Chapter 35

Nutritional Implications of Dietary Oils and Fats in Developing Countries

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Introduction

The functions of dietary fats and oils essentially fall into two categories: nutritional and technical. The most basic nutritional function of dietary oils and fats is as a concentrated source of calories to meet the energy requirements of individuals. Insufficient fat energy or calories in the diet is a widespread complication for protein utilization in developing countries, broadly identified as protein-energy malnutrition (PEM). The role of fat calories to spare proteins so as not to be consumed as energy is not to be underestimated. Fats and oils also provide essential fatty acids and are carriers of the fat soluble vitamins A, D, E, and K.

Although the world need for oils and fats is for nutrition, the food scientists recognize that fats play various roles in foods. The basic functional characteristics of fats and oils can be broadly defined as providing lubricity, structure, and aeration, as well as acting as a heat transfer medium and enhancing the palatability of foods.

This chapter focuses on the nutritional role of fats and oils. The sources of dietary fats and oils are first discussed, followed by an examination of the contribution of fats to total dietary energy. The changes in the availability of dietary fats and dietary energy supply during the last two decades, particularly to communities in developing countries are reviewed. The implication of these changes on the nutritional status of communities is discussed. The emphasis will be on developing countries, many of which are at a nutritional cross-road where the problem of PEM has not been solved while the problem of positive energy balance or obesity and its related complications has emerged. This chapter does not include a detailed discussions of the nutritional implications of types of fats and oils on human health and disease.

Sources of Dietary Fats and Oils

There is a worldwide demand for fats and oils calories. The various sources of fats and oils are important because of the differences in their fatty acid compositions.

Specific fatty acids, in turn, have been linked with cardiovascular disease, cancer, immune function, child growth, and brain development (10).

Seventeen types of oils and fats are available in the world. Generally, the two main sources of oils and fats for human consumption are animals and plants. The major animal sources are tallow, lard, butter, and fish oils derived from cattle, sheep, pigs, and marine animals, respectively. Oils and fats from plant sources are obtained from either oilseeds or fruits of oil-bearing trees. The major oilseeds include soybean, rapeseed/canola, cottonseed, sunflowerseed, groundnut, palm kernel, sesame, corn, linseed and castor oil. Oils and fats obtained from the flesh of fruits are palm oil, olive oil, and coconut oil.

Animal fats generally contain a higher percentage of saturated fatty acids than do the plant sources. Plant sources generally have a higher percentage of the unsaturated fatty acids, except coconut oil. Palm oil is one of the few oils with a balanced composition of saturated and unsaturated fatty acids (7). The two oils containing significant quantities of the essential fatty acids (linoleate and linolineate) are soybean and the low erucic acid rapeseed or canola oil.

In the past, the consumption of the various types of oils and fats differed according to region and was essentially based on local availability. However, with the advent of modern transportation, an export trade of vegetables oils soon grew. In Europe, for instance, dairy and animal fats traditionally consumed have been slowly replaced by plant oils, such as soybean, sunflower oil, and palm oil.

In developing countries, such as Pakistan, India, and Bangladesh, the major oils consumed include groundnut oil, rapeseed, palm oil, and butterfat. In China, the major oils and fats consumed are rapeseed, groundnut, lard, palm oil, and cottonseed oil. Other developing nations, such as South East Asia, Africa, and West Asia, primarily consume palm oil as their major oil. The population of the South Seas largely consumes coconut oil.

In developing countries, the consumption of liquid oil to solid fat is around the ratio of 70% liquid to 30% solid. However, populations in the region of South Asia (Pakistan, India, and Bangladesh) consume solid fats in the forms of ghee and vanaspati. Vanaspati is a product prepared by the hydrogenation of vegetable oils to mimic the consistency of ghee or clarified butter fat.

