*e*J A D E
*electronic* **Journal of Agricultural and Development Economics**

Agricultural and Development Economics Division (ESA) FAO
available online at www.fao.org/es/esa/eJADE

Vol. 1, No. 2, 2004, pp. 220-241

# Globalization, Urbanization and Nutritional Change in the Developing World

Michelle A. Mendez and Barry M. Popkin
*Carolina Population Center, University of North Carolina*
*Chapel Hill, NC, USA*
*popkin@unc.edu*

**Abstract**

*Urbanization and globalization may enhance access to non traditional foods as a result of changing prices and production practices, as well as trade and marketing practices. These forces have influenced dietary patterns throughout the developing world. Longitudinal case study data from China indicate that consumption patterns closely reflect changes in availability, and that potentially obesogenic dietary patterns are emerging, with especially large changes in rural areas with high levels of urban infrastructure and resources. Recent data on women from 36 developing countries illustrate that these dietary shifts may have implications for overweight/obesity in urban and rural settings. These data emphasize the importance of developing country policies that include preventive measures to minimize further adverse shifts in diet and activity, and risk of continued rises in overweight.*

***Keywords***: *dietary patterns, developing countries, overweight, food policy*

## 1. Introduction

Over the past 15 years, there is increasing evidence that the structure of dietary intakes and the prevalence of obesity around the developing world have been changing at an increasingly rapid pace (Popkin 2002b). While there is some evidence to link urbanization with these changes, even less is

understood about the role of globalization. Urbanization is accompanied by shifts in a broad array of elements such as access to mass media, modern technologies related to work and leisure and transportation, and enhanced access to a variety of foods across all seasons of the year, inter alia. Many of these changes may be attributable as well to the increased flow of goods, services, and information associated with globalization. Increased globalization may bring shifts in occupational structures as industries develop and expand in response to world markets; greater access to international mass media programming; and enhanced access to non-traditional foods as a result of changing prices and production practices as well as trade. Because of the multiple shared paths through which urbanization and globalization may influence food availability and choices in developing countries, it is difficult to unravel effects of the two sets of forces on diet and health.

The clustering of populations in urban centers affects dietary patterns by changing the way people interact with their environments, as well as by changing the environments themselves in ways that transform food production and distribution systems. For example, urban living is associated with occupational patterns less compatible with home food production and consumption, and often with limited land availability for cultivation. Urbanization brings infrastructure and resources such as improved transportation and refrigeration systems. Today, in developing countries undergoing rapid urbanization combined with globalization and urbanization, the process includes changes in the socio-cultural environment such as mass media marketing and the widespread availability of less traditional foods, which play an important role in influencing tastes and preferences (Chopra, Galbraith and Darnton-Hill 2002; Lang 1999; Evans et al. 2001). Growing foreign investment has contributed to the rise of fast food restaurants and western-style supermarkets, which may also influence consumer food choices by offering greater variety, quality, convenience and competitive prices in high-value added foods, in addition to perceived higher social desirability (Regmi and Gehlar 2001; Reardon, Timmer and Berdegue 2003). These changes in the food environment are occurring at a rapid pace. As developing countries become more urbanized, these changes are expanding beyond large urban centers and into smaller cities and towns, mirroring the pattern that occurred over time in industrialized countries. For example in China, western-style supermarkets are now found in smaller cities and towns along the Eastern coast and in the interior (Reardon Timmer and Berdegue 2003).

Several studies in developing countries have shown in the past that compared with rural diets, urban diets tended to include higher levels of milled and polished grains (e.g. rice or wheat, rather than corn or millet), foods higher in fat (more animal products), sugar, food prepared away from the home, and processed foods Popkin and Bisgrove 1988). Over time, migrants to urban areas tend to adopt urban dietary patterns, though the timing of such changes has not been studied (Popkin and Bisgrove 1988). However, as infrastructure and resources typical of urban areas become more widespread, the extent to which "urban" dietary patterns are being adopted in rural towns is not known. Residents of many rural areas are likely to be increasingly exposed to environmental factors that affect food choices, particularly in highly urbanized countries. To fully understand the nutritional effects of urbanization and globalization, it may become increasingly important to examine trends in diet and overweight in evolving rural environments as well as in urban communities. Multidimensional measures that more directly capture heterogeneity and change in levels of "urbanicity" may provide insights on the effects of urbanized ecologies on diet beyond those that can be gained using prevailing measures such as static urban–rural designations or population size and density (Stookey et al. 2003).

Little is known about how urbanization and globalization are affecting dietary patterns in lower-income groups (Drewnowski and Popkin 1997; Popkin 2002a). These forces may have positive effects on the poor by increasing incomes and reducing the prevalence of inadequate energy intakes and undernutrition (Sachs et al. 1995; Dollar 2001). However, these effects may not be universal: several studies suggest that the benefits of globalization have been unequal, and that in some countries globalization has had little impact on poverty alleviation (Cook and Kirkpatrick 1997; Cornia 2001). Furthermore, along with reduced undernutrition, rising obesity has been observed in low-income groups in some developing countries (e.g. Monteiro, Wolney and Popkin 2002; Monteiro et al. 2004). This suggests the poor are increasingly adopting obesogenic diet and activity patterns, but there is little

data about the nature of changing dietary behaviors, or the extent to which behavioral changes may be attributable to living in urban (or urbanizing) environments. Understanding the health and nutrition effects of urban environments on the poor is increasingly important, as the process of urbanization in many developing countries has included a massive shift of less advantaged groups to urban areas. In fact, in some countries, as urban populations surpass rural ones, the number of persons defined as living in poverty is greater in urban compared to rural areas (Haddad, Ruel and Garrett 1999).

In this paper, we examine the types of shifts in food availability, dietary intake patterns and obesity that have taken place in developing countries during a period of rapid globalization and urbanization. Between 1960 and 2000 the proportion of the developing country population living in urban areas doubled, from 21.6 percent to 40.4 percent (United Nations Population Division 2002). Recent changes have been particularly rapid in China, where the urban population increased by 39.8 percent between 1980 and 1990 (from 19.6 percent to 27.4 percent) and by another 20.7 percent from 1990 to 2000 (reaching 35.8 percent). In the Middle East, Latin America, and Oceania, the pace of urbanization is slower, but 65 to 75 percent of the population in these regions resided in urban areas by the year 2000. These population shifts have been accompanied by accelerated globalization, as illustrated by factors such as large increases in foreign direct investment (from $24 billion to $170 billion from 1990 to 1998), and a doubling of merchandise exports and imports in the past two decades (World Bank 2001).

