

Dietary and related factors leading to increases in chronic diseases

Many studies have shown the nutrition transition in Asia and the Pacific, as well as the developing world in general [7, 8]. Typically, there are dramatic increases in overall fat intake and a corresponding reduction in the proportion of dietary energy from starchy staple foods, accompanied by a shift from coarse grains and legumes toward more refined grains (mainly rice and wheat), a greater intake of meat, fish, dairy products, and edible oils, and a reduction in fruit and vegetable intake [9]. The general effect is to make diets less bulky, and more energy-dense. There are, however, important variations among these countries. For example, the increase in fat intake and decrease in vegetable intake in the Republic of Korea are far less than might be expected from its development status [10].

This review describes the nutrition transition in Asia and in some SIDS of the Pacific, as well as some of the factors that predict high levels of chronic disease: low birthweight (LBW) and stunting, inappropriate diets, low levels of physical activity, and urbanization. The analyses are mainly at country level, with some household and individual level studies. This broad approach, using averages, inevitably obscures variations within countries.

Fetal and infant insults and related effects: low birthweight (LBW) and stunting

A growing set of studies [11–17] suggests that fetal and infant nutrition insults affect predisposition to CVDs, obesity, hypertension, and adult-onset diabetes. These same insults also may compromise immune function [18]. These early nutrition-related insults contribute to later, diet-related chronic diseases. LBW (associated with thinness) and stunting, have both been linked with these adverse risk profiles, but the mechanisms for this are unclear and this leads to uncertainty about appropriate interventions [19, 20].

High rates of LBW and stunting, accompanied by concurrent rapid shifts in diets and activity patterns and increased obesity, are of special importance in

rapidly developing countries, such as those of Asia and the SIDS of the Pacific. There are very high incidences of LBW in the lower low-income countries, particularly in Bangladesh, India, Nepal, Pakistan, and Sri Lanka and in the Lao PDR. There is, however, enormous variation in LBW rates among countries in the same income groups.

There are no systematic data on the proportion of LBW babies who were born with disproportionately retarded intrauterine growth (IUGR) and who were born very thin. In one 12-month birth cohort sample of all pregnancies in 33 communities, representative of metropolitan Cebu in the Philippines, 36.7% of LBW babies had disproportionately low ponderal indices (PI) at birth [22]. This topic is considered later in a discussion of fetal programming and the effects of LBW on subsequent cardiovascular-related outcomes.

For analysis of stunting, defined as 2 Z-scores below the height-for-weight standard in children aged 2.0 to 5.9 years, the data used are from large, nationally representative surveys. Stunting prevalence is very high in Bangladesh and Indonesia, countries with high LBW rates (fig. 1 and 2), but there are high stunting rates in other upper and lower low-income countries, and in the Republic of Fiji Islands, the only SIDS for which we have data. Elsewhere in Asia, researchers have shown a decline in the proportion of children who are stunted, albeit a decline that is slower than declines in wasting and in LBW [23].

Shifts in the structure of diets

Food disappearance data, from the Food and Agriculture Organization of the United Nations (FAO), were used to document the nutrition transition in Asia and in some SIDS of the Pacific. These are the only data that allow comparisons among countries of the total food available for human consumption. National-level data on food available for consumption comprise the sum of total food production, plus imports, minus exports, and net of losses from processing at the mill

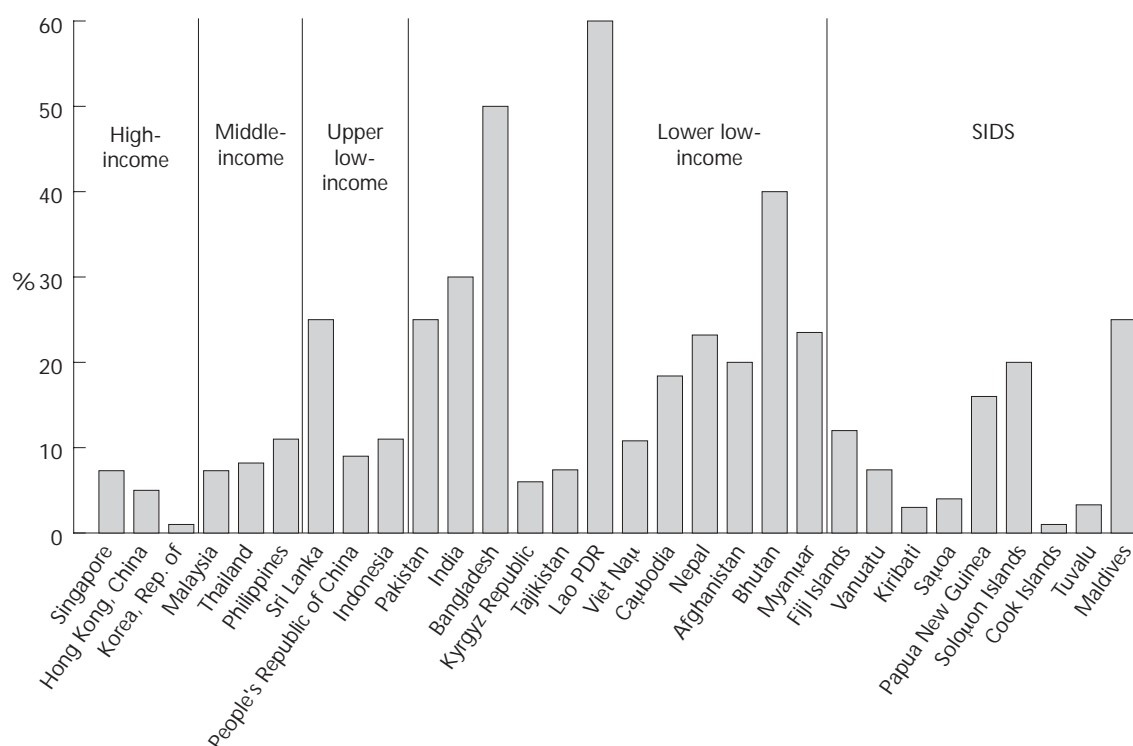


FIG. 1. Prevalence (%) of low birthweight in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: ref. 21

