

## Nutrition and the Global Risk for Chronic Diseases: The INTERHEALTH Nutrition Initiative

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*As chronic, noncommunicable diseases (NCDs) have emerged as leading causes of morbidity and mortality worldwide, the World Health Organization's INTERHEALTH Programme, an international collaboration currently involving 15 countries, has focused its attention on population-based NCD prevention. Participating nations include Australia, Chile, China, Cuba, Cyprus, Finland, Japan, Lithuania, Malta, Mauritius, Russia, Sri Lanka, Tanzania, Thailand, and the United States. This paper will review and assess global trends in food and nutrient intake among INTERHEALTH countries between 1954 and 1986.*

Nations worldwide are experiencing epidemiologic transitions<sup>1</sup> as rates of maternal and infant mortality decline, population life expectancy increases, and chronic noncommunicable diseases (NCDs) (such as cardiovascular diseases, certain cancers, diabetes, chronic respiratory diseases, osteoporosis, etc.) emerge as leading causes of morbidity and mortality. The stages and patterns of epidemiologic transition vary across nations, but several common factors underlie these trends: improvements in public health infrastructures, better control of infectious

diseases, advances in medical technologies, and population lifestyle changes.<sup>2-4</sup>

NCDs are either newly appearing, rapidly rising, or already established at high levels in every country of the world today, depending on its stage of epidemiologic transition.<sup>5</sup> Currently, NCDs account for about 75% of mortality in the developed world and about 40% in the developing world.<sup>6</sup> Some of the most dramatic recent changes in NCD rates, however, have occurred in developing nations. Between 1970 and 1980, the prevalence of chronic diseases increased by 50-100% in many regions of Africa, Asia, and Latin and South America.<sup>7</sup>

The global rise in NCDs has been associated with marked changes in the lifestyle characteristics of populations, such as diet and other potentially modifiable behaviors (smoking, body weight, exercise, etc.).<sup>1-5,7</sup> In response to dietary trends, many nations have established national nutrition policies which emphasize maintaining the nutritional adequacy of the food supply and promoting the prevention of chronic diseases. There is considerable consensus in these policy statements related to dietary interventions for NCD risk reduction including: lowering total and saturated fat, sodium, and cholesterol consumption and increasing complex carbohydrates, fiber, fruits, and vegetables. Such dietary changes are increasingly recognized to have favorable effects on population cardiovascular disease risk factor profiles and NCD morbidity and mortality.<sup>8-10</sup>

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This is the second of a two-part series describing the INTERHEALTH Nutrition Initiative. A broader discussion of methodology and population health profiles can be found in *Nutrition Reviews* 1994;52:179-87.

Based on the philosophy that NCDs have common, modifiable risk factors, the World Health Organization (WHO) has initiated the INTERHEALTH Programme. INTERHEALTH is an international collaboration designed to build capacities for risk factor monitoring within WHO regions, and to exchange social and medical technologies for intervention programs to achieve population-based NCD prevention and control.<sup>6,7,11-14</sup> As INTERHEALTH participants, countries are committed to carrying out the following activities: baseline population NCD risk factor assessment, monitoring of trends in NCD morbidity and mortality, implementing community-based, integrated strategies for NCD risk reduction, and evaluating programmatic success in demonstration and reference communities.

The INTERHEALTH Nutrition Initiative is an important component of the INTERHEALTH programme. Its goals are fourfold: (1) to assess global trends in population food and nutrient intake important in chronic disease prevention; (2) to determine commonalities in international nutrition policies of relevance to NCD risk reduction; (3) to describe the characteristics of integrated, population-based lifestyle interventions for NCD prevention; and (4) to evaluate the impact of community-based interventions on nutritional behavior and population NCD risk, morbidity and mortality. This paper examines the trends in population food intake and nutrients of relevance to NCD prevention among INTERHEALTH countries from 1954 to 1986.