The first part of this paper presents shifts in the availability of key food groups during this period of rapid change. We present information on regional shifts in edible oils, animal source foods (ASFs), fresh fruits and vegetables, and added sugars. Using case study data from China, we examine changes in food group intakes in greater detail, assessing the extent to which potentially obesogenic dietary patterns are emerging in rural as well as in urban areas. To better illustrate the effects of urbanizing environments, we present data on dietary patterns in urban and rural areas that differ in terms of infrastructure and resources. This case study also explores how food group consumption patterns have changed in low- and high-income groups in urban and rural settings. Finally, we assess some implications of these global dietary shifts by briefly describing levels of under- and overweight in women living in urban and rural areas of developing countries. We describe how the prevalence of each type of malnutrition varies across countries at different levels of urbanization. Aspects of urbanization and globalization that influence physical activity in addition to diet play a major role in the ongoing transition from underweight to overnutrition, but are not the focus of this paper.

## 2. Data and Methods

*Global shifts in food available for consumption,1961 to 2000*: Changes in global food availability were calculated using food balance sheet data and population estimates for developing countries between 1961 and 2000. These data were obtained from the Food and Agricultural Organization of the United Nations (http://apps.fao.org). For each year, 1961, 1970, 1980, 1990 and 2000, the mean food availability per capita was calculated for each region. This was based on 118 countries of the developing world: 44 in sub-Saharan Africa; 15 in the Middle East; 34 in Latin America and the Caribbean; and 25 in the Far East (including China). The added sugar category includes sugars and sweeteners; fruits excludes wine; vegetables excludes potatoes; edible oils are vegetable oils; dairy includes milk, yogurt and cheese; meat includes bovine, sheep, pig, goat, poultry and other (but excludes animal source fats such as lard); fish includes fish and seafood. Animal source foods combine eggs, meats and poultry, fish and dairy products, but excludes animal source fats such as lard.

*The China Case Study:* The case study uses data from the China Health and Nutrition Survey (CHNS) from 1991 to 1997. The CHNS was conducted in eight provinces across China. Multistage cluster sampling was used to select communities from areas that differ substantially with respect to economic and health status, as well as geography. Details on the sample and data collection methods have been

published elsewhere (Entwisle et al. 1995; Guo et al. 1999), and are available online (http://www.cpc.unc.edu/projects/china/). Individual-level dietary intake data, collected using three consecutive 24-hour recalls, are used to estimate consumption trends in key food groups among Chinese adults aged 20 to 45 years. Added caloric sweetener data is not available as this is not found in the food composition table for China. Anthropometric data collected by trained interviewers were used to calculate body mass index (weight in kg/height in m2), with which participants were categorized as overweight or obese (BMI ≥ 25.0) or as underweight (BMI ≤ 18.5). Income was estimated based on earnings from market and non-market activities as well as subsidies. Urbanicity was characterized using the China Urbanization Index, a multidimensional index of infrastructure and resources in ten categories: population size, population density, access to markets, transportation, communications/media, economic factors, environment/sanitation, health, education, and housing quality (Stookey et al. 2003). The index was developed using data from community surveys, supplemented with household level information.

*Nutritional Status Changes:* To analyze changes in under- and overweight, we used national data sets from surveys conducted between 1992 and 2000 in 36 developing countries: 20 in sub-Saharan Africa, eight in Latin America and the Caribbean (including Brazil and Mexico), five in Asia (including China and India), and three in North Africa and the Middle East. Many DHS datasets are not used due to lack of appropriate maternal anthropometry data. The China and Mexico data sets are from national health and nutrition surveys conducted by these countries in 1997 and 1999, respectively (see for references on these two survey systems Rivera et al. 2002; Popkin et al. 1993). All other national data sets correspond to standardized USAID/Macro Demographic Health Surveys (DHSs) conducted between 1992 and 2000 (Boerma and Sommerfelt 1993). We used only the most recent data for countries in which two or more DHSs were conducted in this period. DHS data sets were downloaded from http://www.macroint.com/dhs/ or obtained directly from the State Statistical Offices (SSOs) that conducted the surveys.

We restricted analyses in all data sets to non-pregnant women aged 20 to 49 years. Average sample size was 4 266, ranging from 1 460 in Bolivia to 21 171 in Peru, with a total of 157 844 women studied. Average non-response rates were less than 0.2 percent for weight and height measurements and less than 0.7 percent for questions on SES. In the case of the DHS data, most women were mothers of children under five years of age. All analyses presented in this article were age-adjusted to allow for differences in age distribution between, and within, countries (Ahmad et al. 1999).

The overall prevalence of underweight (BMI ≤ 18.5) and overweight-plus-obesity (BMI > 25) were calculated for women in each country based on weight and height measurements. Prevalences were estimated for both urban and rural areas. We also calculated the social distribution of underweight and overweight-plus-obesity for each country using country-specific indicators of SES – namely, the country's quartiles of the women's years of formal education. Since years of education are a numeric non-continuous variable, close to 25 percent of women in each country fall in the education quartiles. However, in some countries, women were highly concentrated in some education categories, and it was necessary to combine one or more quartiles. Prevalence figures were age-adjusted by the direct method, using the age distribution of the world population as a reference (Ahmad et al. 1999). We used survey-specific sample weights, so all estimates are nationally representative (except for the China survey, which only represents eight provinces).

