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The Nutrition Transition and Prevention of Diet-related Diseases in Asia and the Pacific

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Executive Summary

The nutrition transition, currently occurring in Asia and the Pacific, is one facet of a more general demographic, nutritional, epidemiological transition which accompanies development and urbanization. The nutrition transition itself is marked by a shift away from relatively monotonous diets of varying nutritional quality (based on indigenous staple grains or starchy roots, locally grown legumes, other vegetables and fruits, and limited foods of animal origin) toward more varied diets that include more preprocessed food, more foods of animal origin, more added sugar and fat, and often more alcohol. This shift is accompanied by reduced physical activity in work and leisure, leading to a rapid increase in overweight and obesity. Consequently, there is an epidemiological transition from endemic deficiency and infectious diseases (for which poor nutrition is a risk factor), toward diet-related chronic diseases, including ischemic heart disease (IHD), diabetes, obesity, hypertension, stroke, and certain cancers.

Twenty-four Asian countries were grouped by per capita gross national product (GNP) into lower low- (13), upper low- (4), middle- (4), and high- (3) income groups. An additional group was defined for the Small Island Developing States (SIDS) of the Pacific. Case studies of key diet-related chronic diseases were undertaken for the People's Republic of China (PRC) and for Sri Lanka.

The adult populations of rapidly developing countries have dietary and activity patterns vastly different to those when they were young. Many of these adults faced fetal and early childhood insults related to inadequate nutrition. A so-called fetal programming hypothesis is particularly applicable in the Asian countries and Pacific SIDS. Low-income countries in South and Southeast Asia still have high levels of low birth-weight (LBW) and stunting. Related public health problems will continue well into the future. More research is needed on effects of fetal programming, LBW, and stunting in Asia and the Pacific.

Country-level food disappearance data were used to examine diet changes in the five country groups. These confirmed the broad patterns discussed above,

although with some important variations. Intake of dairy products was lower in the high-income group, and higher in the lower low-income group. In the Republic of Korea, the largest high-income country, traditional diets are still widely consumed and contain few dairy products. In India, the largest lower low-income country, there is high consumption of dairy products. In general, food disappearance data indicated increased consumption of vegetables and fruits, though household data in the PRC and Sri Lanka do not appear to support this.

Dietary change has occurred concomitant with equally important shifts in physical activity patterns. Shifts in the structure of occupations have been considerable. At the same time, energy expenditures in many occupations have decreased and inactivity during leisure has increased. The rapid increase of television use is one clear trend. The health implications of these shifts toward reduced physical activity are not well researched in Asia. Furthermore, there is little basis for creating a clear cost-savings analysis of the effects of these shifts, except for increased obesity.

The epidemiological transition was reviewed for two countries in each group, from data on the proportions of deaths by cause. Early in this transition, and even when the proportions of deaths due to endemic deficiency, infectious, and parasitic diseases remain high, stroke is an important cause of death. The prevalence of hypertension and stroke continues to increase with development, unless there are adequate resources to limit hypertension. At a later stage of the transition, cardiovascular diseases (CVDs), including IHD, become the primary cause of deaths from chronic diseases. Finally, as incomes continue to rise, deaths from certain cancers increase in absolute and relative importance. Variations in this broad pattern include the emerging epidemic of adult-onset diabetes in urban India, the very high levels of obesity in the SIDS, and the high CVD levels in low-income countries with high fat diets (e.g., the Kyrgyz Republic) compared to lower levels in countries with lower fat diets (e.g., the Republic of Korea).

Obesity is now a major disease in Asia and the Pacific. International standards that delineate overweight and obesity may not be appropriate for this region, in which metabolic diseases tend to occur at lower body mass index (BMI) limits than in other regions. Data from eight countries, that are representative of the five groups, confirm increases in obesity levels with development and urbanization. There are some variations; for example, in the SIDS, obesity is higher than their income levels would have predicted. In the Republic of Korea, obesity is low because of high vegetable and low fat intakes. Data from four countries suggest that obesity is not very strongly correlated to income, except in Indonesia, where high income is indicative of urbanization. In general, obesity is a problem of the urban poor as well as the rich. The urban poor have added predisposing factors, associated with LBW.

Between 3 and 15% of Asian households contain both underweight and overweight individuals: typically an underweight child and an overweight, nonelderly adult. Expressed differently, in 30 to 60% of households where a household member is underweight, another is overweight. This has implications for policy interventions. It is oversimplistic to assume that communicable diseases are associated with poverty and noncommunicable diseases (NCDs) with affluence.