## Background

### *The INTERHEALTH Programme*

The INTERHEALTH Programme was initiated in 1986 by the World Health Organization's Division of Noncommunicable Diseases (WHO NCD) in response to global concerns about the increased contribution of NCDs to morbidity and mortality in the developed and developing world. INTERHEALTH is led by WHO in conjunction with a coordinating center at the Public Health Institute in Helsinki, Finland. The INTERHEALTH Nutrition Initiative is directed by the Boston University Schools of Medicine and Public Health in cooperation with WHO and the INTERHEALTH Coordinating Center. Currently, 15 countries in the six WHO regions participate in INTERHEALTH and comprise its Steering Committee including: AFRO (Tanzania, Mauritius), PAHO (Chile, Cuba, USA [Stanford, Texas, Florida]), EMRO (Cyprus), EURO (Finland, Malta, Lithuania, Russia [Moscow]), SEARO (Thailand, Sri

Lanka), and WPRO (Australia, Japan, and China [Beijing, Tianjin]).<sup>6,7,11-14</sup>

### *INTERHEALTH Protocols*

INTERHEALTH projects use standardized methods<sup>6,13,15</sup> to assess population risk for NCDs including: smoking behavior, alcohol consumption, the prevalence of obesity (using measured height and weight for determination of body mass index [BMI]), systolic and diastolic blood pressure and rates of hypertension, and serum total cholesterol levels. In addition, 12 INTERHEALTH projects have assessed food and nutrient intake and, in most situations, have used either the 24-hour dietary recall or 3-day food record methodologies.

INTERHEALTH countries have also adopted common protocols<sup>15</sup> for monitoring NCD morbidity and mortality rates. Currently data are compiled for the following conditions: cardiovascular diseases (myocardial infarct, stroke, hypertension, rheumatic heart disease, cardiomyopathy); cancer (total cancers and those cancers that could potentially be influenced by INTERHEALTH interventions, such as lung, colon, breast, stomach, and cervical cancers); diabetes mellitus; osteoporosis; and chronic respiratory diseases (asthma and chronic obstructive pulmonary disease [COPD]).

## Methods

For the present report, per capita food and nutrient intake estimates were derived from food balance sheets, published in Rome by the Food and Agriculture Organization (FAO) of the WHO.<sup>16</sup> All data derived from FAO reports reflect national food disappearance and per capita food availability including imports/exports and excluding livestock feed and loss during storage and transportation. These data show trends in national food supplies and enable the identification of changes that may occur in population dietary patterns over time. It is important to note that food balance sheets provide an estimate of foods available to the consumer at the national level, but do not measure consumption at the individual level, or reflect differences in intake which may exist in different geographic regions or ethnic groups.<sup>16</sup> In this report, food balance sheets from six time periods (1954-1956, 1957-1959, 1960-1962, 1972-1974, 1975-1977, and 1984-1986) were used to estimate macronutrient availability per capita (fat, carbohydrate, and protein) within each INTERHEALTH country. The major food sources of macronutrients were also identified. FAO data were used to characterize population food patterns and to assess the proportion of total proteins and fats derived from animal and vegetable sources and

**Table 1.** Range in Macronutrient Availability: 1954–1986 FAO Data<sup>a</sup>

Country	% Fat	% Protein	% Carbohydrate
Thailand	9–13	8–9	78–82
Tanzania	13–14	9–10	76–78
China	13–15	10–11	75–76
Mauritius	16–21	8–9	70–75
Cuba	18–19	10	71–72
Chile	18–20	11–13	68–70
Sri Lanka	18–20	8	72–74
Japan	9–25	12–13	62–80
USSR	26–27	12	60–62
Cyprus	25–31	12–13	57–62
Malta	29–34	11–12	53–60
Finland	32–38	11–13	50–56
Australia	34–38	11–13	51–54
United States	41–43	12	46–47

<sup>a</sup> These estimates do not account for calories from alcohol, because of unavailable alcohol data for earlier time periods. Data in cells represent ranges in nutrient availability over the 3 decades. Nutrient availability was stable in countries where only one number appears. The upper end of the fat range and the lower end of the carbohydrate range are the 1986 levels, reflecting the changing proportions of these macronutrients in the diet.

the contribution of simple and complex carbohydrate sources to total carbohydrates. Data on sodium and micronutrients were not available from the FAO data.

## Results

### Nutrient Availability

The ranges of macronutrient availability within INTERHEALTH countries between 1954 and 1986 are presented in Table 1. Fat availability varied five-fold across countries and protein and carbohydrate

availability varied nearly twofold. The estimates of per capita fat availability were consistently highest in the United States (41–43% of calories) and Australia (34–38% of calories) where carbohydrate availability was lowest (46–54%). Conversely, fat availability was lowest in Thailand (9–13%) and Tanzania (13–14%), where carbohydrate availability was highest (76–82%). Fat availability did not decrease in any INTERHEALTH country over the three decades studied. In all countries, the upper end of the fat availability range represents the 1986 availability level. As fat availability rose, it replaced carbohydrates as an available energy source. Therefore, the lower end of the carbohydrate availability range was actually the 1986 availability level in all countries. Protein availability remained stable over the three decades and ranged from 8 to 13% of calories among INTERHEALTH countries. However, as fat availability increased in certain countries, the proportion of animal protein tended to increase. Total caloric availability increased over time in all INTERHEALTH countries except Finland (data not shown).