Dietary Fats and Oils as Sources of Energy

The total daily dietary energy comes from three main nutrients, namely protein, fat, and carbohydrate. Fat has the highest available energy value per gram, 9 kcal, as compared to 4 kcal for protein and carbohydrate. The contribution of each of these nutrients to total dietary energy considerably varies between different countries, as well as between different communities within the country. For most countries, the diet provides an average of about 11% of its energy from proteins, with the remaining 80–90% from fats and carbohydrates. In developed countries, average energy intake from dietary fat ranges from 35–45%. In contrast, in developing countries, energy intakes of 10–20% fat or less are common.

Being the most concentrated form of food energy, the fat content of a diet generally determines its energy density. Diets with a low energy density may be too voluminous or bulky to permit consumption of an amount sufficient to meet energy requirements, particularly in children and the elderly. Diets based on root crops, plantains, or cereals may fall into this category. It would be beneficial to increase the energy density of such diets by either adding fat or increasing the availability and consumption of those foods that are naturally good sources of fat and other nutrients. The World Health Organization (WHO) has proposed that the lower limit for the average fat intake by a population group be set at 15% of total dietary energy (9). This lower limit was believed necessary to meet the needs for essential fatty acids and to overcome the problem associated with low energy density of food. Infants and very young children will probably need higher fat intakes than this, especially in population groups with various degrees of undernutrition.

As the total fat content of the diet increases, an increasing proportion of persons within that population may develop obesity. Various other disorders (e.g., diabetes, hypertension, and coronary heart disease) are associated with this. Studies have shown that a mean body mass index (BMI) of 22–23 is associated with a dietary fat content that provides 15–20% energy, whereas a BMI of 25–26 is associated with a dietary fat content that provides 35–40% energy. Considering this, WHO has recommended 30% as an acceptable upper fat intake (9).

Availability of Dietary Fats

It is difficult to have absolute confidence in the statistics reported for oils and fats consumption or availability. In developing countries, consumption closely approaches availability because food is not wasted. However, the statistics on oils and fats availability for food items do not take into account secondary products such as margarine, ghee, shortenings, and cooking oils, which are exported. Therefore, in countries that are major exporters of edible oils (e.g., Malaysia, North America, and certain European countries) the statistics on availability may be overestimated. On the other hand, in net importing countries the figures may be understated. Nevertheless, it is still worthwhile to examine the data on the availability of dietary fats because they do provide a general picture on the situation and permit gross comparisons.

Figure 35.1 shows that the dietary oils and fats availability in developed countries has been increasing during the five year period, from 19.2 kg/capita/year in 1970 to 23.5 in 1990. A similar rise can be seen for developing countries, which increased from 7.2 kg/capita/year in 1970 to 12.0 in 1990. However, a large gap in availability between the two groups of countries can be observed, and this gap remained more or less the same over the two decades. The WHO targeted dietary fat intake for populations is 20–25 kg/capita/year (3), which as can be seen, has already been reached in developed nations. However, in the developing world, the average availability for oils and fats over the period is only about 9.4 kg/capita/year. This would mean that countries occupying a low position on the economic ladder are probably fat/calorie deficient and, therefore, that their populations could be at greater risk to nutrient deficiencies.