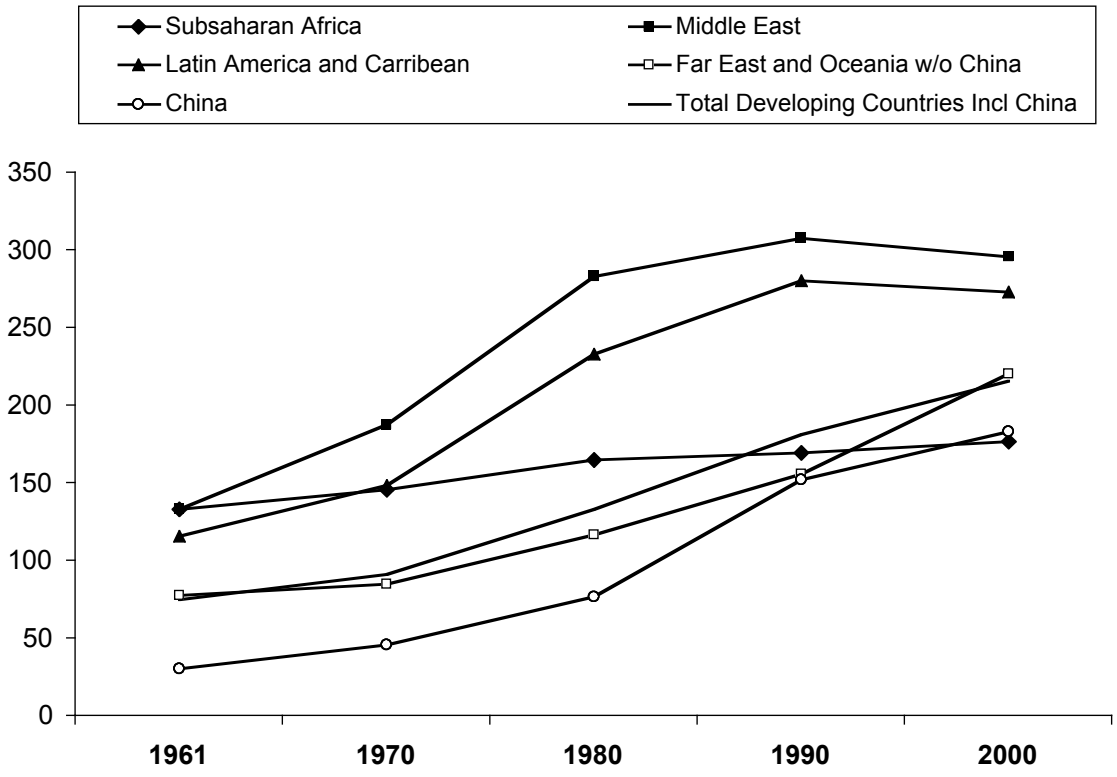
We first tested the significance of differences in overweight (and underweight) prevalence in urban vs. rural areas. Next, we tested the differences in overweight vs. underweight prevalence within both urban and rural areas. Finally, we examined the magnitude and direction of the associations between SES and prevalence of malnutrition (underweight or overweight– plus–obesity) in each country, by calculating age-adjusted prevalence ratios (with 95 percent confidence intervals) comparing the highest to the lowest education quartile within urban and rural areas.

## 3. Results

*Global shifts in food available for consumption: 1961–2000*

**Edible oils:** Throughout the developing world, the availability of edible vegetable oils for consumption has nearly tripled (see Figure 1). In some countries, the increase has been even more marked. For instance, availability of edible oil for consumption in China has risen six fold over this period, while intakes in the rest of Asia and Oceania tripled. In the past two decades, edible oil availability continued to rise in Asia and Oceania. However, availability of oils in Latin America and the Middle East – already more than 65 percent higher than in other regions by 1990 – appears to have leveled off.

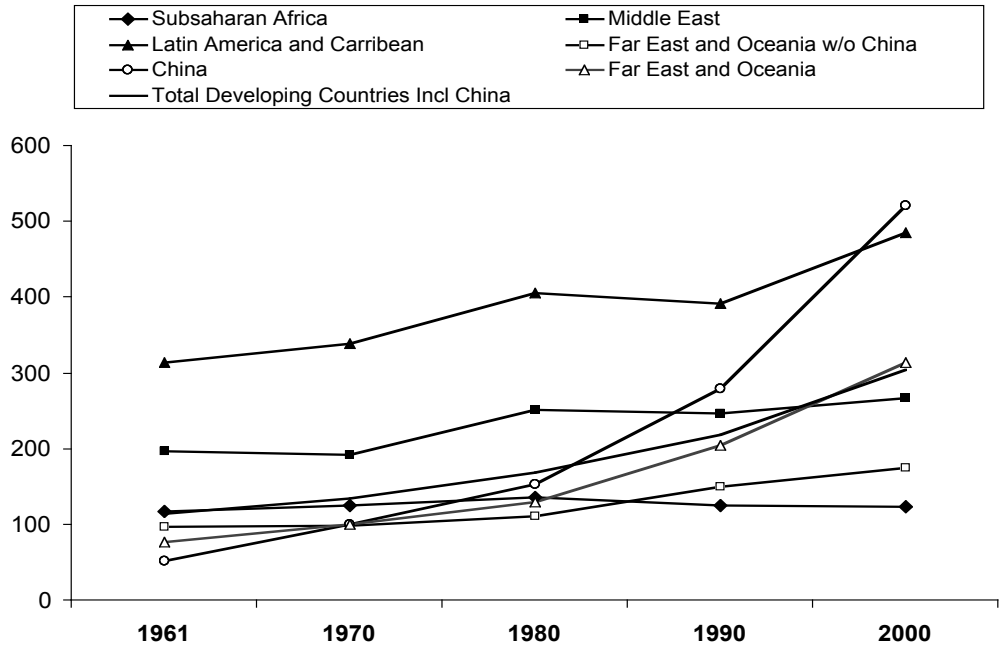
Figure 1: Regional trends in availability for consumption of edible oils, 1961-2000




Source: Food balance data from FAOSTAT data base

**Animal source foods:** Figure 2 illustrates changes in world production of animal source foods (ASF) available for human consumption, including eggs, meats (pork, all others), poultry, dairy and fish. There was almost a tenfold increase of ASF's in China, and overall a tripling of the amounts available for consumption in the developing world. In most regions, ASF intakes continued to increase rapidly in past two decades: only sub-Saharan Africa and the Middle East did not experience substantial changes in animal food consumption over that period. However, levels of ASF consumption in the Middle East were already consistently higher than those in most other developing regions.