The trends in total fat availability from 1954 to 1986 and its animal/vegetable components are summarized for INTERHEALTH countries in Table 2. Most INTERHEALTH countries had either established moderate to high levels of fat availability (>25% of calories) or rising levels of dietary fat. Only one-third of INTERHEALTH countries had low-to-moderate levels of fat availability that were relatively stable. Fat availability rose markedly in Japan (from 9 to 11% of total calories in 1954–1956 to 25% in 1984–1986). Significant increases in fat availability occurred in Cyprus (from 25 to 31% of calories), Malta (29 to 35%), and Finland (32 to 38%). Fat availability also increased in two developing nations: Thailand (9 to 13%) and Mauritius

**Table 2.** Trends in Total Fat Availability: INTERHEALTH Countries 1954–1986

Total Fat Availability	Increasing Over Time	Markedly Increasing Over Time	Stable Over Time
Low to moderate ( $\leq 25\%$ of kcal)	Mauritius <sup>a</sup> Thailand	Japan <sup>b</sup>	Chile <sup>c</sup> China Cuba <sup>a</sup> Sri Lanka Tanzania
Moderate to high (>25% of kcal)	Australia <sup>c</sup> Cyprus <sup>b</sup> Finland <sup>b</sup> Malta <sup>b</sup>		United States <sup>c</sup> USSR <sup>b</sup>

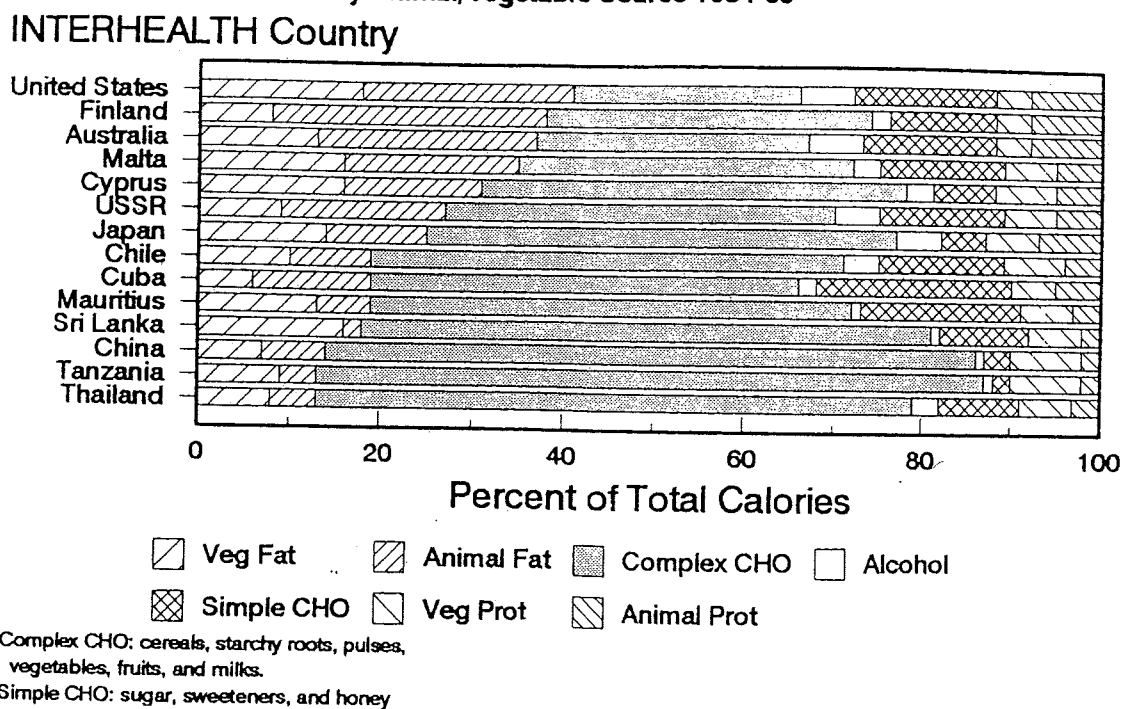
Note: Vegetable fat includes palm and coconut oils.

<sup>a</sup> Animal fat rising.

