

# Symposium: Obesity in Developing Countries: Biological and Ecological Factors

## The Nutrition Transition and Obesity in the Developing World<sup>1</sup>

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**ABSTRACT** Changes in diet and activity patterns are fueling the obesity epidemic. These rapid changes in the levels and composition of dietary and activity/inactivity patterns in transitional societies are related to a number of socioeconomic and demographic changes. Using data mainly from large nationally representative and nationwide surveys, such as the 1989, 1991, 1993 and 1997 China Health and Nutrition Surveys, in combination with comparative analysis across the regions of the world, we examine these factors. First, we show the shifts in diet and activity are consistent with the rapid changes in child and adult obesity and in some cases have been causally linked. We then provide a few examples of the rapid changes in the structure of diet and activity, in particular associated with increased income. Cross-country and in-depth analysis of the China study are used to explore these relationships. People living in urban areas consume diets distinctly different from those of their rural counterparts. One of the more profound effects is the accelerated change in the structure of diet, only partially explained by economic factors. A second is the emergence of a large proportion of families with both currently malnourished and overweight members as is shown by comparative analysis of a number of Asian and Latin American countries. J. Nutr. 131: 871S-873S, 2001.

**KEY WORDS:** • nutrition transition • obesity epidemic

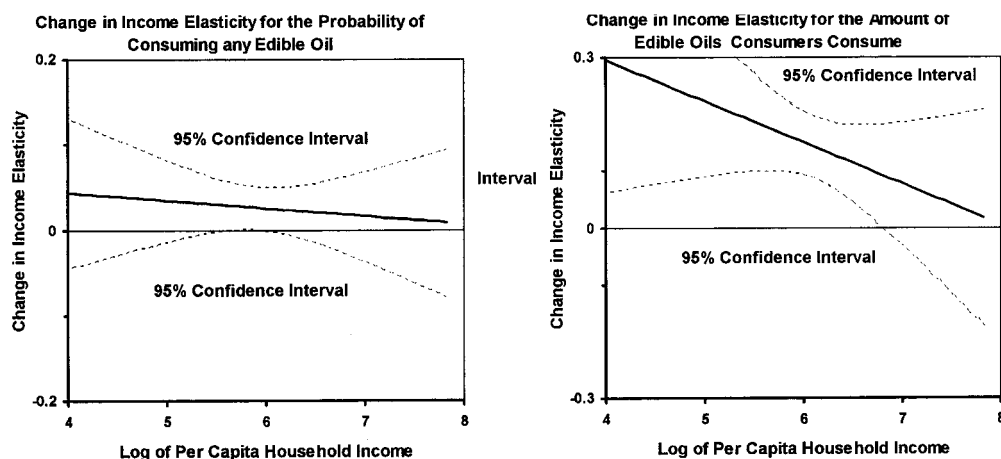
**The world moves toward the higher fat and higher refined carbohydrate Western diet!** In country after country we and others have documented a marked shift in the structure of the diet (Kim et al. 2000, Monteiro et al. 1995, Popkin 1994, 1998, World Cancer Research Fund 1997). Most countries in Asia, Latin America, Northern Africa, the Middle East and the urban areas of sub-Saharan Africa have all experienced a shift in the overall structure of its dietary pattern with related disease patterns over the last few decades. Major dietary change includes a large increase in the consumption of fat and added sugar in the diet, often a marked increase in animal food products contrasted with a fall in total cereal intake and fiber. In many ways this seems to be an inexorable shift to the higher fat Western diet, reflected in a large proportion of the population consuming over 30% of energy from fat. However, there are many exceptions and the foods that drive these changes differ by region. For instance, for Asia a major component

appears to be the increase in amount of edible oils in the diet. But there is great heterogeneity in the diet shifts. For instance, one of the higher income countries in Asia, South Korea, has retained many elements of a traditional diet despite a rapid increase in income during this past half-century (e.g., Kim et al. 2000). In India and South Asia, higher dairy product as well as added sugar consumption are central. Unfortunately vegetable ghee in India appears to have very high trans fatty acid levels. According to Dr. Walter Willett, Chairman, Department of Nutrition, Harvard University, a major source of edible oil in India, "Dalda," a vegetable ghee, has trans fatty acid levels of about 50%.

**Dietary shifts are accelerating!** The rate of change is accelerating. Evidence from Latin America and Asia points toward a situation where the rates of change in the structure of diet and activity are such that the burden of a high energy-dense diet and low activity pattern are going to be found as much, if not more, among the poor. We utilized longitudinal analysis of the effects of income on food choice and overall diet from Chinese adults followed between 1989 and 1993 (see Guo et al., 1999, 2000). We also examined the changes from 1989 to 1993 in the income elasticities and confidence bands about these temporal changes in elasticities. While we separately looked at the decisions to consume each food and then the conditional demand for the amount of food consumed daily, here we present in **Figure 1** one example to illustrate a most important trend. These results present the change in income elasticity for the conditional demand for the quantity of oil for households of various income levels. The income

<sup>1</sup> Presented as part of the symposium "Obesity in Developing Countries: Biological and Ecological Factors" given at the Experimental Biology 2000 meeting held in San Diego, CA on April 15-19, 2000. This symposium was sponsored by the American Society for Nutritional Sciences and was supported in part by an educational grant from Monsanto Company. Symposium proceedings are published as a supplement to *The Journal of Nutrition*. Guest editors for the symposium publication were Benjamin Caballero, Center for Human Nutrition, Johns Hopkins University, Baltimore, MD and Najat Mokhtar, Ibn Tofail University, Kenitra, Morocco.