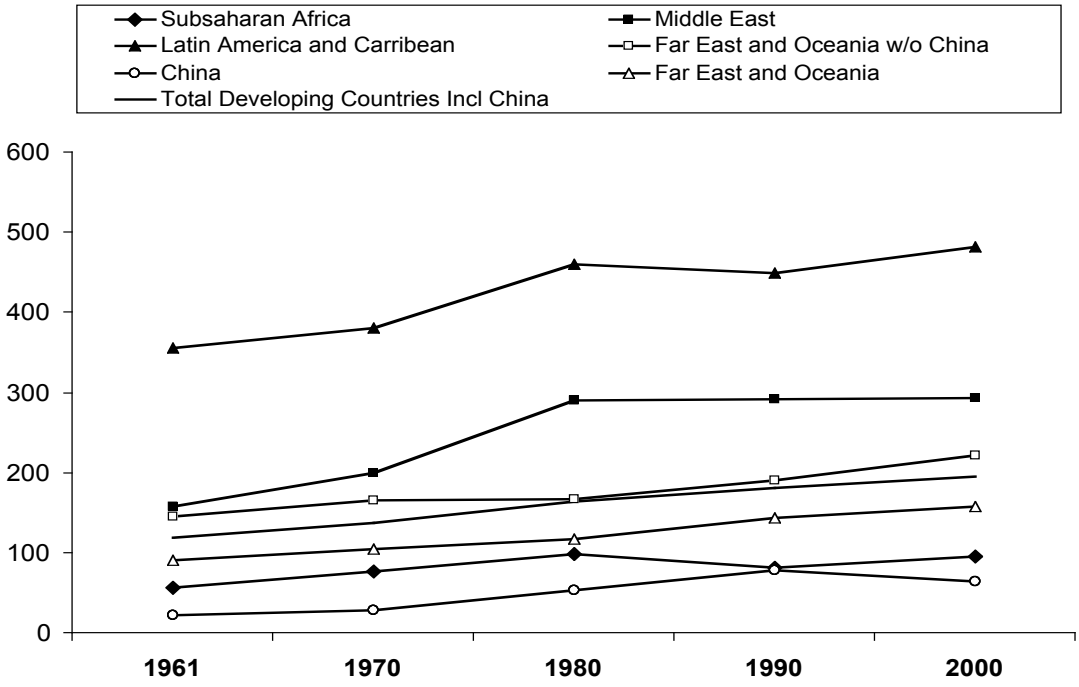
Figure 2: Regional trends in availability for consumption of total animal source foods, 1961-2000




Source: Food balance data from FAOSTAT data base

**Added Caloric Sweeteners:** Added caloric sweeteners have become increasingly a component of the diet of persons throughout the developing world, as shown in Figure 3 (Galloway 2000; Mintz 1977; Popkin and Nielsen 2003). Latin America in particular has very high levels of added caloric sweeteners available for food consumption; levels are also high in the Middle East.

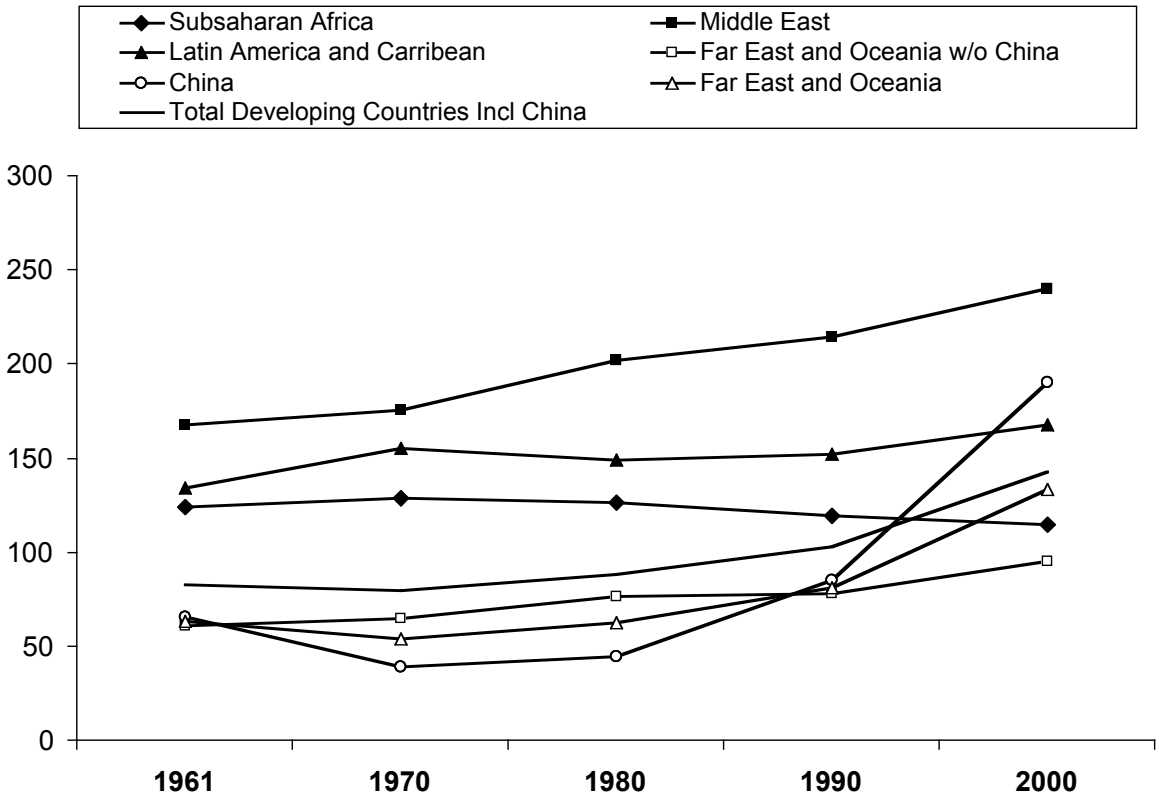
Figure 3: Regional trends in availability for consumption of total caloric sweeteners, 1961-2000




Source: Food balance data from FAOSTAT data base

**Fruits and Vegetables:** Mean levels of fruit and vegetable (F&V) available for consumption in developing countries increased by about 72 percent, from 83 kcals/day in 1961 to 143 kcals/day in 2000 (see Figure 4). Thus changes in F&V availability were much less marked than shifts in edible oils (189 percent) or ASFs (169 percent).