For the PRC and Sri Lanka, the relative risks of underlying diet-related factors (overweight, dietary fat, fruit and vegetable intake) as well as early childhood risk factors (LBW and stunting), were calculated for the five major diet-related chronic diseases (CVDs, cancers, diabetes, hypertension, and stroke). This analysis excluded the economic costs of lost days of work and lower productivity due to morbidity from these same diet-related chronic diseases.

In the PRC in 1995, these diseases accounted for 41.6% of all deaths, and 22.5% of all hospital expenditures. The resulting costs were equivalent to 2.1% of the gross domestic product (GDP), of which three-quarters were costs to the hospital system. At least 20 to 25% of these diseases are attributable to dietary factors. The LBWs of those who were adults in 1995 accounted for at least 10% of stroke and CVD, 33% of diabetes, and almost 50% of hypertension. From the data available, it was projected for the PRC that in 2025 diet-related chronic diseases will cause 52.0% of all deaths; dietary factors, especially overweight, will contribute between 32 and 53% to risks for these chronic diseases; and that childhood factors will have declined in significance because stunting is expected to account then for between 6 and 22% of diet-related chronic diseases.

In Sri Lanka in 1995, diet-related chronic diseases accounted for 18.3% of all deaths and 16.7% of all hospital expenditures (10.2% of public hospital expen-

ditures). The resulting costs from diet-related chronic diseases were equivalent to 0.3% of GDP. In Sri Lanka, the prediction for 2025 is that diet-related chronic diseases will account for 20.9% of all deaths. In Sri Lanka in 1995, dietary factors contributed between 10 and 20% to risks for these chronic diseases. LBW accounted for between 1.4% to 18%, its greatest impact being on diabetes. In 2025 in Sri Lanka, it is projected that dietary factors, especially overweight, will account for 18 to 40% of diet-related chronic diseases, and that the importance of LBW as a predisposing factor will increase.

National nutrition policies have had impressive effects in selected developed countries, particularly Norway. The PRC has issued national dietary guidelines. Agricultural and pricing policies are also important. The high production and relatively cheap availability of vegetable oils in Asia has had potentially adverse effects on diets and health.

Mass communication efforts are needed. Promoting traditional diets has been helpful in limiting fat intake and obesity in the Republic of Korea. Health promotion efforts in Mauritius have succeeded in reversing several adverse trends contributing to CVD. Thailand has successfully used mass media for other areas of health promotion, and is developing pilot schemes on chronic diseases. There may also be lessons from mass media efforts in Brazil. In the Asia-Pacific region, Singapore has been the leader in exercise promotion and weight control in schools.

National food and agricultural policies, that consider diet-related chronic diseases, are a future priority. Key elements include agricultural policy shifts, promotion of traditional, healthful eating patterns, use of mass media to build public awareness regarding diet and exercise, and school-based programs. The PRC has progressed furthest in Asia toward a national plan, but needs increased capacity to link economic policy to nutritional concerns. Similarly, there is not yet enough experience in Asia and in Pacific SIDS to move to full-scale programs. Rather, implementation and evaluation of pilot studies, as well as capacity building, are needed now. It is important to continue research on the underlying causes of the demographic, nutrition, and epidemiological transition and to evolve strategies with respect to urban and rural nutrition and related emerging problems.

Finally, it is emphasized that NCDs affect the urban poor as well as the rich of Asia. Obesity is not well correlated with income. Over the next half-century, interventions against NCDs will be most important for the poor of the Asia-Pacific region. That 20 to 60% of households in this region have both undernourished and overweight members is indicative of the need to address these issues as issues of poverty and not of wealth.

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List of Abbreviations

ADB	Asian Development Bank	NIDDM	Noninsulin dependent diabetes mellitus
BMI	Body mass index	NNMB	National Nutrition Monitoring Bureau
CHNS	China Health and Nutrition Survey	OECD	Organisation for Economic Cooperation and Development
CVD	Cardiovascular disease	PAR	Population attributable risks
DNA	Deoxyribonucleic acid	PI	Ponderal index
GDP	Gross domestic product	PUFA	Polyunsaturated fatty acids
GNP	Gross national product	RR	Relative risk
HDL-C	High density lipoprotein cholesterol	SES	Socioeconomic status
IFPRI	International Food Policy Research Institute	SIDS	Small Island Developing States
IHD	Ischemic heart disease	SFA	Saturated fatty acids
IR	Insulin resistance	TC	Total cholesterol
IUGR	Intrauterine growth retardation	UNICEF	United Nations Children's Fund
LBW	Low birthweight	TG	Triglycerides
LDL-C	Low density lipoprotein cholesterol	WCRF	World Cancer Research Fund
MUFA	Monounsaturated fatty acids	WHO	World Health Organization
NCD	Noncommunicable disease		
NIH	National Institutes of Health		