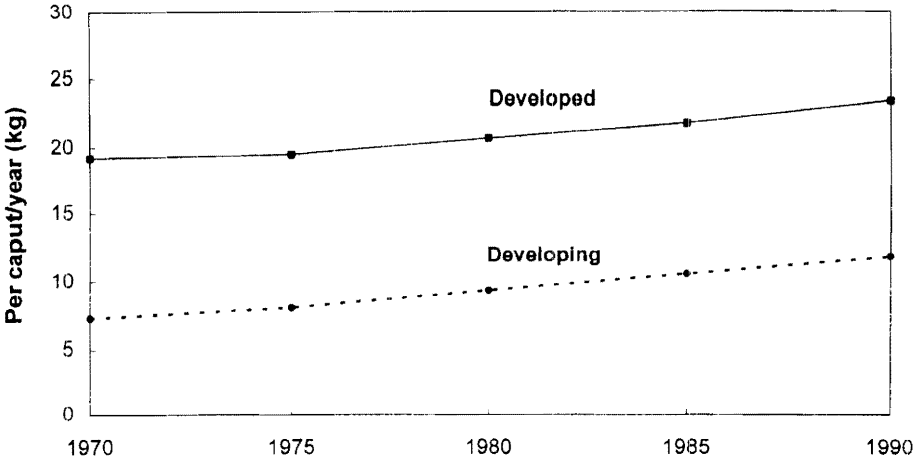

Fig. 35.1. Five-year averages of oils and fats availability in developed and developing countries (1970–1990).

Table 35.1 and Figure 35.2 show the availability of oils and fats in various developing countries from 1987–1993. The differentiating factors among the countries are cultural differences, thus targeting their food habits, position in the economic ladder, and population. A substantial disparity in availability can be observed for the different regions. Some of the regions recorded an increase in availability over the period, while for others per caput availability has remained stagnant.

Among the regions with the lowest per capita availability of oils and fats are South Asia and Africa. The average per capita availability in South Asia (Pakistan, Bangladesh, and India) was 8.1 kg/caput/year and this is equal to an average of only 200 kcals/d or 10% of dietary energy (based on a 2000 kcal diet). These countries have low income and large populations, showing a tendency to perpetuate their situation of not having enough dietary calories. Protein and carbohydrate intake may very likely be low as well. Micronutrient deficiencies will also become significant problems.

African countries, which had an even lower average per capita dietary fats availability of 5.5 kg/year (135 kcal/d), act out the same scenario. Sub-Saharan Africa is one of the countries with high percentages of populations taking dietary energy of below 1.54 BMR (4,5).

TABLE 35.1 Oils and Fats Availability (kg/capita/year), 1987–1993

Countries	1987	1988	1989	1990	1991	1992	1993
Developed	21.8	22.1	22.0	23.1	21.1	21.4	22.2
Middle and South America	19.8	20.4	21.3	21.1	19.0	18.7	21.9
Near East	12.7	14.1	14.4	14.9	13.9	14.8	14.0
East Asia	15.1	15.4	15.3	16.3	16.8	17.2	17.8
South East Asia	10.9	11.3	11.8	11.5	13.6	15.2	17.1
South Asia	7.7	7.8	8.0	8.1	8.2	8.4	8.5
Africa	5.5	5.5	5.2	5.3	5.4	5.5	5.6

Source: Reference 6.

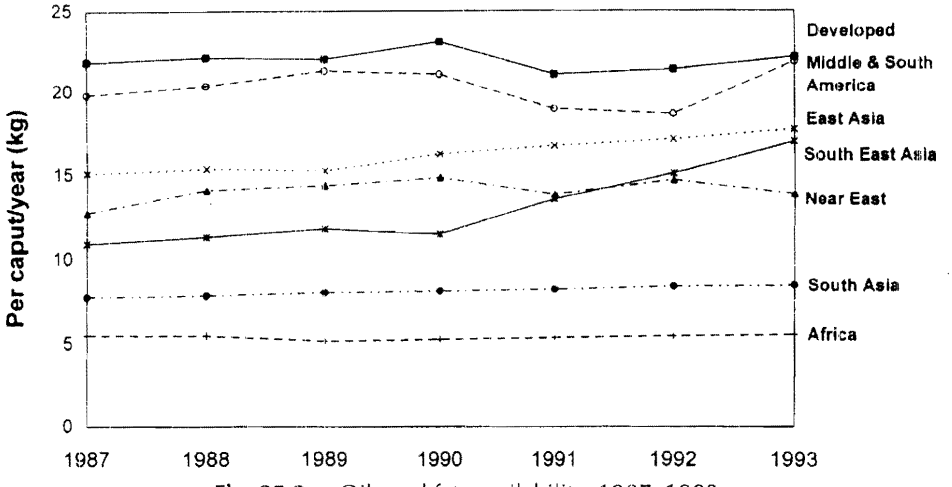

Fig. 35.2. Oils and fats availability, 1987–1993.