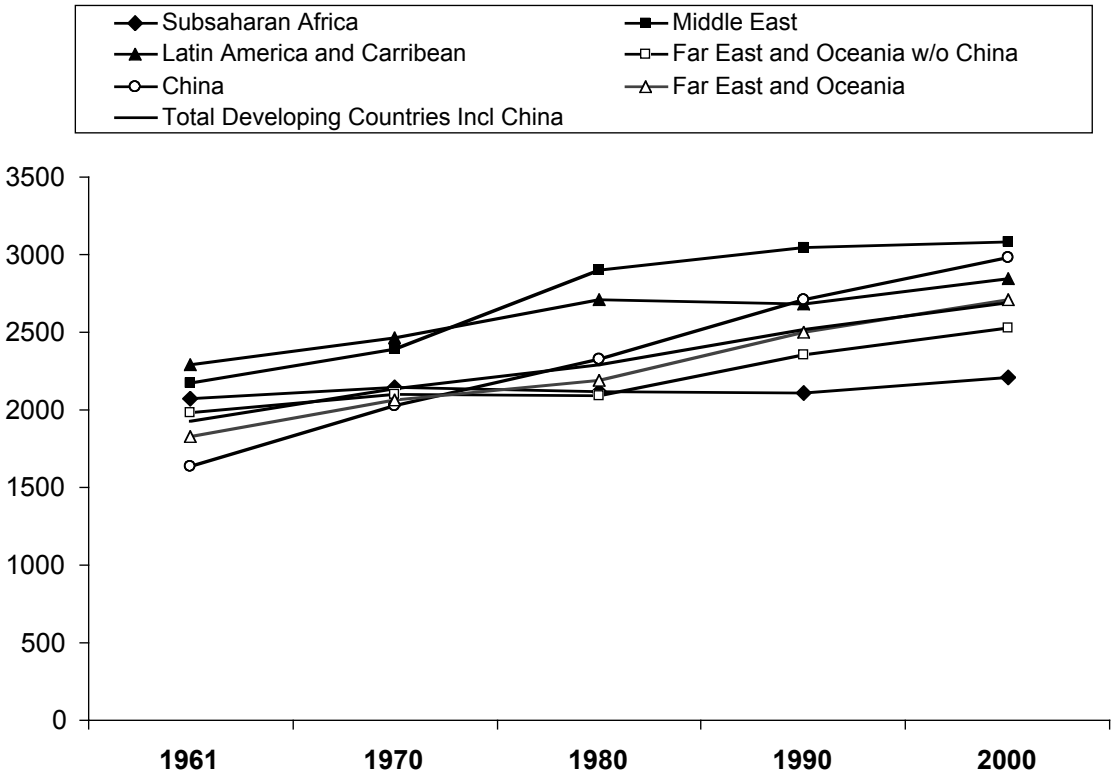
Figure 4: Regional trends in availability for consumption of total fruits and vegetables (excluding potatoes), 1961-2000




Source: Food balance data from FAOSTAT data base

**Energy:** There is an increasing trend in the amount of energy available for consumption. Overall, the highest levels of energy available for consumption are found in the Middle East (see Figure 5). There has been a remarkably large increase in China over the past 10 to 20 years: China now ranks second in terms of energy available for consumption, followed by Latin America and the rest of Asia and Oceania. Mean levels food energy available are lowest in sub-Saharan Africa, by a considerable margin.

Figure 5: Regional trends in availability for consumption of total calories, 1961-2000




Source: Food balance data from FAOSTAT data base

*Urbanization and dietary shifts in developing countries: the China case study*

In only six years, between 1991 and 1997, there have been marked changes in the dietary intakes of Chinese adults, reflecting the large changes taking place in food availability (see Table 1a; see also Du et al. 2002a, 2002b). Shifts in intakes of animal source foods have been especially pronounced, increasing by 23 percent in urban areas, and by 27 percent in rural areas. Edible oil consumption has also increased substantially, again with larger increases in rural (19 percent) than in urban (11 percent) areas. As a result of these changes, the proportion of adults consuming high-fat (>30 percent calories from fat) diets increased from 33.0 to 60.8 percent in urban areas, and from 13.5 percent to

29.3 percent in rural areas. Vegetable intakes have remained steady, changing very little in both urban and rural dwellers. Fruit intakes have more than doubled in both urban and rural areas, although intakes in both areas remain extremely low. As changes in fruit and vegetable intakes have been small, animal foods and oils–rather than healthier food choices–appear to have displaced cereals in both urban and rural communities. While the proportion of calories from cereals has fallen from 63.2 percent to 55.0 percent (a decrease of 8.9 percent) and from 71.8 percent to 63.2 percent (a decrease of 7.3 percent) in urban and rural areas respectively, calories from animal foods have increased by 1.6 percent and 2.5 percent, and from fats and sugars by 7.0 percent and 5.6 percent.

Although some changes in food group intakes have been larger in rural than in urban areas, urban diets have remained consistently richer in ASFs and oils, and poorer in quantities of vegetables. As a result of the greater shifts in rural areas, however, urban–rural disparities in ASF and vegetable oil intakes have narrowed over time. Urban dwellers, however, consume more than twice as much fruit as rural residents, and this disparity has not changed.

We conducted additional analysis using the CHNS urbanization index to take the level of urbanicity of both urban and rural areas into account (see Table 1b). Dietary patterns across communities at different levels of urbanicity are explored in greater depth in a companion paper (Mendez, Popkin and Du 2003), but selected findings are presented here. In this analysis, it became clear that simple urban–rural disparities masked substantial heterogeneity in dietary patterns across differing environments. Dietary patterns in rural areas with very high urbanicity scores closely resemble diets in areas formally designated as urban, with high intakes of animal foods and oils. Only rural communities with very low levels of urbanicity have maintained low intakes of animal foods and edible oils.

Over time, intakes of animal foods and oils increased much more quickly in lower than in higher income groups (see Table 2). Consumption of ASFs by adults in the lowest income tertile increased by 44 percent in both urban and rural areas, but by 20 to 25 percent in the highest income tertile. Similarly, consumption of vegetable oils increased several times faster in low- than in high-income adults. Thus although higher-income groups have maintained higher intakes of these foods, the income disparity has narrowed considerably. In contrast to the large shifts for these foods in low-income groups, there was little change in vegetable intakes at any income level, and fruit consumption increased largely in high-income adults.