<sup>b</sup> Animal and vegetable fat rising.

<sup>c</sup> Vegetable fat rising.

## FAO Macronutrient Data By Animal/Vegetable Source 1984-86



**Figure 1.** FAO macronutrient data, by animal/vegetable source, 1984–1986. Veg = vegetable; Prot = protein; CHO = carbohydrate.

(16 to 21%), although dietary fat levels remained within the low-to-moderate range (<25% of calories) in these countries. According to FAO estimates, fat availability was moderate in the former USSR across the six time periods (26–27% of calories).

Animal fats were the major contributors to rising fat availability in Mauritius. Vegetable oils were rising as a proportion of total fats in the US, Australia and Thailand, but in the latter countries tropical oils predominated. In Finland, Cyprus, the former USSR, Japan, and Malta, both animal and vegetable fats appeared to contribute to the rising fat availability. While total fat availability remained relatively stable in Cuba, the relative proportion of animal fats was rising.

The contribution of fats, carbohydrates, alcohol, and proteins (and their major dietary sources) to total energy availability among INTERHEALTH populations in 1984–1986 are presented in Figure 1. Across nations, as fat availability rose, the relative proportion of animal fat increased and vegetable protein decreased. Increases in fat availability were also associated with declines in carbohydrate availability, particularly from complex dietary sources. As fat availability rose, alcohol availability tended to rise as well. The rank ordering of nations as depicted in Figure 1 did not change dramatically over

the three decades; however the relative contribution of total carbohydrate and fat did shift, as noted above.

### *Dietary Patterns*

The food patterns of INTERHEALTH populations are mapped in Figure 2. Sugar, fruits, and vegetables were major carbohydrate sources in all INTERHEALTH countries. The countries differed, however, in the types of carbohydrate staples available (primarily wheat, potatoes, or rice). There were also major differences in the sources of proteins (animal versus vegetable and fish sources) and fats (predominantly animal fats, tropical oils [coconut, palm, and palm kernel oils], or other vegetable fats). Countries whose populations had more wheat (Finland and Cyprus) or potatoes (Malta, Australia, the US, Chile, Cuba, and the former USSR) available tended to have more animal fats and proteins available including beef, pork, milk, eggs, and butter. The food sources of fats and proteins were similar in these countries but total fat availability was lower in Central and South American nations in comparison with North American, European, and Mediterranean countries. The Central and South American countries also had more carbohydrate and vegetable proteins available (particularly rice, beans, and

grains). In Asia (Thailand, Sri Lanka), Africa (Mauritius, Tanzania), and the western Pacific (China, Japan), rice was the predominant starch and populations in these countries had more vegetable proteins available (particularly cassava, sweet potatoes, beans, nuts, and grains), more limited quantities of animal proteins, and one of two major categories of fats: tropical oils or other vegetable oils.

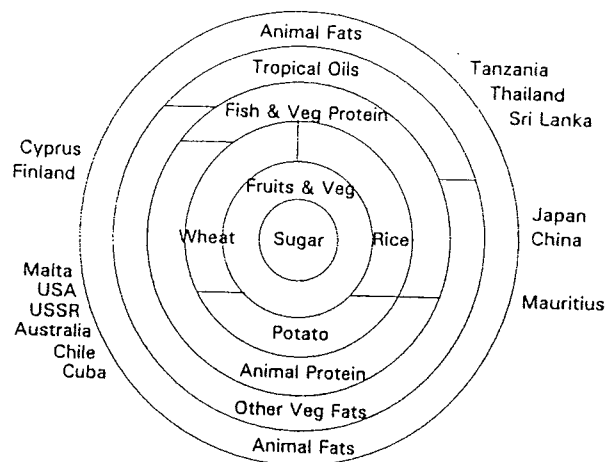
The transition in Japan from the low-fat, high-carbohydrate diet to one richer in animal fat and protein was characterized by marked changes in the food supply. Between 1954–1956 and 1984–1986, Japan demonstrated a decreased availability of rice, soybeans, and fish, and increased availability of sugar, beef, pork, and eggs.

## Discussion

These data indicate that food and nutrient supplies over the past three decades among INTERHEALTH countries do not promote the achievement of national nutrition recommendations for chronic disease prevention. Nowhere among INTERHEALTH countries did total fat availability (percentage of calories) decline between 1954–1956 and 1984–1986. Most countries had either moderate to high or rising levels of dietary fat availability and declining availability of vegetable protein and total carbohydrate, particularly from starch.