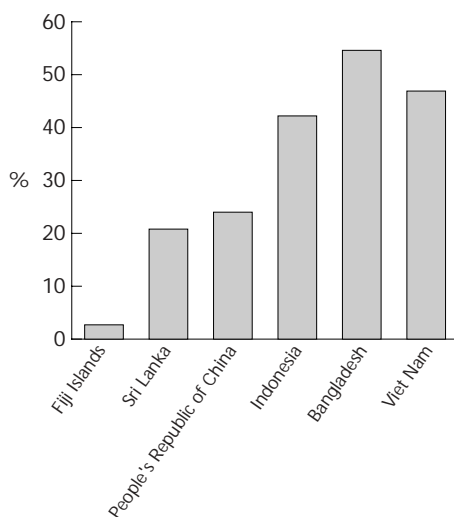


FIG. 2. Prevalence (%) of stunting among children aged 2 to 6 years in Asian countries and the Fiji Islands. These data are the most recent available for each country in the 1990s, e.g., 1993 for the People's Republic of China, Indonesia and Viet Nam. Sources: Fiji, data provided by the Pacific Commissions; Indonesia [24]; PRC, People's Republic of China Health and Nutrition Survey (1993), http://www.cpc.unc.edu/projects/china/china_home.html; Viet Nam [25]; Sri Lanka [26]; Bangladesh country report, ADB regional technical assistance project 5824, ADB Manila, 2000

level and food fed to animals. They do not, however, reflect actual consumption as there are additional losses in the food-chain that link producers and processors to consumers.

Typically scholars who have compared food disappearance data with household and individual food intake data, estimate that disappearance data measure about 20% to 27% more food available for consumption than actual consumption levels. In addition, it is important to note that a greater proportion of perishable foods is lost, wasted, or discarded between production and consumption than is the case with nonperishable foods. For example, food balance data overestimate the amount of fruits and vegetables available for consumption, relative to grains and tubers. Moreover, assumptions of food extraction and perishability have not been adjusted over time and it is possible that improvements in storage and distribution of food, in particular for the more perishable fruits and vegetables, might underestimate intakes today compared to intakes more than two decades ago.

Aggregate FAO food disappearance data measure aggregate consumption and do not measure food distribution to specific areas, to urban and rural populations, to households of various income levels, or to individuals in various age-gender groups. Moreover, using comparisons of country groups means losing detailed variations among countries. Some country groups (table 1) are dominated by one or two countries

with large populations, e.g., the high-income group by the Republic of Korea, the middle-income group by Thailand and the Philippines, the SIDS by Papua New Guinea, the upper low-income group by the PRC, and the lower low-income group by India.

Three-year averages were calculated for each country and the averages were weighted for 1996 population size within country groups, so that the values would represent the actual population sizes within country groups.

In general, Asia and Pacific SIDS are becoming less dependent on locally produced and frequently monotonous diets based on staple grains and starchy roots. They are being replaced by diets that include much more fat, more foods of animal origin, and

often more sugary food and drink, much of which is produced elsewhere in the country or imported [27]. At the same time, the shift toward diets that are notably more energy-dense, that contain much more fat, more added sugar and sometimes more alcohol, with a marked reduction of starchy staples, is increasing the incidence of diet-related chronic diseases, some of which have become epidemic with remarkable speed.

Available food consumption data are summarized in table 2. The total energy available for consumption has increased and most countries are experiencing large shifts in the structure of their diets. The proportions of energy by dietary components are presented for each country group.

TABLE 2. Trends in foods available for consumption [annual totals in kg per capita] from 1962 to 1996 for Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific

Food group		1962	1967	1972	1977	1982	1987	1992	1996
Cereals	High-income	175.6	192.8	217.3	210.9	184.6	184.4	163.2	163.3
	Middle-income	126.6	129.8	136.7	135.4	136.2	129.8	142.6	133.9
	Upper low-income	122.5	145.0	153.0	165.3	194.3	200.9	197.4	192.1
	Lower low-income	147.8	144.2	151.8	148.9	154.7	159.5	164.7	171.9
	SIDS	36.4	43.2	50.8	55.1	61.5	68.1	74.8	88.0
Starchy roots	High-income	42.3	51.4	44.8	31.5	22.8	16.7	16.9	18.4
	Middle-income	28.6	25.1	20.3	37.9	29.7	28.3	31.3	31.4
	Upper low-income	108.5	109.2	107.1	101.5	81.9	63.6	59.3	62.5
	Lower low-income	11.5	15.0	17.1	20.2	20.8	19.7	20.4	21.1
	SIDS	307.4	297.9	282.4	268.3	255.4	243.7	225.5	208.1
Cereals and starchy roots	High-income	217.8	244.2	262.1	242.4	207.4	201.0	180.1	181.7
	Middle-income	155.2	154.9	157.0	173.3	165.9	158.1	173.9	165.3
	Upper low-income	231.0	254.2	260.1	266.8	276.3	264.4	256.7	254.7
	Lower low-income	159.3	159.3	168.9	169.1	175.5	179.3	185.1	193.0
	SIDS	343.8	341.2	333.2	323.3	316.9	311.8	300.3	296.0
Dairy products	High-income	5.1	4.6	7.0	10.2	14.8	19.9	25.6	27.9
	Middle-income	12.4	14.5	14.7	17.6	16.8	18.8	34.5	40.8
	Upper low-income	2.9	2.5	6.5	3.3	4.2	5.5	8.9	10.1
	Lower low-income	38.5	35.5	35.7	37.8	41.7	46.8	50.2	55.0
	SIDS	9.5	12.6	15.0	14.0	14.2	14.5	16.3	16.7
Eggs	High-income	2.4	3.2	5.0	6.0	7.3	8.7	9.5	9.7
	Middle-income	5.2	5.4	5.7	6.6	6.3	6.2	8.6	8.3
	Upper low-income	1.8	1.8	1.9	2.1	2.6	4.7	7.2	12.5
	Lower low-income	0.4	0.5	0.6	0.7	0.8	1.1	1.2	1.3
	SIDS	0.7	0.7	0.8	0.8	1.0	1.1	1.2	1.3
Dairy products and eggs	High-income	7.5	7.8	12.0	16.2	22.0	28.5	35.1	37.6
	Middle-income	17.6	19.9	20.4	24.2	23.1	25.0	43.1	49.1
	Upper low-income	4.5	4.3	8.5	5.4	6.8	10.2	16.1	22.6
	Lower low-income	38.9	35.9	36.2	38.5	42.6	47.9	51.4	56.3
	SIDS	10.2	13.3	15.8	14.9	15.3	15.6	17.4	18.0
Meat/poultry	High-income	8.6	10.8	13.5	16.8	23.7	28.8	40.2	48.1
	Middle-income	12.7	15.2	15.0	15.8	18.1	18.7	27.7	30.6
	Upper low-income	4.6	8.6	9.2	9.4	13.7	19.2	26.9	35.2
	Lower low-income	4.9	5.0	4.9	4.9	5.3	5.8	6.5	6.9
	SIDS	15.9	17.8	20.9	22.8	22.9	25.5	27.9	27.3