On the other hand, other developing regions such as South East Asia and East Asia have shown a steady improvement in the dietary oils and fats availability. South East Asia had an annual average availability of 13.0 kg/caput (300 kcal/d), and East Asia had an average of 16.3 kg/caput/year (400 kcal/d).

Middle and South America seem to have kept up with the developed nations. The average annual oils and fats availability in the developed nations is 22.0 kg/caput (540 kcal/d), while in Middle and South America it is 20.5 kg/caput (500 kcal/d).

In regions with energy deficiency problems, oils and fats play a major role in satisfying the demand for a concentrated source of calories. Palm oil, being readily available at a lower cost in the world market, may play a major role to combat the potential for protein-energy malnutrition in the developing countries.

In regions with trends of increasing availability of dietary fats and oils, such as East Asia, Southeast Asia, and Latin America, some focus on the qualitative aspects of oils and fats may be required (on the usage of natural oils and fats with minimal processing, for instance).

Trends in Availability of Dietary Energy Supply

Because fats and oils are important sources of dietary energy, energy supply reflects availability. The dietary energy supply (DES) for developing countries has increased to an average of 2,470 kcal/caput/d in 1988/90, from a level of 2,330 in 1980 and 2,120 in 1970. Figure 35.3 gives the trends in DES by different regions. The rate of increase in DES per capita has been generally slow in the 1980s when compared to the 1970s. The dietary energy supply in China (East Asia) increased from around 2,000 kcal in 1970 (about the lowest in the world at that time) to a high level of more than 2,500 in 1990. Southeast Asia also showed significant increases, although slightly less than China. In South Asia, energy availability has remained very low, although slightly increasing during the last 15 years. The food situation in Africa is

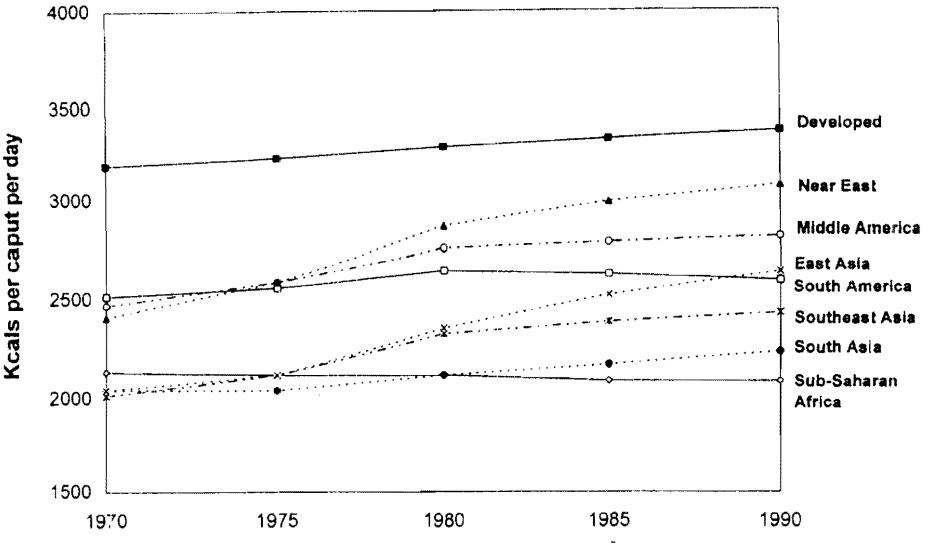

Fig. 35.3. Dietary energy supply, 1970–1989.

most serious as it experienced some declines in the mid-1980s as a result of drought, recovering later but remaining flat since then.