These dietary trends parallel the established high or rising rates of noncommunicable, chronic diseases throughout many parts of the world.<sup>17</sup> For example, Epstein noted that in seven nations where fat consumption rose over the past 20 years (Czechoslovakia, Greece, Bulgaria, Romania, the former Yugoslavia, Spain, and Hungary), cardiovascular disease rates rose demonstrably.<sup>18</sup> The prevalence of breast cancer also appears to be rising in countries where fat intake is high or rising.<sup>17</sup> Cancers of all sites appear to be rising rapidly in urban areas of Africa, Asia, and Central and South America, reflecting increased tobacco use and a transition from diets rich in complex carbohydrates, fiber, and fruits and vegetables to diets more concentrated in animal fats and proteins.<sup>17</sup> Rising rates of noninsulin-dependent diabetes in Africa, China, other Asian nations, and South America (most notably in industrialized, urban areas) have been attributed to decreasing population consumption levels of fiber and plant foods and increased fats and sweets.<sup>17,19</sup> Diets high in sodium, alcohol, and animal protein but lower in calcium, in combination with high rates of smoking have been linked to the rising incidence rates of osteoporosis in developed nations.<sup>17</sup>

In addition to dietary influences, other environmental and lifestyle factors are important contributors to the observed rise in NCDs globally. Since



**Figure 2.** Dietary patterns of INTERHEALTH populations. INTERHEALTH countries are grouped based on food sources of macronutrients that predominated in their respective food supplies. For example, the dietary patterns characteristic of Tanzania, Thailand, and Sri Lanka consisted of fats predominantly from animal sources and tropical oils, proteins derived from fish and vegetable sources, and carbohydrates from rice, fruits, and vegetables, and sugar. In contrast, the food supplies of Cyprus and Finland were characterized by fats derived from animal and vegetable fats, protein from animal products (excluding fish), and carbohydrates from wheat, fruits, and vegetables, and sugar.

epidemiologic transition is characterized by increased life expectancy, the rates of NCDs would be expected to increase in part as a function of population aging. As well, lifestyle factors such as adverse trends in diet, cigarette smoking, and physical activity patterns, and increasing prevalence rates of obesity contribute to rising NCD rates.<sup>17</sup>

Nutrition surveys of individuals conducted within INTERHEALTH countries provide estimates of macronutrient and food intake which are similar, in most cases, to those obtained from FAO food balance sheets.<sup>20–29</sup> This supports the use of food balance sheets to track international trends in food and nutrient supplies and to make international comparisons when survey data from international populations are sparse or unpublished. Two exceptions were found for surveys conducted within urban areas of China (Beijing and Tianjin) and two regions of the former USSR (Russia and Lithuania). Fat intake in these population segments may be markedly higher than the per capita estimates derived from FAO data. Fat intake was estimated to be 42–45% of calories in a 1987 survey in Lithuania,<sup>30</sup> and 41–45% of calories in a 1979–1981 survey in Moscow,<sup>31</sup> as compared to the FAO dietary fat estimate of approximately 27% for the same time period. In China, fat intake was observed to be as high as 32% in urban areas (1989), versus the 1984–1986 FAO

estimate of 14%.<sup>32</sup> Surveys of individuals also indicate that populations in urban versus rural areas are more likely to increase animal fats and proteins in the diet at the detriment of vegetable staples and traditional foods. These findings suggest that FAO per capita estimates do not capture important urban/rural differences in food and nutrient consumption, particularly in developing nations. As well, FAO data are less informative in the USSR because of wide geographic variability, a broad spectrum of ethnic groups, and differences in dietary patterns throughout this vast country comprising 15 republics. These differences emphasize the importance of nutrition monitoring activities, using standardized methodologies for assessing diet among various population subgroups within countries that participate in INTERHEALTH.

## Conclusions

The changes in dietary patterns among INTERHEALTH nations indicate global nutrition trends which are unfavorable with respect to NCD morbidity and mortality. Such findings are cause for concern and highlight the need for continued emphasis and international collaboration on development and implementation of national nutrition policies and integrated intervention programs for the global reduction in chronic disease morbidity and mortality. The INTERHEALTH programme provides a unique opportunity to examine trends in population health profiles, to collectively consider and share effective integrated strategies for NCD risk reduction, and to accelerate favorable global trends in NCD prevention and management. Participation in the INTERHEALTH Programme is likely to enhance the efforts of individual countries to promote improved health and nutritional status of populations worldwide.

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