continued

TABLE 2. Trends in foods available for consumption [annual totals in kg per capita] from 1962 to 1996 for Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific (*continued*)

Food group		1962	1967	1972	1977	1982	1987	1992	1996
Fish, and other seafood	High-income	15.9	22.0	32.0	39.5	44.7	49.0	48.7	51.7
	Middle-income	17.5	24.8	28.3	29.2	29.9	30.0	31.6	31.4
	Upper low-income	5.5	5.6	5.5	6.2	6.5	10.1	14.2	22.7
	Lower low-income	3.6	4.2	4.5	4.2	4.1	4.4	5.1	5.4
	SIDS	18.3	23.1	30.1	26.8	36.9	39.4	30.4	25.5
Fruits	High-income	11.5	19.9	26.1	33.5	44.6	55.1	82.8	94.9
	Middle-income	81.8	81.0	73.3	100.0	109.6	105.3	88.0	93.5
	Upper low-income	16.3	14.4	13.9	14.3	17.5	28.0	33.1	51.5
	Lower low-income	26.6	28.1	26.0	25.4	27.0	29.1	29.8	33.4
	SIDS	176.3	179.5	181.7	181.1	176.6	168.6	173.6	165.9
Vegetables	High-income	70.4	84.4	97.1	168.7	171.2	160.5	167.6	169.5
	Middle-income	47.6	47.0	48.7	47.6	47.6	45.6	45.3	48.5
	Upper low-income	59.1	42.2	36.7	38.2	47.8	71.8	88.6	123.2
	Lower low-income	32.5	35.3	37.5	38.8	41.1	43.8	44.4	46.3
	SIDS	65.7	69.6	70.5	70.0	71.5	73.0	71.7	67.9
Fruits and vegetables	High-income	81.9	104.3	123.2	202.2	215.8	215.7	250.4	264.4
	Middle-income	129.4	128.0	121.9	147.7	157.2	151.0	133.3	142.0
	Upper low-income	75.5	56.7	50.5	52.6	65.3	99.9	121.6	174.7
	Lower low-income	59.1	63.4	63.5	64.2	68.1	72.8	74.2	79.6
	SIDS	242.0	249.1	252.1	251.1	248.0	241.6	245.3	233.8
Animal fats	High-income	1.1	1.3	2.2	3.2	2.3	2.4	2.7	3.3
	Middle-income	0.7	1.0	1.0	1.0	1.0	1.0	1.8	1.4
	Upper low-income	0.3	0.5	0.6	0.7	0.8	1.0	1.3	1.6
	Lower low-income	1.0	1.0	1.0	1.0	1.0	1.1	1.3	1.5
	SIDS	1.3	1.6	1.9	2.2	2.0	2.3	2.1	2.7
Added sugar	High-income	4.6	6.4	9.7	13.5	17.0	27.0	32.8	35.5
	Middle-income	12.1	15.7	17.0	20.5	20.6	22.4	26.2	31.7
	Upper low-income	3.5	4.1	4.5	5.2	7.5	8.7	8.5	9.1
	Lower low-income	16.3	16.7	17.3	17.8	17.8	18.5	19.7	20.1
	SIDS	9.2	11.4	13.1	13.2	14.1	13.2	12.2	13.6

Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org/>

Notes: Values are 3-year averages, weighted based on countries' within groups income at each point in time. For country groups, see table 1.

Trends in per capita food availability are presented in figures 3 and 4 for lower low-income and high-income countries. The lowest income countries, dominated by India, show an actual increase in cereal and starchy roots availability and more modest increases in other foods. In contrast, the highest income countries have decreased their supplies of cereals and starchy roots, tripled their fruits and vegetable availability, and increased their dairy and egg, meat and poultry, and added sugar availability.

Apart from increases among lower low-income and a slight increase among upper low-income countries, there is a marked decline in the availability of cereals and starchy roots—items that have provided much of the dietary energy of Asians and Pacific islanders for centuries (fig. 5). These aggregate trends mask a significant shift away from so-called coarse and higher fiber grains to rice and wheat, which are usually refined [9, 28].

