans

The extra daily carb intake required in sports nutrition (to the nearest 5 grams):

Total Carbohydrate Intake (grams)

	Exercise time			
Weight (lb)	*0 (min)*	*30 (min)*	*60 (min)*	*90 (min)*
150	310	340	375	410
160	330	365	400	435
170	350	390	425	465
180	370	410	450	490
190	390	435	475	520
200	415	460	500	545
210	435	480	525	570

Protein

Due to the nature of protein and it's use in muscle, some sports require a higher intake than others. These are high intensity sports like sprinting and body building. Good sources of protein include:

- meats
- fish
- eggs

NOTES

- cheese
- milk
- beans
- nuts
- soy products
- lentils

The following is the increase required during normal training (to the nearest gram):

Total Protein Intake (grams)

	Exercise time			
Weight (lb)	*0 (min)*	*30 (min)*	*60 (min)*	*90 (min)*
150	52	60	68	76
160	55	64	72	81
170	58	68	77	86
180	62	72	81	91
190	65	76	86	96
200	69	80	90	101
210	72	84	95	106

Fats

There are three types of fats:

- saturated
- poly-unsaturated
- mono-unsaturated

In sports nutrition the majority of fats consumed should be mono-unsaturated. Sources include:

- olive oil
- rapeseed oil
- hazelnuts
- almonds
- brazil nuts
- cashews

NOTES

- avocados
- sesame seeds
- pumpkin seeds

An increase is recommended in the following amounts (to the nearest gram):

Total Fat Intake (grams)

	Exercise time			
Weight (lb)	*0 (min)*	*30 (min)*	*60 (min)*	*90 (min)*
150	67	75	81	89
160	71	79	86	94
170	75	84	91	99
180	80	89	97	106
190	84	94	102	111
200	89	99	108	118
210	93	104	113	123

Water

So many factors play a role in the amount of water a sports person requires, climate and personal physiology being the most important. There are 2 schools of thought on fluid replacement for the athlete:

(i) You should drink 4 to 8 ounces for every 15 minutes of exercise.

(ii) You should weigh yourself after the workout and drink 15 to 20 ounces for every pound of weight loss.

We subscribe to them both, you obviously need fluid while you exercise especially on hot days. So why not weigh yourself afterwards as well for a further check and take on more fluids if needed.

Sodium

Again a difficult one to quantify, the sports person does need more as it's secreted in sweat, but there are still many factors that govern how much a particular sweats.

This is where sports drink becomes ideal, the sodium levels are perfect. One bottle of an isotonic sports drink combined with your normal fluid replacement will be adequate.

NOTES

Vitamins and Minerals

The extra calorie intake if it's balanced will more than cover your needs for the R.D.A. However in sports nutrition.

There is now research that shows larger amounts of vitamin C and E can help improve performance. Supplements can provide all the vitamin C needed. The good news about vitamin E is that foods with good fats (mono-unsaturated) are also high in vitamin E. These include:

- soya bean oil
- sunflower oil
- almonds
- cashew nuts
- walnuts

Now onto beta-carotene, found in many vegetables especially carrots beta-carotene is known to improve athletic performance. For this reason it's often added to many protein powders on sale today. Doses range from 15mg to 50mg.

Supplements

Many athletes consider taking dietary supplements because they are looking for the "magic ingredient" to increase performance. In the extreme case of performance-enhancing supplements, athletes (particularly body-builders) may choose to use illegal substances such as anabolic steroids, compounds which are related to the hormone testosterone, which can quickly build mass and strength, but have many adverse effects such as high blood pressure and negative gender specific effects. Blood doping, another illegal ergogenic, was discovered in the 1940s when it was used by World War II pilots.

Dietary protein began to be consumed in the 1940s and muscle building results were found in resistance and strength training athletes. Protein intake is a part of the nutrient requirements for the regular athlete and is an important component of exercise training, because it can also aid in performance and recovery. Dietary protein intake for well-trained athletes should occur before, during and after physical activity as it is advantageous in gaining muscle mass and strength. However, if too much protein and amino acid supplements are consumed (especially by the Average Joe exerciser), it can be more harmful than beneficial; health risks include: "dehydration, gout, calcium loss, liver, and renal damage [and] gastrointestinal side effects include diarrhoea, bloating, and water loss" (Lawerence). A bountiful protein diet must be paired with a healthy, well-rounded meal plan and regular resistance exercise. Yet, characteristics such as

the type of exercise, intensity, duration, the carbohydrate values of diet, the individual's sex and age and also the amount of background training and training environment.

NOTES

Creatine may be helpful for well-trained athletes to increase exercise performance and strength in concordance with their dietary regimen. Also, the substance glutamine, found in whey protein supplements, is the most abundant free amino acid found in the human body. For well-trained and well-nourished athletes it is considered that glutamine may have a possible role in stimulated anabolic processes such muscle glycogen and protein synthesis. Other popular supplements studies done include androstenedione, chromium, and ephedra. The findings show that there are no substantial benefits from the extra intake of these supplements, yet higher health risks and costs.

5.8 SUMMARY

- Aging is characterized by diminished organ system reserves, weakened homeostatic controls, and increased heterogeneity among individuals, influenced by genetic and environmental factors.
- Nutritional needs of the older individual are determined by multiple factors, including specific health problems and related organ system compromise; an individual's level of activity, energy expenditure and caloric requirements; the ability to access, prepare, ingest, and digest food.
- Changes in bowel function are of great concern to the elderly. Constipation is a major complaint.
- High fiber diet has been shown to decrease risk of colon cancer and to help lower cholesterol. It helps prevent constipation.
- Healthy older persons can use the same guidelines as middle age: choose a variety of foods, maintain a healthy weight, choose a diet low in fat, saturated fat, and cholesterol.
- Many athletes consider taking dietary supplements because they are looking for the "magic ingredient" to increase performance.
- Sports nutrition has many goals to enhance performance. It improves performance by improving body composition, which increases speed, quickness, mobility, and strength.

5.9 GLOSSARY

- **Anemia:** A disease caused due to deficiency of iron, particularly in elderly.
- **Vitamin B6-** A vitamin if deficient can cause people to feel tired or depressed.

- **Folate-** This a vitamin which is important for cell renewal.
- **Sports Nutrition:** The study and practice of nutrition and diet which is related to athletic performance.

5.10 REVIEW QUESTIONS

1. What are the systemic changes occure in elderly? Discuss.
2. Discuss the dietary plan for elderly. Why is this important?
3. What are the main health problems associated with the elderly?
4. What are the pricipal goals of sports nutrition?
5. Discuss the calories and carbohydrates needs of sport persons.

5.11 FURTHER READINGS

- *Geriatric Nutrition,* Edited by John E. Morley, David R. Thomas, Published at CRC Press.
- *Geriatric Nutrition: A Comprehensive Review,* By John E Morley, Zvi Glick, Laurence Z Rubenstein, Publisheed at Raven Press.
- *Nutrition & Biochemistry For Nurses* by jacob Anthikad, Published at Jaypee.
- *Geriatric Nutrition and Diet Therapy,* By Marie Jaffe, Published at Skidmore-Roth Pub.