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**FIGURE 1** Changes in income elasticities for edible oil consumption among adults aged 20–45 in China from 1989 to 1993. (Source: Guo et al. 2000.)

elasticity for the demand for edible oil rose significantly between 1989 and 1993, and was positive at all income values and significantly different from zero for all but the top few percentage of the income distribution. Although the poor did not increase their consumption of all commodities that much more than did the rich in China during this period, during the same time span higher fat foods became much more responsive to income levels. Pork, edible oils and eggs had significant increases in their income elasticities. The quantity of fat in the diets increased significantly and now appears to increase much more rapidly with increases in income. Overall, these changes portend an important deterioration in the healthiness of the Chinese diets that could burgeon as the Chinese economy continues its expansion. Moreover, the edible oil relationship is indicative of a potential shift toward a higher fat diet for the poor relative to the rich.

This same research showed a remarkable acceleration in the decline in the proportion of the diet that is coming from what were previously viewed as superior grain and grain products—rice and wheat. These results fit closely with the trend toward increased obesity in China as we note below. There are two important issues. First, lower income people can afford more fat (from edible oils) and this upward shift in fat consumption is important for explaining part of the nutrition transition in China (e.g., Drewnowski and Popkin 1997). Also, it is clear that the nutrition transition in China is not decelerating but actually increasing. What is not clear is why. The shifts in the nature of work and leisure are straightforward, but the changes in diet and the reasons for the structural shifts in diet are what cannot be explained.

**Activity changes are equally rapid!** A major change in economic structure associated with the nutrition transition is the shift from a preindustrial agrarian economy to industrialization. This transformation then accelerates; the service sector grows rapidly, industrial production is dominated by capital-intensive processes and time-allocation patterns change dramatically. The sectoral distribution of the labor force toward industry and service has accelerated around the world.

Along with the shift toward occupations that require less energy to be expended, the new technologies allow those at each occupation to engage in increasingly sedentary work. Extant national occupational status and other labor force data do not provide any evidence of this remarkable shift in the energy expenditure patterns within each occupation. It requires individual level information and we have shown for China that the shifts are so marked that they were linked with

large increases in body mass index (BMI) and a greater risk of obesity (Paeratakul et al. 1998, Popkin 1999).

Related to the effect of industrialization and modernization on market production is a similar shift in time allocation and physical effort in home and leisure activities. Since the discovery of fire, a key thrust in the continuing development of household technology for processing and storing food has been to save time and enhance the quality of life. In the last century, the evolution of household technology seems to have accelerated. In food-preparation technology, recent developments include efficient ways to prepare and store food (canning, refrigeration, freezing, radiation treatment, packaging etc.); food processing with tools such as electric mixers and food processors; and cooking with pressure cookers, cookware made with improved metals and alloys, metal stoves using various fossil fuels and microwave ovens.

These food-preparation technologies, together with home electrification, washing machines and clothes dryers, vacuum cleaners, piped water and so forth, have transformed home production from a time-consuming, often back-breaking, full-time occupation for peasant or working-class women. Although home production still requires time and energy, purchased technology is widely accessible to substitute for the time of the mother and others who engage in home production activities. One way to see how these household technologies have made transformations in a society is to examine the studies of the introduction of electricity to agricultural societies, which show large, rapid transitions in the use of time, the roles of various household members and other social factors. Herrin's classic study on the impact of electrification on the lives of families in poorer regions has demonstrated the profound shift in the use of time related to the use of electricity.

Possibly an even more astounding shift has come in leisure activities. The rapid shift in television ownership and the equally important provision of cable linkages to bring the images and marketing to each household are key elements. In the past, leisure activities for children often meant active play, but leisure today may mean a quite sedentary activity such as viewing television or playing a computer game. Documentation of such patterns across the lower income world is not available in terms of time spent and the shift in activities, an area requiring greater focus.

**These changes are linked with obesity increases!** Where scholars have tried to rigorously link these dietary and activity changes with body composition changes among adults, the results have been persuasive. They have repeatedly shown in

longitudinal studies of these relationships among children and adults that the dietary and activity patterns affected BMI (e.g., Bray and Popkin 1998, Paeratakul et al. 1998). Also they have shown that these changes are dynamic and there appears to be emerging a shift toward greater overweight among the poor in some countries (Monteiro et al. 2000). The income–dietary fat intake changes noted above for China indicate that China is in the early stages of this same shift toward an inverse income–BMI relationship (Guo et al. 2000). In our China research, we found a remarkable increase in obesity among the adults we have followed for 8 y (1989 to 1997). In an unpublished manuscript by Bell and others, the overweight prevalence of Chinese men (BMI  $\geq$  of 25.0) tripled during this period while among women it doubled.

**Double burden within the same household emerges as a new concern!** New research done by Doak and others (unpublished manuscript) showed that a considerable proportion of households have undergone the nutrition transition in which overweight and underweight coexist. Not only was the prevalence of such households high (representing 3–15% of all households in six countries studied) but these joint under/over households account for an important proportion of all households with an underweight member. For instance, these levels for three countries are as follows: Brazil (44%), China (23%) and Russia (57%). This research challenges the assumption that underweight and overweight are opposing public health concerns and illustrates the need for public health programs

that are able to simultaneously address underweight and overweight.

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