For all the countries studied here, there is a marked increase in availability of eggs and dairy products

(fig. 6). Surprisingly, the highest intakes are in the lower low-income countries. This reflects partially, among the high-income countries, the low importance of dairy products in the Republic of Korea. Hong Kong, China has a high supply of dairy products, but this accounts for little in the total weighted average in the high-income group. India is predominant in the lower low-income group and is a high consumer of dairy products. This gives the impression that the availability in the lower low-income group is high relative to all other groups. Eggs and dairy products are important sources of saturated fats in the diet. In India, consumption of *ghee*, a highly saturated fat product, is important because high consumption of saturated fats is closely related to chronic diseases.

Meat and dairy products are also major sources of saturated fats and major contributors to chronic diseases. A very rapid annual growth in consumption of meat and dairy products from 1993 to 2020 has been projected [29], e.g., for the PRC, consumption

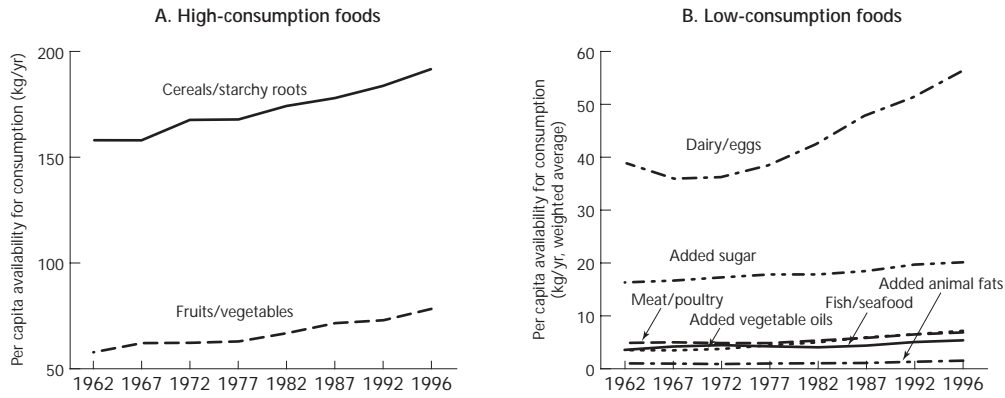


FIG. 3. Trends in per capita food available for consumption for lower low-income Asian countries. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; for the names of lower low-income Asian countries, see table 1

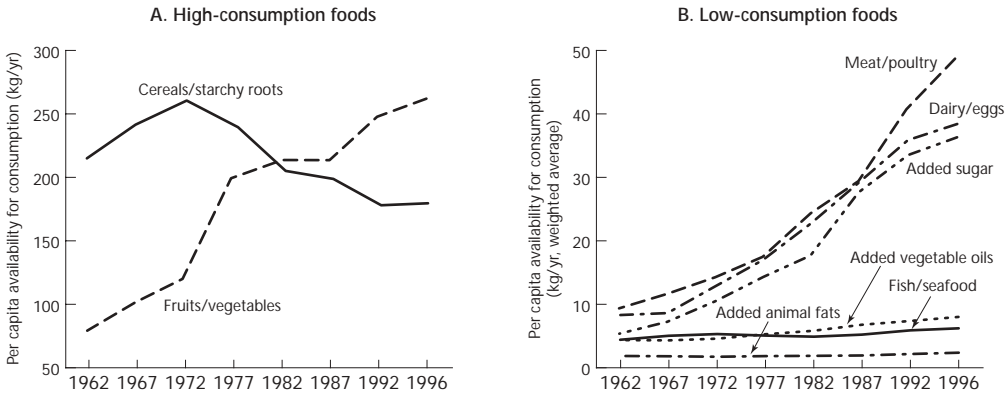


FIG. 4. Trends in per capita food available for consumption for high-income Asian countries. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; for the names of high-income Asian countries, see table 1

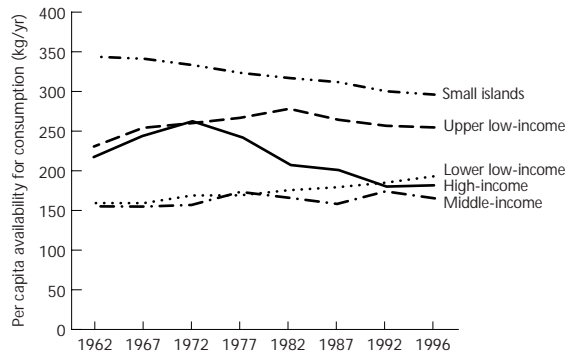


FIG. 5. Trends in food cereals and starchy roots available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

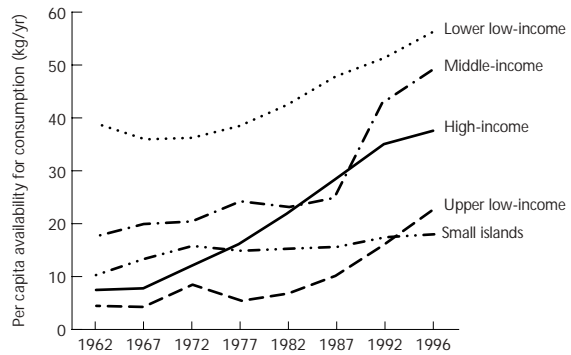


FIG. 6. Trends in dairy and egg products available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

of meat and dairy products is projected to increase at 3.0% and 2.8% per year, respectively, over this period. The corresponding rates of increase for combined meat and dairy products for East Asian countries, other than the PRC, and for Southeast Asia, are about 2.0% and 2.8% [29]. Other research from the PRC finds a much higher income elasticity and rate of change in meat and dairy product consumption [30].

Fruit and vegetable availability has increased markedly for the high-income and the upper low-income countries (fig. 7). It is improving slightly for the middle-income and lower low-income countries. It remains very high for the SIDS. However, continuing reductions in fruit and vegetable intake have been indicated by household surveys in the PRC [9].