Food and Agriculture Organization (FAO) has used these figures for dietary energy supply to estimate proportions and numbers of people with inadequate dietary intake. As Figure 35.4 shows, there has been a substantial reduction in the proportions of people underfed, particularly in Asia and the Near East/North Africa for the period 1970–1990. However, the proportion is estimated to have slightly risen in Sub-Saharan Africa. Overall, the decrease in the underfed proportion led to

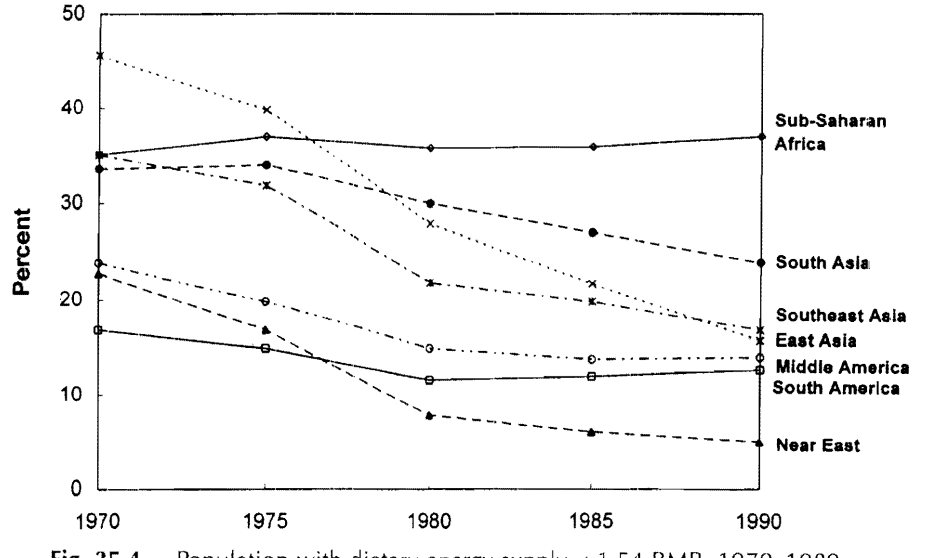

Fig. 35.4. Population with dietary energy supply < 1.54 BMR, 1970–1989.

a considerable drop in the numbers consequently affected, from nearly 1,000 million in 1974/76 to about 800 million in 1988/90 (ACC/SCN, 1992).

Trends in Nutritional Status

Undernutrition continues to be a significant problem in many developing countries. In the 1960s, it was widely believed that childhood undernutrition was primarily due to the insufficiency of protein in the diet. It was subsequently shown that the more important nutrient is not protein, but rather energy. Protein-energy malnutrition (PEM) does occur together when both protein and energy are insufficient due to the lack of food supply, but the extent of energy deficit is greater than that of protein.

PEM can occur in various population groups. In early infancy, when breast milk is not given, inadequate formula feeding may precipitate PEM. The deficiency can affect preschool children, bringing about high mortality rates and morphological and functional changes in the chronic, mild, and moderate forms. Depending on the age of onset and duration, such deficiencies can have irreversible consequences for later life. In women of child-bearing age, energy malnutrition can affect pregnancy outcome and fetal development. In adults engaged in moderate to heavy physical labor, inadequate energy intake limits daily activities.

With the increasing energy availability in many developing countries, the prevalence of PEM in many communities has declined. Between 1975 and 1990, the total prevalence of underweight children ages 0–5 in developing countries is estimated to have fallen by 7.3%, approximately from 42% to 34%. Underweight children are defined as being below minus 2 standard deviations from the mean weight-for-age. Figure 35.5 and Table 35.2 show these changes in nutritional status for various regions. For most regions, the decline in the percentage of underweight children was higher in the 1970s than during the 1980s. In China and the Americas, the improve-

