

# The Nutrition Transition: An Overview of World Patterns of Change

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*This paper examines the speed of change in diet, activity, and obesity in the developing world, and notes potential exacerbating biological relationships that contribute to differences in the rates of change. The focus is on lower- and middle-income countries of Asia, Africa, the Middle East, and Latin America. These dietary, physical activity, and body composition changes are occurring at great speed and at earlier stages of these countries' economic and social development. There are some unique issues that relate to body composition and potential genetic factors that are also explored, including potential differences in body mass index (BMI)—disease relationships and added risks posed by high levels of poor fetal and infant growth patterns. In addition there is an important dynamic occurring—the shift in the burden of poor diets, inactivity and obesity from the rich to the poor. The developing world needs to give far greater emphasis to addressing the prevention of the adverse health consequences of this shift to the nutrition transition stage of the degenerative diseases.*

Key words: nutrition transition, dietary change, obesity

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## Introduction

This paper summarizes some issues and evidence that lead us to assert that the rapid onset of obesity and nutrition-related noncommunicable diseases (NR-NCD) in the developing world may be unique. Understanding this topic is important for planning a strategy to prevent obesity and its complications in the developing world. Essentially the key assertions are:

- The speed of change appears unique due to the timing of the economic, technological, and social

transformation now faced by lower and moderate income, transitional societies.

- The differences in the rates of change may be exacerbated by some biological relationships.

## Assertion 1

The shifts in dietary and activity patterns and body composition seem to be occurring more rapidly. The pace of the rapid nutrition transition shifts in diet and activity patterns from the period termed the receding famine pattern, to one dominated by NR-NCDs seems to be accelerating in the lower- and middle-income transitional countries. We use the term “nutrition” rather than “diet” in considering NR-NCDs, because the term NR-NCD incorporates the effects of diet, physical activity, and body composition rather than solely focusing on dietary patterns and their effects.<sup>1</sup> This is based partially on incomplete information that seems to indicate that the prevalence of obesity and a number of NR-NCDs are increasing far much faster in the lower- and middle-income world than it has in the west. Another element is that the rapid changes in urban populations are much greater than that experienced a century or less ago in the west; a third element is the shift in occupational structure and the rapid introduction of the modern mass media.<sup>2</sup> Underlying such changes is a general concern for rapid globalization as the root cause.

Clearly, there are quantitative and qualitative dimensions to these changes. On the one hand, changes toward a high-density diet, reduced complex carbohydrates and other important elements, and inactivity may be proceeding faster than in the past. The shift from labor-intensive occupations and leisure activities toward more capital-intensive, less strenuous work and leisure is also occurring faster. On the other hand, qualitative dimensions related to multidimensional aspects of the diet, activity, body composition, and disease shifts may exist. The social and economic stresses that people face and feel as these changes occur might also be included.

At the start of a new millennium, scholars often feel as if the pace and complexity of life, reflected in all aspects of work and play, are increasing exponentially;

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there are also unanticipated developments, new technologies, and the impact of a very modern, high-powered communications system. It is this sense of rapid change that makes it so important to understand what is happening and anticipate the way changes in patterns of diet, activity, and body composition are occurring. While the penetration and influence of modern communications, technology and economic systems—related to what is termed globalization—have been a dominant theme of the last few decades, there seem to be some unique issues that have led to a rapid increase of “globalization and its impact.”

Placing the blame on globalization is, on the one hand, focusing on broad and vaguely measured set of forces; this ignores the need to be focused and specific—which would allow us to develop potentially viable policy options. It is difficult to measure each element of this globalization equation and its impact. These processes certainly have been expanded, as indicated by enhanced free trade, a push toward reduction of trade barriers in the developing world, and the increasing penetration of international corporations into the commerce in each country (measured by share of GNP or manufacturing). Similarly, other economic issues related to enhanced value given to market forces and international capital markets are important. Equally, the increasing access to western media, the removal of communication barriers enhanced by the World Wide Web, cable TV, mobile telephone systems, etc., is important. The accelerated introduction of western technology into the manufacturing, basic sectors of agriculture, mining, and services is also a key element.