The availability of added animal fats and vegetable oils has increased markedly for all the countries stud-

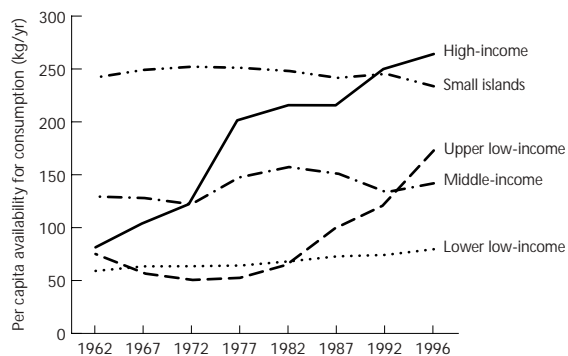


FIG. 7. Trends in fruits and vegetables available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

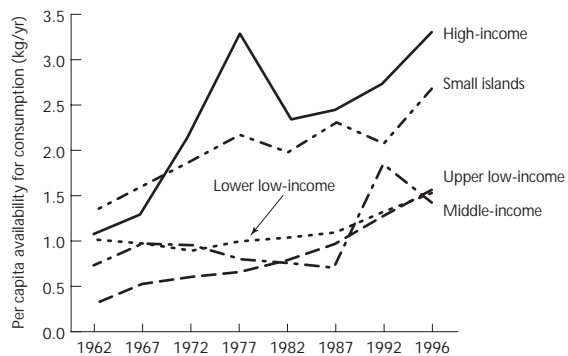


FIG. 8. Trends in added animal fats available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

ied. Availability is particularly high for edible vegetable oils. These vary in origin from country to country and include red palm, coconut, corn, soybean, and cottonseed oils. In Sri Lanka and the Philippines, coconut oil is a major source of saturated fat. In Malaysia, edible oil comes largely from red palm oil, which has a high polyunsaturated to saturated fat ratio and is more healthy than coconut oil. The processing of these edible oils varies greatly. There is little systematic research on the composition of these oils. One small study has found trans fatty acid levels of about 50% in *dalda*, a vegetable *ghee* widely consumed in India (Willett WC, personal communication, 2000).

Figures 8 and 9 show that the high-income countries already have a very high consumption of added fats and that all the low-income countries show very rapid recent increases in availability of these items. Increased edible oil is a key reason for the marked increases in energy density of Asian diets [8].

Availability of sugar, added in processed food production and at home, is increasing among the middle- and high-income countries and is high in all countries, except upper low-income countries (fig. 10). In particular, note the high level for lower low-income countries and the contrasting very low level for upper low-income countries. This relates mainly to the very low levels of added sugar consumed in the PRC, as compared to most other countries in Asia.

Figures 11 to 15 depict subcategories within macronutrient categories, to emphasize some of the changes in availability of energy. Energy from added sugar was separated from energy from carbohydrates, to describe its energy contribution meaningfully. Energy from sweeteners in food balance sheets was considered to be 'energy from added sugar' and this was subtracted from total carbohydrate energy to get 'energy from carbohydrate excluding added sugar.' This is a rough

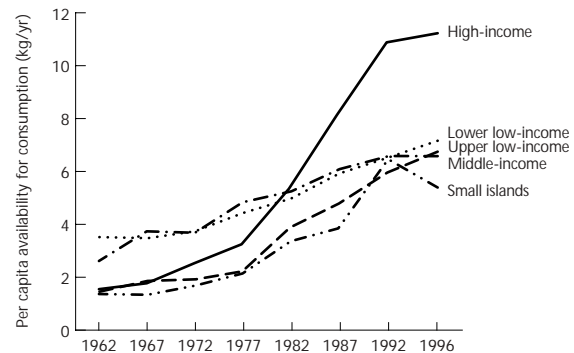


FIG. 9. Trends in added vegetable oils available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

estimation for both 'energy from added sugar' and 'energy from carbohydrate excluding added sugar,' because energy from sweeteners also comes, though minimally, from other nutrients.

Similarly, 'energy from added animal fat' was considered to be from animal fats such as butter, *ghee*, and fish liver oil in the food balance sheets. These refer, however, to a limited category of foods including added animal fats, but not any other fats of animal origin, such as those in meats. At the same time, 'energy from added animal fat' also includes minimal amounts of energy from other nutrients, similar to the case for added sugar. A very rough approximation for 'energy from vegetable oil' was made by subtracting 'energy from added animal fats' from 'total fat energy.' 'Energy from vegetable oil' is, therefore, essentially 'energy from fat excluding added animal fats and therefore

differs from the calories from vegetable oil presented in the sources used here, i.e., the food balance sheets. Although these data are not ideal, these are the best approximation available to illustrate the important trends in fat intake.

The high-income countries have shifted from diets dominated by complex carbohydrates to diets with more fats, added sugar, and protein (fig. 11; table 3). These countries have per capita available energy for consumption of over 3,000 kcal/day. Figures 12 to 15 present energy data for the other country groups. The bulk of the population of Asia has less than 3,000 kcal/day available for consumption per capita and, as indicated, actual energy consumption is lower.

In general, this change to more diverse diets improves access to adequate micronutrients and decreases the incidence of micronutrient deficiencies.