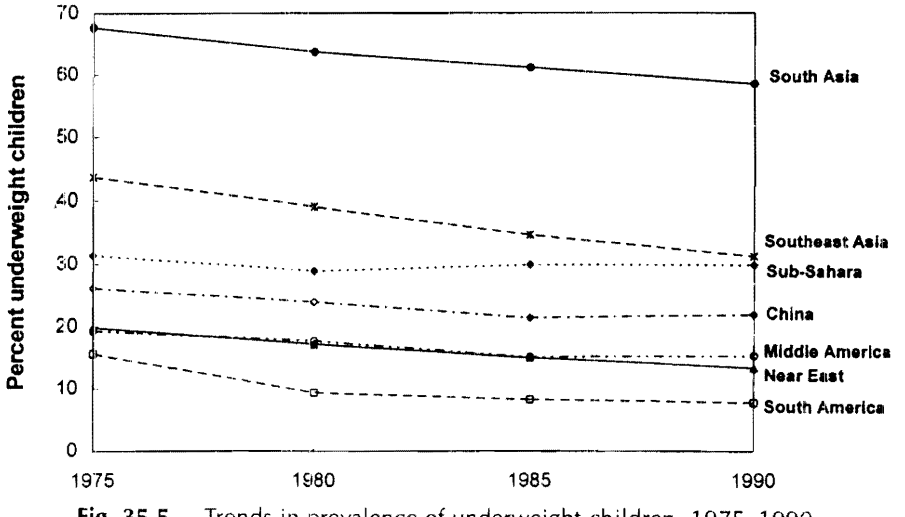

Fig. 35.5. Trends in prevalence of underweight children, 1975–1990.

TABLE 35.2 Regional Prevalence and Numbers of Underweight Preschool Children in Developing Countries, 1975–1990

	Percent underweight				Numbers underweight[a]			
Region	1975	1980	1985	1990	1975	1980	1985	1990
Sub-Saharan Africa	31.4	28.9	29.9	29.9	18.5	19.9	24.1	28.2
Near East/North Africa	19.8	17.2	15.1	13.4	5.2	5.0	5.0	4.8
South Asia	67.7	63.7	61.1	58.5	90.6	89.9	100.1	101.2
South East Asia	43.6	39.1	34.7	31.3	24.3	22.8	21.7	19.9
China	26.1	23.8	21.3	21.8	20.8	20.5	21.1	23.6
Middle America/Caribbean	19.3	17.7	15.2	15.4	3.4	3.1	2.8	3.0
South America	15.7	9.3	8.2	7.7	4.8	3.1	2.9	2.8
Global Total	41.6	37.8	36.1	34.3	168	164	178	184
Total 0–4 child population in developing countries					402	434	493	536

Source: Reference 1.
[a]In millions.

ment in nutritional status in the late 1980s was less than the early 1980s. Nutrition in Sub-Saharan Africa probably deteriorated on average during the 1980s.

Figure 35.6 illustrates, in another way, the prevalences and numbers of underweight children by region for 1980 and 1990. In this graph, the underweight percentage for the children is plotted on the left axis, while the right axis is the number of children underweight. It can be seen that for some regions the numbers of children underweight have increased though the prevalence has declined. These regions include South Asia, China, and, particularly, Sub-Saharan Africa.

As a result of the increasing affluence in many developing countries, rapid changes are occurring in the life-styles of the populations in these countries, includ-