Glossary

Body mass index	Body weight in kilograms divided by height in meters squared (kg/m^2).
Cardiovascular diseases	Diseases involving the heart and the blood vessels.
Dalda	A type of ghee made from vegetable oil in India.
Fetal programming	The hypothesis that intrauterine nutrition has long-term metabolic effects that adversely affect cardiovascular disease and related risk factors.
Food balance (sometimes called food disappearance data)	A macrolevel measure of food available for consumption; estimated as production plus imports minus exports and net of food extraction costs at the mill level and food fed to animals.
Ghee	Butter fats that are refried; common in South Asian cuisine.
Ischemic heart disease	A disease of the heart caused by narrowed coronary arteries and thus less blood and oxygen reaching the heart, including heart attack and related heart problems.
Intrauterine growth retardation	Birthweight below a given low percentile limit for gestational age (e.g., birthweight less than 10th percentile for gestational age); typically reflects inadequate supply of nutrients and oxygen to the fetus.
Low birthweight	Birthweight below 2,500 grams.
Malnutrition	Various forms of poor nutrition caused by a complex array of factors including dietary inadequacy, infections, and sociocultural factors.
Morbidity	Any measure of disease, excluding mortality.
Obesity	Excessive body fat content; commonly measured by BMI (see above). The Asian standard for obesity is a BMI above 24.99 and the international standard is a BMI above 30.
Overnutrition	Excess energy imbalance caused by energy intake exceeding energy expenditure.
Overweight	Excess weight relative to height; commonly measured by BMI (see above). The Asian standard for overweight is 23.00 to 24.99, and the international standard is a BMI from 25 to 29.99 for grade I, 30–39.99 for grade II, and greater than 40 for grade III.
Stunting	The process of failure to reach linear growth potential as a result of inadequate nutrition and/or poor health. This implies long-term malnutrition and poor health, measured as height for age 2 Z-scores below a standard.
Syndrome X	A clustering of risk factors for cardiovascular disease, including obesity, adult onset diabetes, hyperlipidemia, and hypertension. Syndrome X is also known as metabolic syndrome.
Undernutrition	Inadequate dietary intake. This may occur in association with infection.

Underweight	Low weight-for-age; i.e., 2 Z-scores below a weight-for-age standard. This implies stunting and/or wasting.
Wasting	Low weight-for-height (weight divided by height) 2 Z scores below a weight-for-height standard. This describes a recent or current severe process leading to significant weight loss, usually as a consequence of acute starvation and/or severe disease.
Z-score	The deviation of an individual's value from the median value of a reference population, divided by the standard deviation of the reference population.

Introduction

The food supplies and therefore the diets of developing countries, are in a state of rapid transition. This nutrition transition is accompanied by equally rapid changes in levels of physical activity and in the body composition of humans, and is part of a general demographic, nutritional, epidemiological transition. A demographic transition, from rural societies with low life expectancy at birth and families with many children, to urban societies with higher life expectancy at birth and fewer children, has been well documented [1, 2]. The epidemiological transition that follows the demographic transition is also fairly well understood: a shift from endemic deficiency and infectious diseases, mostly of early life, to epidemic chronic diseases, generally of later life [3].

There is now sufficient evidence to propose a general theory for this causally and chronologically linked demographic, nutrition, and epidemiological transition. When populations undergo massive social and technological change that includes increasing urbanization, their food supplies and therefore their diets change. Consequently, disease patterns also change. This can be traced in countries that are now economically developed; for example, Britain between the sixteenth and eighteenth centuries, following the agrarian and industrial revolutions. In Africa, Asia, Latin America, and in the Small Island Developing States (SIDS) of the Pacific, such transitions are taking place very much faster and, in some cases, with extreme rapidity.

Current evidence suggests that some diet-related diseases become epidemic at a speed that is a function of the velocity of demographic and nutrition transition, and that they emerge as epidemics in a predictable sequence. The implications for public policy-making are immense. It follows that a full understanding of these transitions is vital as a basis for policy-making, not only in the field of public health, but also in health care, rural and urban development, agriculture, industry, transport, employment, education, and finance.