Table 1a: Shifts in consumption in the Chinese diet for adults ages 20 to 45. (Mean intake grams/per capita/per day.)

| | Urban | | | Rural | | |
|---|---|---|---|---|---|---|
| | **1991** | **1997** | **%cg** | **1991** | **1997** | **% cg** |
| Animal foods (g) | 151.1 | 185.8 | 23.0% | 84.9 | 107.8 | 27.0% |
| Meat | 71.1 | 83.3 | 17.2% | 39.9 | 45.3 | 13.5% |
| Poultry | 7.7 | 15.3 | 98.7% | 5.1 | 8.9 | 74.5% |
| Fish | 24.5 | 28.4 | 15.9% | 15.4 | 21.3 | 38.3% |
| Eggs | 44.3 | 47.6 | 7.4% | 38.4 | 45.5 | 18.5% |
| Edible vegetable oils (g) | 41.1 | 45.5 | 10.7% | 35.0 | 41.8 | 19.4% |
| Vegetables (g) | 304.4 | 309.5 | 1.7% | 360.9 | 363.5 | 0.7% |
| Fruit (g) | 17.2 | 35.2 | 104.7% | 7.8 | 15.9 | 103.8% |

Source: China Health and Nutrition Study 1989–1997

Table 1b: Shifts in consumption in the Chinese diet for adults ages 20 to 45 by level of urbanicity (mean intake grams/per capita/per day)

| | | | Urban | | Rural | |
|---|---|---|---|---|---|---|
| **1997 Dietary Intakes** | **Urban** | **Rural** | ***Low*** | ***High*** | ***Low*** | ***High*** |
| **Animal Foods (g)** | | | | | | |
| Low income | 123.1 | 73.0 | 90.0 | 135.6 | 64.5 | 145.7 |
| Middle income | 176.1 | 104.6 | 160.5 | 182.4 | 93.8 | 170.5 |
| High income | 213.7 | 160.8 | 205.4 | 218.0 | 127.6 | 246.1 |
| All | 185.8 | 107.8 | 174.3 | 191.0 | 89.6 | 200.0 |
| **Plant Fats (g)** | | | | | | |
| Low income | 41.6 | 37.2 | 51.6 | 37.5 | 37.1 | 37.4 |
| Middle income | 43.8 | 43.4 | 49.8 | 41.2 | 43.9 | 40.7 |
| High income | 47.9 | 46.4 | 52.5 | 45.3 | 45.2 | 49.6 |
| All | 45.5 | 41.8 | 51.5 | 45.3 | 41.3 | 44.1 |

Source: China Health and Nutrition Study 1989–1997

Table 2: Shifts in consumption in the Chinese diet for adults ages 20 to 45 by income level (mean intake grams/per capita/per day)

| | Urban | | | Rural | | |
|---|---|---|---|---|---|---|
| | **1991** | **1997** | **% chg** | **1991** | **1997** | **% chg** |
| **Animal Foods (g)** | | | | | | |
| Low income | 85.7 | 123.1 | 43.6% | 50.7 | 73.0 | 44.0% |
| Middle income | 150.3 | 176.1 | 17.2% | 89.4 | 104.6 | 17.0% |
| High income | 171.7 | 213.7 | 24.5% | 133.6 | 160.8 | 20.4% |
| **Edible Oils (g)** | | | | | | |
| Low income | 30.2 | 41.6 | 37.7% | 30.6 | 37.2 | 21.6% |
| Middle income | 40.1 | 43.8 | 9.2% | 34.7 | 43.4 | 25.1% |
| High income | 44.8 | 48.0 | 7.1% | 41.8 | 46.4 | 11.1% |
| **Vegetables (g)** | | | | | | |
| Low income | 312.7 | 323.9 | 3.6% | 357.0 | 351.8 | -1.5% |
| Middle income | 303.0 | 308.3 | 1.7% | 363.4 | 386.5 | 6.4% |
| High income | 303.0 | 305.5 | 0.8% | 364.1 | 352.5 | -3.2% |
| **Fruit (g)** | | | | | | |
| Low income | 8.7 | 7.8 | -10.3% | 6.8 | 10.2 | 50.0% |
| Middle income | 9.6 | 19.0 | 97.9% | 8.4 | 20.7 | 146.4% |
| High income | 25.2 | 55.9 | 121.8% | 8.6 | 18.1 | 110.5% |

Source: China Health and Nutrition Study, 1989–1997

*Global nutritional status changes*

Current levels of overweight-plus-obesity (hereafter "overweight") among women in developing countries from different regions are shown in Figures 6, 7 and 8. In most countries, overweight has reached levels that are quite troubling, particularly in urban areas, where prevalence is generally highest. Among urban women across the developing world, overweight ranges from 10 to 70 percent

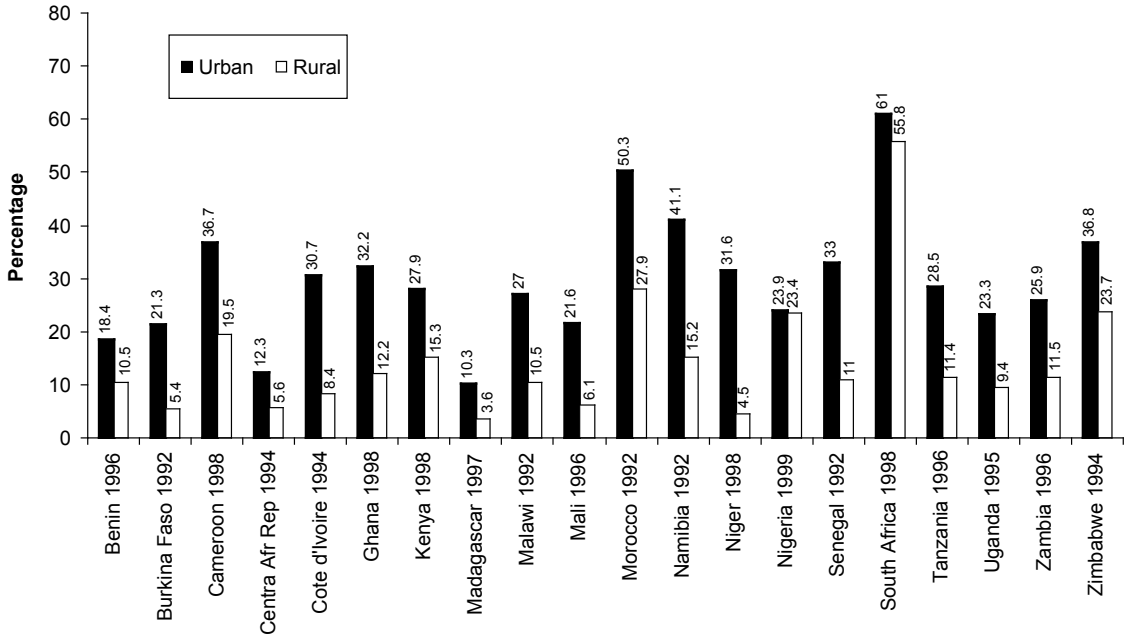
of the population; levels are well over 20 percent in most countries. Prevalence of overweight in rural women ranges from 4.5 percent to 65.6 percent. Throughout the developing world, overweight prevalence among women tends to be highest in countries where the greatest proportion of the population lives in urban centers (see Figures 9a, 9b). In countries with urbanization levels above the median (39 percent), the mean prevalence of overweight was 49 percent, nearly twice as high as in less urbanized countries (29 percent).