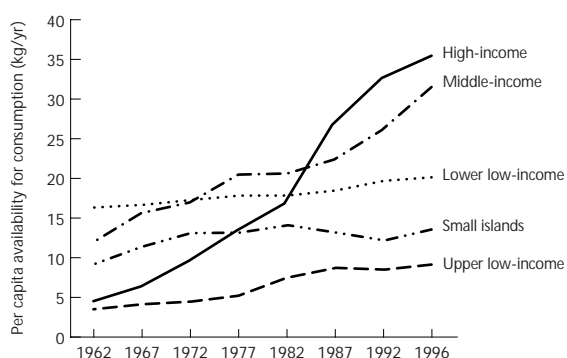


FIG. 10. Trends in added sugar available for consumption per capita in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages, weighted for 1996 country population size within groups; for country groups, see table 1

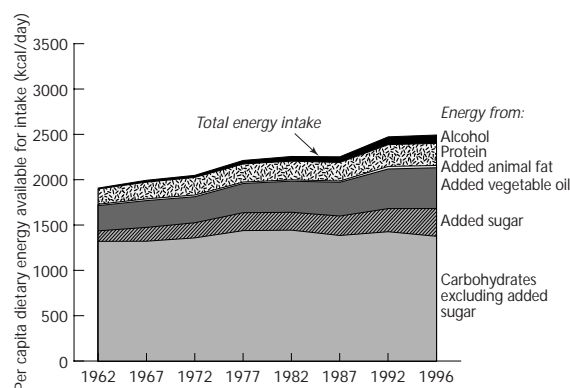


FIG. 12. Trends by source for per capita dietary energy available for intake in middle-income countries of Asia. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; middle-income countries are listed in table 1

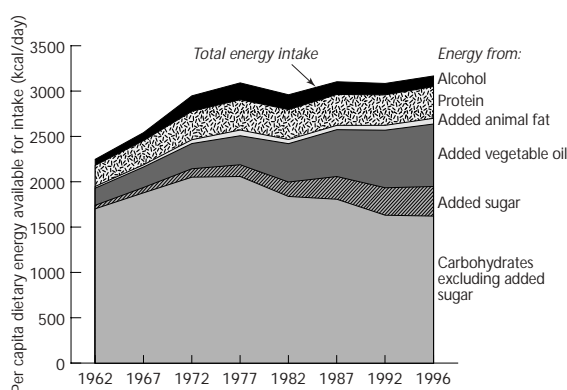


FIG. 11. Trends by source for per capita dietary energy available for intake in high-income countries of Asia. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; high-income countries are listed in table 1

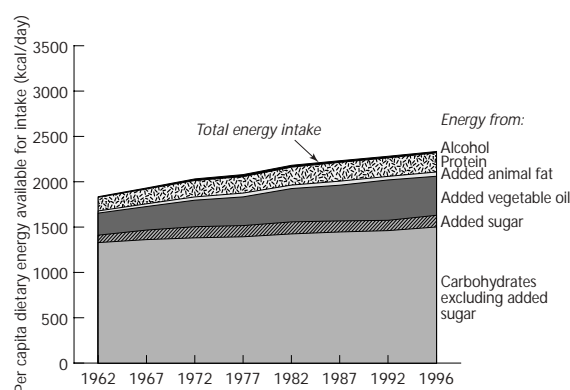


FIG. 13. Trends by source for per capita dietary energy available for intake in Small Island Developing States (SIDS) of the Pacific. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; Pacific SIDS are listed in table 1

TABLE 3. Trends (1962 to 1996) in per capita total dietary energy available for consumption, and in the proportions (%) from different macronutrients, in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific

Group	Year	Per capita total dietary energy (kcal/day)	% dietary energy from			
			Carbohydrate	Fat	Protein	Alcohol ^a
High-income	1962	2,247	77.8	8.8	10.3	3.0
	1967	2,543	76.4	9.6	10.5	3.5
	1972	2,948	72.7	10.9	10.6	5.8
	1977	3,091	70.7	12.5	10.8	6.0
	1982	2,959	67.5	15.8	11.1	5.5
	1987	3,103	66.4	18.1	11.0	4.5
	1992	3,084	62.8	22.3	10.9	4.1
	1996	3,167	61.5	23.7	11.1	3.7
Middle-income	1962	1,908	75.2	15.4	8.9	0.5
	1967	1,995	73.9	15.8	9.2	1.1
	1972	2,050	74.4	15.0	9.5	1.1
	1977	2,213	73.9	15.3	9.0	1.7
	1982	2,258	72.7	15.9	9.1	2.3
	1987	2,254	70.9	17.1	9.1	2.8
	1992	2,474	68.0	18.8	9.7	3.5
	1996	2,497	67.3	19.0	9.8	3.7
Upper low-income	1962	1,715	80.1	9.4	10.1	0.5
	1967	1,953	78.7	11.2	9.6	0.5
	1972	2,017	79.1	11.0	9.3	0.6
	1977	2,110	79.1	11.0	9.2	0.8
	1982	2,436	76.4	13.2	9.1	1.2
	1987	2,583	73.1	15.6	9.4	1.9
	1992	2,672	69.4	18.8	9.8	2.1
	1996	2,831	65.8	21.2	10.4	2.6
Lower low-income	1962	2,020	76.7	13.0	10.1	0.1
	1967	1,949	76.8	13.0	10.0	0.2
	1972	2,034	77.3	12.7	9.9	0.2
	1977	2,044	76.6	13.4	9.8	0.2
	1982	2,115	76.1	13.9	9.8	0.2
	1987	2,215	75.2	14.8	9.7	0.2
	1992	2,309	74.7	15.4	9.6	0.3
	1996	2,422	74.2	15.9	9.6	0.3
SIDS	1962	1,834	76.9	14.6	8.2	0.4
	1967	1,931	76.0	15.0	8.5	0.5
	1972	2,031	74.1	16.2	8.9	0.9
	1977	2,079	73.0	17.3	8.7	1.1
	1982	2,181	71.4	18.6	9.1	0.9
	1987	2,232	70.2	19.7	9.3	0.8
	1992	2,281	69.0	21.3	9.0	0.8
	1996	2,334	69.9	20.5	9.1	0.6

a. % energy from alcohol = 100 - (% energy from carbohydrate + % energy from protein + % energy from fat). Values are 3-year averages, weighted based on country in groups at each year; for country groups, see table 1.