The nutrition transition in Asia and in the SIDS

of the Pacific is a central part of a sequence of transitions. These begin with the demographic transition. Increased urbanization and technological change lead to a shift from physically active to sedentary occupations, less walking and cycling, more use of cars and television, increased use of labor saving devices at work and home, and changes in income profiles.

The nutrition transition itself is marked by a shift from relatively monotonous diets based on indigenous staple grains or starchy roots, locally grown legumes, other vegetables and fruits, and (except for prosperous subpopulations) limited foods of animal origin, toward more varied diets that include more preprocessed food, more foods of animal origin, more sugar and fat, especially in processed drinks and foods, and often more alcohol. The most immediate result of the combination of such relatively energy-dense diets with physically inactive lives, is a rapid increase in overweight and obesity. This is a usual, though not inevitable, consequence of urbanization.

The consequent epidemiological transition is from a predominance of endemic deficiency and infectious diseases, often caused or exacerbated by poor nutrition, to epidemic, chronic diseases. Diet-related chronic diseases include tooth decay, gastrointestinal disorders, obesity, adult-onset diabetes, hypertension, peripheral vascular disease and stroke, hyperlipidemia, angina and ischemic heart disease (IHD), and certain cancers. Most of these diseases also have nondietary causes; for example, the use of tobacco with lung cancer. There is also genetic predisposition to some of these diseases. The risk of this eventuating in overt clinical symptoms is increased by inappropriate environmental factors, including diet.

This review describes the nutrition transition and nutrition-related changes that affect key chronic diseases in Asia. These changes include, among others, fetal and infant nutrition insults, and poor dietary and activity patterns. Other behavioral changes that also contribute to these diseases, such as increased tobacco use and air pollution, are not discussed. First, the chronic diseases affected by dietary and related

lifestyle changes are reviewed, and then their health and economic consequences, intervention options, and policy are examined.

Countries in the Asia-Pacific region are at very different stages in the nutrition transition. Moreover, large subpopulation groups, within even the poorest countries, already face a heavy burden from diet-related chronic diseases. In India, for example, urban residents in general, and other residents in wealthy areas such as the Punjab, have very different diets, body composition, and chronic disease profiles than residents in other areas. Obesity and cardiovascular diseases (CVDs) are prevalent at very high rates in urban India [4, 5]. In most Asian and Pacific countries, there are subpopulations that face food insecurity and undernutrition. There are also significant differences in the undernutrition profiles of Asian men and women. However, in the countries studied here, gender differences in obesity are smaller than those of other regions of the developing world.

The diverse Asian countries covered in this review are grouped using gross national product (GNP) per capita as the sole indicator (table 1). Detailed health cost data were obtained for the People's Republic of China (PRC) and Sri Lanka. A separate group was created for some SIDS of the Pacific. SIDS are in a relatively advanced stage of epidemiological and nutrition transition and face great problems of diet-related chronic diseases. Their needs, their institutional and logistical infrastructure, the underlying causes of their nutrition-related problems, and their abilities to absorb loans, are very different from those of the larger countries of Asia.

TABLE 1. Asian countries and Small Island Developing States (SIDS) of the Pacific that are in nutrition transition; grouped on 1998 gross national product (GNP) per capita, unless otherwise stated

Group	Countries	1998 GNP per capita (US\$)
High-income	Singapore	30,060
	Hong Kong, China	23,670 ^a
	Korea, Rep. of	7,970
Middle-income	Malaysia	3,600
	Thailand	2,200
	Kazakhstan	1,310
	Philippines	1,050
Low-income Upper	Uzbekistan	870
	Sri Lanka	810
	People's Republic of China	750
	Indonesia	680
Low-income Lower	Pakistan	480
	India	430
	Mongolia	400
	Bangladesh	350
	Kyrgyz Republic	350
	Tajikistan	350
	Lao PDR	330
	Vietnam	330
	Cambodia	280
	Nepal	210
	Afghanistan	<760
	Bhutan	<760
	Myanmar	<760
SIDS	Fiji Islands	2,110
	Federated States of Micronesia	1,800
	Tonga	1,690
	Marshall Islands	1,540
	Vanuatu	1,270
	Maldives	1,230
	Kiribati	1,180
	Samoa	1,020
	Papua New Guinea	890
	Solomon Islands	750
	Cook Islands	—
Nauru	—	
Tuvalu	—	

Source: ref. 6.

a. GDP = Gross domestic product.