Another way to consider the types of changes facing the developing world is to consider an urban squatter's life and a rural villager's life in China 20 years ago versus today. During the 1970s, food supply concerns still existed. There was no television, limited bus and mass transportation, little food trade, minimal processed food existed, and most rural and urban occupations were very labor intensive. Today, work and life activities have changed. Small gas-powered tractors are available, modern industrial techniques are multiplying, offices are automated, soft drinks and many processed foods are found everywhere, TVs are found in about 89% of households (at least a fifth of whom are linked to Hong Kong Star and western advertising and programming), younger children do not ride bicycles, and mass transit has become heavily used. Multiply such changes by similar ones occurring in much of Asia, North Africa, the Middle East, Latin America, and many areas (particularly cities) in sub-Saharan Africa and it is evident that the shift from a subsistence economy to a modern, industrialized one occurred in a span of 10–20 years. This is in contrast to Europe and other industrialized

high-income societies, where this occurred over many decades or centuries.

To truly measure and examine these issues, we would need to compare changes in low- and middle-income countries that occurred between 1980–2000 with changes that occurred a half century earlier for the developing world. However, data on diet and activity patterns are not available and there is only minimal data on NR-NCDs and obesity.

## Obesity Trends

A recently published volume summarized many of the rapid shifts in obesity and overweight status in the regions of the developing world.<sup>1,3,4</sup> In China, we examined the shifts in body composition among adults aged 20–45 over an 8-year period. We showed an increase in both the BMI and the shape of the BMI distribution curve over the 8-year period.<sup>5</sup> From 1989 to 1997, the proportion of underweight men and women decreased considerably and the prevalence of both overweight and obesity increased greatly. In fact, the proportion of overweight or obese men more than doubled from 6.4.0% to 14.5% and the proportion of overweight or obese women increased 50% from 11.5% to 16.2%.

In one recent paper, we showed that the increase in the prevalence of overweight and obesity during the past several decades is much faster in the developing world.<sup>1</sup> While the annual percentage point increase in overweight plus obesity was about 0.3 to 0.5 percentage points of the total adult population per year in Europe and the United States, the same percentage point increase was double to fourfold that rate in a large number of developing countries.

## Dietary Changes: Shift in the Overall Structure over Time

The diets of the developing world are shifting equally rapidly. We do not have good data for most countries on total energy intake, but we do have reasonable data to examine shifts in the structure of the diet. Food balance data were used to examine the shift, over time, in the proportion of energy from fat.<sup>6,7</sup> We have shown dramatic increases in the energy density of the diet in China and other countries, large shifts toward increased edible oil intake, and increased sweetening of the diet by dramatic jumps in added sugar intake. The latter is based on unpublished research.<sup>8</sup>

When we specifically examine the combined effect of these various shifts in the structure of rural and urban Chinese diets, we find an upward shift in the energy density of the foods consumed. In this study, the kcal of energy intake from foods and alcohol per 100 grams of food in both urban and rural Chinese adult diets in-

creased over 10% (to 2.42) between 1989 and 1997. These are very rapid shifts in energy density. It is important to note that this value of 2.42 is not comparable with the normal measure of energy density of the diet. The normal method includes full measures of all beverages, while the Chinese Food Composition Table, from which these data were extracted, measures only a few beverages (milk, coconut juice, sugarcane juice, spirits, beer, wine, champagne, and brandy) and excludes many beverages, in particular tea and coffee. There are a number of clinical studies that varied the energy density of the diet in ad libitum studies. Each finds higher density increases, and often only an increase as low as from 1 kcal/gram to 1.3 kcal per gram can increase total energy intake. For these reasons, energy density changes in China, and most likely in other developing countries, are critical components of dietary change to be monitored.

### **Physical Activity Shifts are Equally Rapid**

There are much less data and analysis on the shifts, over time, in energy expenditures and physical activity patterns in general. Some published studies have demonstrated the remarkable shift in the structure of occupations, as well as in the activities performed in each occupation.<sup>9</sup> Using data from the China Health and Nutrition Survey (CHNS) results with adult physical activity patterns measured over the 1989–97 period to examine this topic, we have shown a remarkable downward shift for the proportion of adults, aged 20–45, whose daily activity profile categorizes them in a moderate category, compared with those in the light category over the last decade. In other work, we have shown that light and moderate activity profiles are linked with greater obesity.<sup>10</sup>

### **Assertion 2**

Is the biology different? Or rather, do we have different social structures and body composition patterns that affect BMI-disease relationships? Or are there genetic variants that are important?