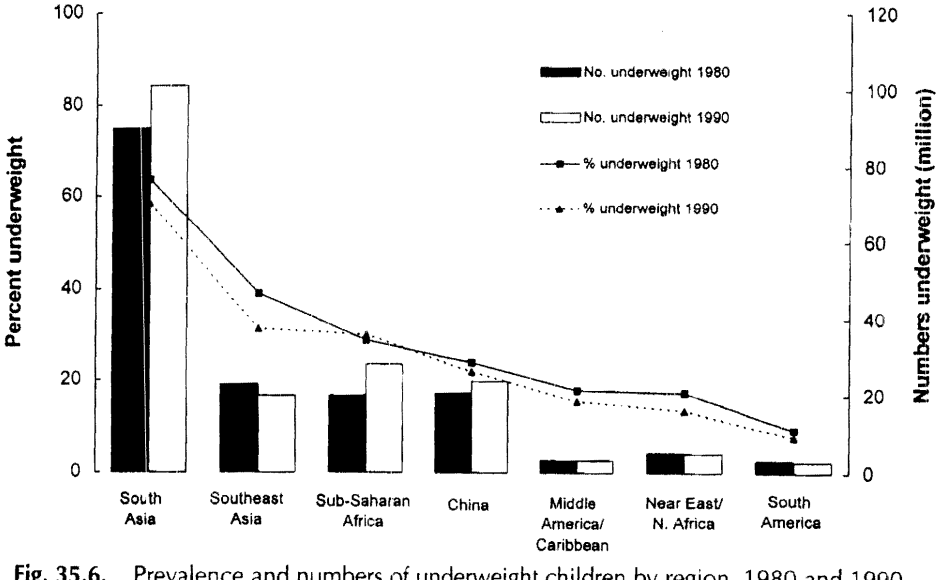

Fig. 35.6. Prevalence and numbers of underweight children by region, 1980 and 1990.

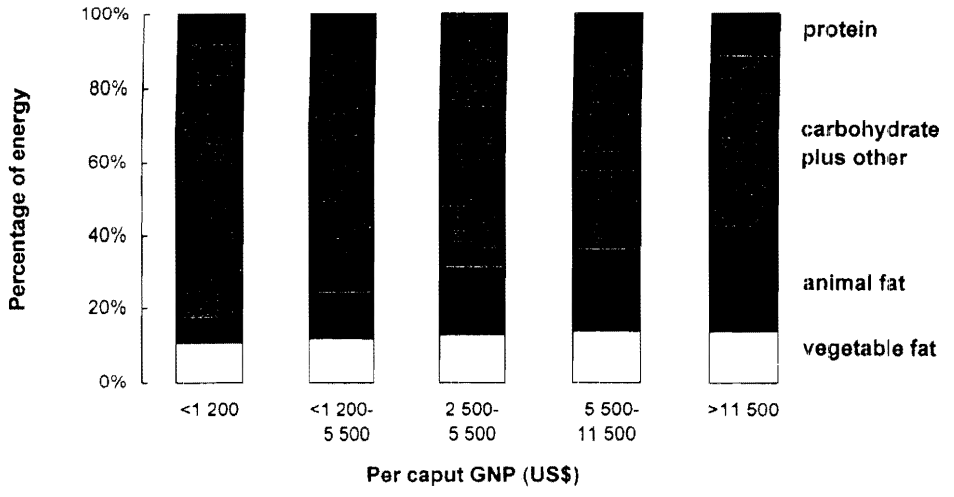

Fig. 35.7. Components of diet in relation to per caput gross national product.

ing changes in dietary patterns. The percent of energy from fats and oils, and therefore dietary energy supply, in these countries has significantly increased during the years. Figure 35.7 shows how the main components of the diet tend to be related to a nation's relative affluence. As gross national product (GNP) increases, there is a shift toward an "affluent" diet characterized by an excess of energy-dense foods rich in fat, particularly animal fats, and a parallel decline in complex carbohydrate foods. Free sugars, particularly sucrose and glucose syrups, also form a much higher proportion of the total dietary carbohydrates in very affluent communities (e.g., 50% as compared to the 5–10% observed in many communities with a low income).