Table 3: Shifts in overweight and underweight prevalence in Chinese adults 20–45y, 1991–1997 [Overweight (% BMI ≥ 25); underweight (% BMI ≤ 18.5)]

| | **Overweight** | | | | **Underweight** | | | |
|---|---|---|---|---|---|---|---|---|
| | ***Urban*** | | ***Rural*** | | ***Urban*** | | ***Rural*** | |
| | 1991 | 1997 | 1991 | 1997 | 1991 | 1997 | 1991 | 1997 |
| **Male** | 12.4 | 27.4 | 6.4 | 13.1 | 5.7 | 2.0 | 4.4 | 2.4 |
| **Female** | 15.7 | 24.5 | 10.8 | 17.6 | 5.7 | 2.5 | 4.7 | 3.4 |
| *By Income Group* | | | | | | | | |
| **Male** | | | | | | | | |
| Low | 14.7 | 25.9 | 3.8 | 9.3 | 2.8 | 2.8 | 6.0 | 3.5 |
| Middle | 10.5 | 25.5 | 6.7 | 12.1 | 7.9 | 2.0 | 2.5 | 1.7 |
| High | 13.0 | 29.1 | 10.4 | 19.8 | 5.0 | 1.7 | 4.1 | 1.6 |
| **Female** | | | | | | | | |
| Low | 14.7 | 24.4 | 8.2 | 14.4 | 5.4 | 3.4 | 6.5 | 4.9 |
| Middle | 18.4 | 25.5 | 12.2 | 18.1 | 6.0 | 2.0 | 4.0 | 3.8 |
| High | 14.0 | 23.9 | 13.3 | 24.1 | 5.6 | 2.7 | 2.7 | 1.2 |

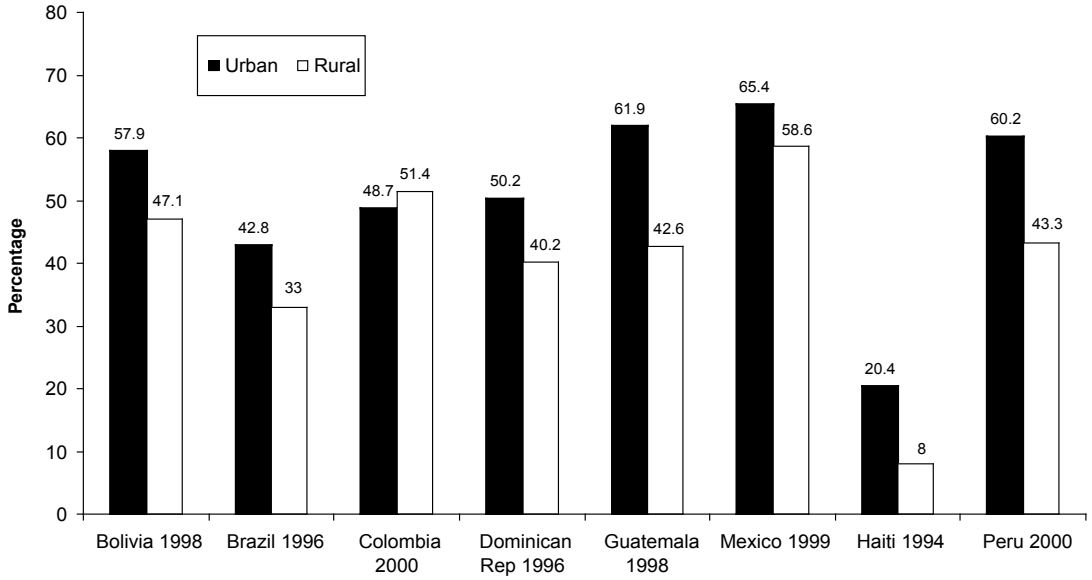
Source: China Health and Nutrition Study 1989–1997

Figure 6: Prevalence of overweight in urban and rural areas of sub-Saharan Africa in women 20-49 years old (BMI≥25 for overweight)



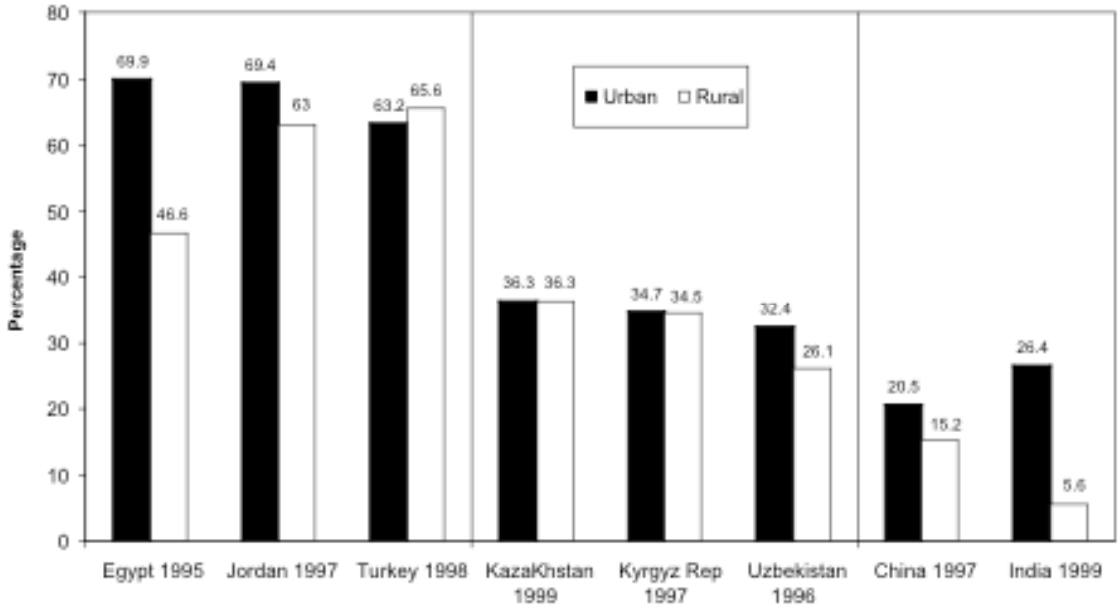

Source: Demographic and Health Surveys, weighted to be nationally representative. Age-standardized on the world population