There are a number of different ways these questions could be answered in the affirmative. One is if the body composition and other unmeasured race-ethnic factors affect susceptibility to NR-NCDs. Another might be if previous disease patterns (e.g., the presence of malaria or other tropical diseases) led to disease patterns that predisposed the population to certain problems. One component of this might be the fetal insult syndrome developed and popularized by Barker.<sup>11</sup>

There has been a growing body of research that shows the international standards, used to delineate who is overweight and obese, is not appropriate for many

large subpopulations in the world. For instance, a BMI of 25 in an Asian adult appears to have a far greater adverse metabolic effect than in a Caucasian adult. In fact, the World Health Organization (WHO) and the International Obesity Task Force (IOTF) convened a group of scientists and agencies in Asia to review this topic.<sup>12</sup> This group held international meetings and has proposed a lower BMI cutoff for Asians of 23 for overweight and of 25 for obesity. In one paper comparing China; the Philippines; and U.S. Hispanics, blacks and whites, the odds of being hypertensive were higher for Chinese men and women compared with the other subpopulation groups at lower BMIs in the 23–25 range. Ethnic differences in the strength of the association between BMI and disease outcomes warrant further consideration.

What is not clear is how much of this difference between sub-populations' BMI-diabetes or other BMI-morbidity relationships is a function of differences of body composition, metabolic or genetic factors, or social causes. Elsewhere we have shown that part of the apparent race-hypertension relationship may also be explained partially by socioeconomic status.<sup>13</sup>

There is another pathway related to the role of previous health problems for which we have less understanding and no real documentation of its impact (e.g., malnutrition that caused a virus to mutate, parasitic infections that affected long-term absorption patterns, or a parasite that is linked with an unknown genotype—comparable to sickle cell anemia and its evolutionary linkage with malaria). We have no basis for speculation about this potential pathway.

However, the final pathway—the effect of fetal and infant insults on subsequent metabolic function—is one that appears to be a critical area. If the rapid shifts toward positive energy imbalance are occurring concurrently with higher levels of low birth weight in a population, then this becomes a much more salient aspect of this argument. In the developing world, where intrauterine malnutrition rates are high and a high prevalence of nutrition insults during infancy exist, the work of Barker and many others portends important potential effects on the prevalence of NR-NCDs in the coming decades.<sup>11,14</sup> Not only is there an emerging consensus that fetal insults, in particular with regard to those thin, low birth weight infants who subsequently face a shift in the stage of the transition and become overweight, are linked with increased risk of the NR-NCDs, but infancy may equally be a period of high vulnerability. Studies by Hoffman et al., suggest that fat metabolism of stunted infants is impaired to the extent that this could lead to increased obesity and other metabolic shifts.<sup>15</sup> Other work on the role of stunting on obesity had suggested such an effect,

but Hoffman's work suggests the mechanism and fits with the correlational work.

### Assertion 3

The burden of sedentarianism, nutrient-dense poor diets and obesity is shifting to the poor! An extensive literature that has documented the global burden of these diseases as they affect the poor<sup>16</sup> has led to worldwide initiatives to develop effective vaccines and new generations of low cost prevention and treatment options. The total burden of these NR-NCDs is increasing very rapidly as the increase in obesity prevalence in the lower and middle income worlds is manifold higher on an annual basis than that for the higher income world.<sup>1</sup> With these rapid increases comes a need to go beyond country average figures to understand more about the disease patterns and burdens across the social classes.

An important and extensive review of literature by Sobal and Stunkard<sup>17</sup> showed that the burden of obesity faced the rich in low income countries in the 1980s and earlier periods whereas for the higher income nations, the poor had the higher burden of obesity. Martorell and his collaborators have shown that based on data from the mid1990 s and earlier from Demographic and Health Surveys, a few countries have higher levels of obesity among the poor.<sup>4</sup> Research by Popkin et al.<sup>18</sup> shows an acceleration of the shift in obesity and related factors to the poor. For example, now even in China low education adults are more likely to be overweight than are high education Chinese. This pattern is found in all moderate income countries (e.g., Chile, Brazil, Mexico).

### Discussion

The shift toward the nutrition transition stage linked with a high level of NR-NCDs is finding most lower- and middle-income countries unprepared. The changes are occurring very rapidly and the costs, in terms of health, are great. Large populations are still undernourished and programs and policies to address these new changes in a preventive way are not being developed. Further understanding of the causes and consequences of these shifts must be understood and far greater priority needs to be given to the area of prevention.

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