The shift toward a "westernized" dietary pattern has brought about a new nutrition scenario in many developing countries. These countries are now faced with the twin problems of malnutrition, (i.e., undernutrition among some segments of the communities and the problems of obesity and associated disorders in other groups). These disorders, frequently termed the diet-related chronic noncommunicable diseases, include coronary heart disease, cerebrovascular disease, various cancers, diabetes, dental caries, and osteoporosis (4). With increasing GNP, mortality from these diseases has significantly increased in many developing countries in all regions of the world (Fig. 35.8). Modest increases in prosperity in populations with low GNP seem to be associated with the most marked increases in the proportion of these chronic diseases (9). Such diseases will pose a great stress on the health services of less affluent and developing communities that cannot afford such expenditures. In Malaysia, for example, a new dimension of the nutrition scene in the country is the increasing prevalence of diet-related noncommunicable diseases brought about by rapid socioeconomic development and reflected in changes in dietary patterns and lifestyles, as well as increased life expectancy of the population. Epidemiological data show that there is an increasing prevalence of diseases such as obesity, diabetes, cardiovascular diseases, and cancer (8).

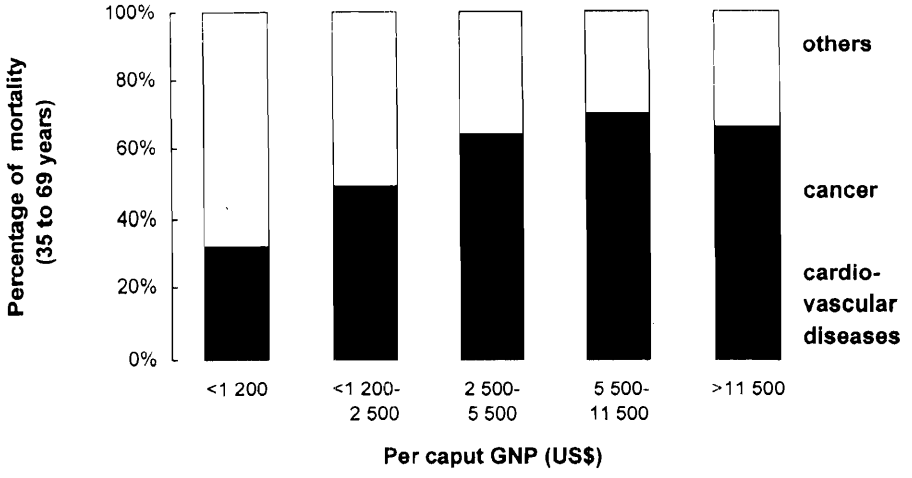

Fig. 35.8. Proportion of deaths from cardiovascular diseases, cancer, and other diseases, for both sexes aged 35–69 years, in relation to per capita gross national product.

Conclusions

Dietary fats and oils play an important role in the nutritional well being of communities. In many developing countries, the priority is still the procurement of a sufficient food supply (including dietary fats and oils) for the whole population and the elimination of various forms of nutritional deficiency among vulnerable groups (e.g., protein-energy, vitamin, and mineral deficiencies). Improvement is needed in the quality as well as the quantity of the diet, but greater quantities of food are particularly important in sub-Saharan Africa and Southern Asia.

At the same time, there has been a definite shift in some developing countries toward an "affluent" diet characterized by not only an excess of energy-dense foods rich in fat and free sugars, but also a deficiency of complex carbohydrates foods. These countries are at a nutritional cross-road whereby the problem of PEM has not been solved while the problem of positive energy balance or obesity and its associated complications have emerged. The challenge for these countries is to cope with these twin problems of malnutrition.

The nutritional issues highlighted in this chapter have been dealt with in detail at the International Conference on Nutrition jointly organized by the Food and Agriculture Organization and the World Health Organization in December 1992. The Conference, attended by more than 1,300 representatives from government organizations and NGOs from 162 nations, adopted The World Declaration on Nutrition. A global Plan of Action with specific and detailed strategies and actions was drawn up to provide guidelines to achieve the objectives of the Declaration (5). Countries are now preparing their respective national plans of action to tackle the most pertinent and important nutritional issues to their people.

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