Dairy foods and other foods of animal origin contain micronutrients that can improve the nutrition quality of otherwise relatively monotonous diets.* However, the rapid shift toward more energy-dense diets that contain more fat, more saturated fat, often more sugar,

and more foods of animal origin, contributes to an increase in chronic diseases.

Shifts in physical activity patterns

* Allen LH, Gillespie S. Effectiveness of large-scale nutrition interventions. Washington DC: IFPRI, 2000 (Unpublished manuscript).

Reduced physical activity and habitual inactivity accompany the nutrition transition in persons of all ages [27]. Modernization and industrialization lead to

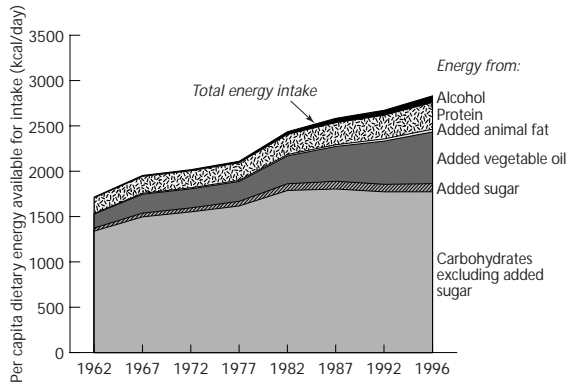


FIG. 14. Trends by source for per capita dietary energy available for intake in upper low-income countries of Asia. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; upper low-income countries are listed in table 1

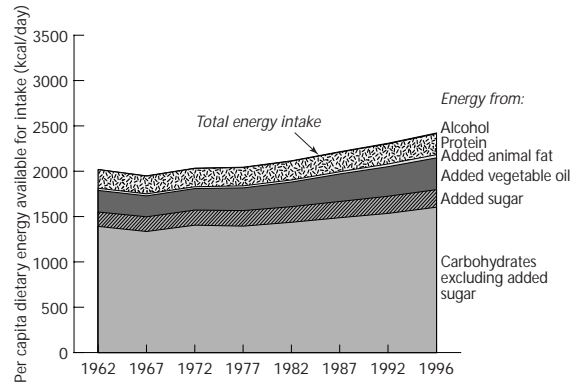


FIG. 15. Trends by source for per capita dietary energy available for intake in lower low-income countries of Asia. Source: FAOSTAT, Food and Agriculture Organization of the UN. <http://apps.fao.org>. Notes: Values are 3-year averages; lower low-income countries are listed in table 1

reduced physical activity, at work and at home, for men and women. The only systematically collected information available at the national level for the countries studied here is on the occupations of men and women. As occupations shift from agriculture and manual labor, to manufacturing and to the service sector, the levels of energy expended by humans naturally drop. The equally profound shifts in activity within occupations have been studied very little. In the PRC, these shifts toward reduced activity within the same occupation have been related to increased obesity [31]. Figures 16 and 17, and table 4, contain national data for the proportions of men and women employed in agriculture, service, and manufacturing in Asia and Pacific SIDS. These data are based on large, continuous, national surveys. In all of the country groups, men are shifting much more than women from agriculture toward industry and service sector jobs.

No Asian or Pacific studies were available for another important determinant of physical activity—modes of transportation. However, there is a shift away from walking and cycling to mass transit and cars—a major change in regular physical activity and thus in energy expenditure. Reduced physical activity outside work is also apparent.

One of the most remarkable changes in the Asia-Pacific region is the explosion of new information sources and mechanisms that reach households even in the most isolated villages and towns. The expansion of mass media, such as television, has major influences on consumer knowledge and attitudes, as well as on diets and physical activity. The percentage of households that own television sets has increased dramatically throughout Asia, particularly in the PRC and higher income countries. In the PRC, the China National Health Surveys [32] showed that television ownership

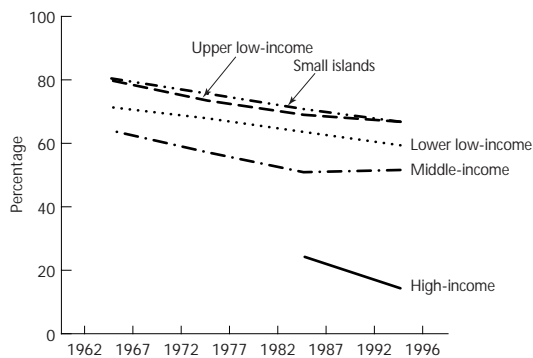


FIG. 16. The percentage of adult males engaged in agricultural occupations in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: [6]. Notes: values are weighted averages, based on country population size within groups; for country groups, see table 1

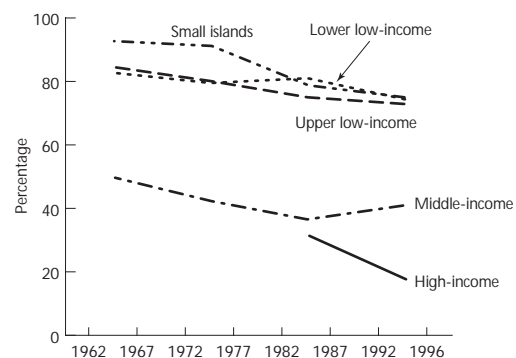


FIG. 17. The percentage of adult females engaged in agricultural occupations in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: [6]. Notes: values are weighted averages, based on country population size within groups; for country groups, see table 1

TABLE 4. The proportions (%) of economically able men and women, aged 18 to 65, employed by work sector in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific, in the 1960s, 1970s, 1980s, and 1990s

Group	Agriculture (%) ^a				Industry (%)				Service (%)			
	1960	1970	1980	1990	1960	1970	1980	1990	1960	1970	1980	1990
Male												
High-income ^b	7.0 ^c	4.2 ^c	24.3	14.4	52.4 ^c	51.5 ^c	32.2	37.7	40.6 ^c	44.3 ^c	38.2	45.4
Middle-income	64.1	57.2	50.9	51.6	14.0	17.5	19.2	18.8	22.0	25.3	30.0	28.7
Upper low-income	79.9	73.5	69.0	66.8	6.8	12.0	15.3	16.4	13.3	14.5	15.7	16.8
Lower low-income	71.4	67.9	63.6	59.4	11.2	12.6	13.9	16.3	17.4	19.6	22.6	24.4
SIDS	80.5	75.7	70.8	66.8	8.4	9.2	10.2	10.6	11.2	15.1	19.1	22.6
Female												
High-income	9.7 ^c	4.7 ^c	31.5	17.8	49.7 ^c	61.2 ^c	27.6	29.9	40.7 ^c	34.2 ^c	37.8	50.8
Upper low-income	84.5	80.1	75.0	72.9	6.3	8.0	12.2	13.3	9.2	11.9	12.9	13.8
Lower low-income	82.7	79.5	81.0	74.4	8.9	10.5	9.8	14.3	8.8	10.6	9.2	11.4
Middle-income	49.7	42.3	36.5	40.9	18.3	17.7	17.8	15.1	32.0	4.0	45.7	42.6
SIDS	92.7	91.2	78.8	75.0	2.5	3.1	4.9	6.6	17.3	16.6	16.3	18.3

a. Agriculture includes mining and forestry.

b. For lists of country groups, see table 1.

c. Data for Singapore only.

increased, even for the lowest income tertile: from 43% of households in 1989 to 76% in 1993, and to 89% in 1997. Habitual television watching affects diet and activity patterns. Diets can change as a result of exposure to advertising and role models in the television programs. People consume snacks while watching television. Watching television is sedentary and displaces more active leisure activities. There is a vast literature, from high-income countries in other regions, that has linked watching television to greater inactivity and obesity [33–35], but no comparable studies have been made yet in the Asia-Pacific region.

Weighted averages were calculated for television ownership per 1,000 people from 1965 to 1995, in the

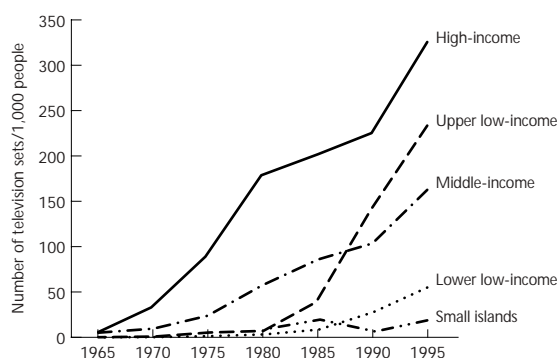


FIG. 18. Ownership of televisions in Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: [6]. Notes: values are weighted averages, based on country population size within groups; for country groups, see table 1

country groups studied here (fig. 18). The explosion in television ownership began much earlier for higher income countries but now has reached all countries studied in the region. The levels and the rates of increase in ownership are far greater in the upper lower-income and middle-income countries.

Urbanization

During the last half century, there has been a large shift of populations from rural to urban areas throughout the developing world. Urbanization is occurring more slowly in Asia and the Pacific than in Latin America, the Middle East, and Africa. In Asia and the Pacific, however, the rate of increase in urban populations from the 1960s to the present has been more than four times greater than the increase in rural populations. The urban proportion of Asian-Pacific populations has increased continuously in the past three decades and this trend continues (fig. 19).

During the twentieth century, the population in rural Asia decreased, while it increased in urban areas [36]. As people move into cities, their food supplies change, and therefore, so do their diets and body composition. High levels of obesity are particularly apparent in lower- and middle-income countries. Urban occupations, transportation and food marketing systems, housing markets, and concentration of population, combine to create different patterns of food supply and demand, and of time allocation [37]. The consequence is overnutrition, meaning that people eat more than they need. This causes overweight, obes-

ity, and other major chronic diseases, such as CVDs. In the developing world, rapid urbanization results in the co-existence of malnutrition and obesity within many households. This is further discussed below.

The urban diet, even in very low-income countries and the poorest areas of cities, contains much more energy from fats and sugar than the rural diet. Urban food is more likely to be processed and often contains more highly refined cereals and sugars and fewer unrefined, staple foods than rural diets. In urban areas, even poor people are able to afford processed foods that are relatively high in fat and also in refined starches and sugars. Edible oils, in particular, can be very cheap. This enables urban people on low incomes to prepare meals that approximate the fat levels of those eaten only by higher income groups in previous decades [8]. Further, the high intake of processed food in the urban diet greatly increases consumption of salt; a factor linked to hypertension.

In Asia and the Pacific, urban diets are generally more diverse than rural diets, contain more animal food and therefore more animal protein, and often contain more micronutrients. However, the effect of

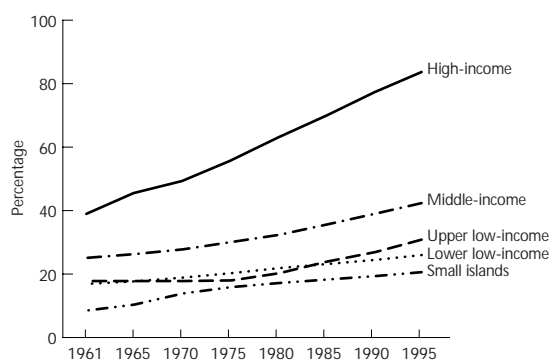


FIG. 19. Trends in the percentage of persons residing in urban areas of Asian countries, grouped by income, and Small Island Developing States (SIDS) of the Pacific. Source: [6]. Notes: values are 3-year averages, weighted for country population size within groups; for country groups, see table 1

relatively energy-dense diets and physical inactivity is to increase the incidence of overweight, obesity, and other diet-related chronic diseases.