Figure 7: Prevalence of overweight in urban and rural areas of Latin America and Caribbean in women 20-49 years old (BMI≥25 for overweight)



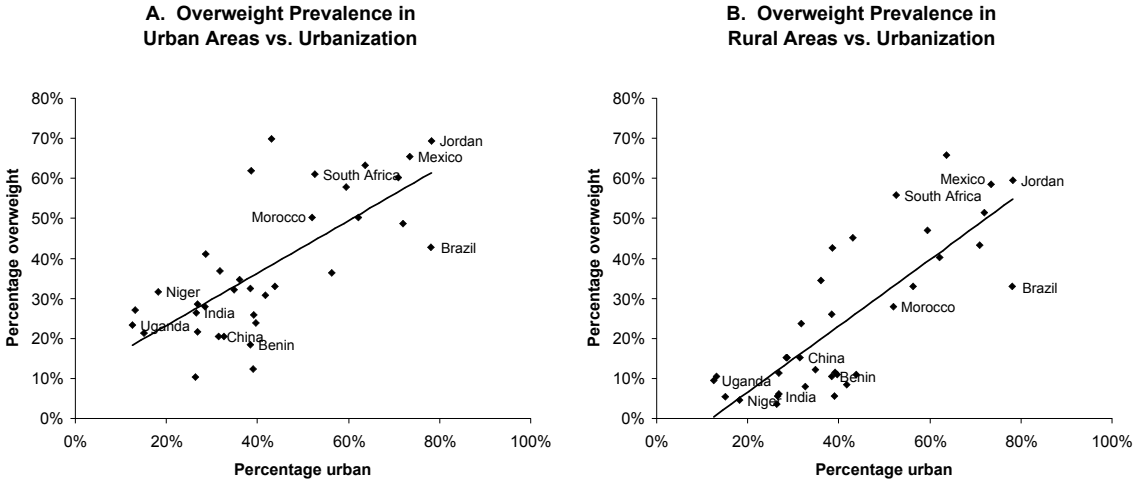

Source: Demographic and Health Surveys, weighted to be nationally representative. Age-standardized on the world population

Figure 8: Prevalence of overweight in urban and rural areas of North Africa/West Asia/Europe, Central Asia, and South and Southeast Asia in women 20-49 years old (BMI≥25 for overweight)




Source: Demographic and Health Surveys, weighted to be nationally representative. Age-standardized on the world population

Figure 9: The relationship of overweight prevalence with the proportion urban (BMI≥25 for overweight)




Source: Demographic and Health Surveys, weighted to be nationally representative. Age-standardized on the world population

Data from China bear out the recent emergence of the malnutrition observed elsewhere in the developing world. In the relatively short time frame between 1991 and 1997 (see Table 3), there have been large increases in overweight prevalence in Chinese adults living in both urban and rural areas. Conversely, there were substantial declines in underweight throughout China; prevalence was < 5 percent in all areas by 1997. Overweight has increased in women and men in both urban and rural areas, although levels remained lower in rural China. Interestingly, income disparities in overweight prevalence are very small in urban areas, although there is substantially more overweight in high-income than in low-income rural residents.

## 4. Conclusions and Policy Recommendations

The effects of urbanization and globalization on dietary patterns and nutritional status in developing countries are complex. These forces are associated with potentially beneficial dietary shifts such as increases in energy sufficiency, greater consumption of fruits, but also appear to promote potentially obesogenic shifts such as increased intakes of edible oils, animal foods and caloric sweeteners. While there have been substantial reductions in undernutrition in this period of rapid development and social change, overweight has become an increasing problem. Among adult women, overweight now exceeds underweight in almost all developing countries, particularly in the most urbanized countries. Food availability and intake data suggest that adverse shifts in dietary composition are taking place at a much higher speed than potentially beneficial changes: there has been relatively little change in levels of fruits and vegetables, but very large increases in edible oils, ASFs and added sugar and caloric sweeteners over short periods of time. Numerous studies have shown that consumption of energy-dense (high-fat, added sugar) foods tends to promote excessive energy intakes (Rolls 2000). These adverse dietary shifts have undoubtedly contributed to the rise in overweight and obesity observed throughout the developing world.

Case study data from China indicate that consumption patterns closely reflect changes in food availability. There were large increases in dietary fats, oils and ASFs in the 1990s. As a result of these changes, mean intakes of ASFs in China have reached levels similar to maximum amounts

recommended in the United States guidelines and food pyramid (USDA 2000). In contrast, intakes of fruits and vegetables fall below recommendations, which would be in the range of 500–700g/day (authors' calculations based on three fruit and four vegetable servings/day)– levels comparable to those reported for some Mediterranean countries (Moreno, Sarria and Popkin 2002). In the past two decades, levels of fruit and vegetable availability in most regions have been relatively flat, with the exception of large increases reported for China. However, it is not clear to what extent the rise in reported availability of fruits and vegetables in China reflects patterns of human consumption. Between 1991 and 1997, fruit and vegetable availability in China nearly doubled, increasing from 324 to 580g/day (88 to 152 kcals/day), while reported consumption in adults in the CHNS changed very little–from 354 to 369g/day. This raises questions about the accuracy of the Chinese fruit and vegetable availability data. Worldwide, current availability of fruit and vegetables–especially in sub-Saharan Africa and the Far East–remains well below availability levels in Mediterranean countries like Spain (249 kcals/day) and Greece (359 kcals/day) (FAO 2001).

With globalization, many developing countries are experiencing large shifts in food imports. Between 1990 and 1998, there were large increases in trade in processed grain products, while trade in unprocessed bulk grains has declined (Regmi and Gehlar 2001). Similarly, there have been large increases in trade in oils (Williams 1984). At the same time, foreign direct investment in the food industry, notably supermarkets and fast food restaurants, has expanded several-fold in many countries (Reardon, Timmer and Berdegue 2003; Bolling and Somwaru 2001). For example, between 1989 and 1998, sales by U.S. owned food processing affiliates in South America grew from US$5 billion to $15 billion, and sales in Asia increased from US$5 billion to US$20 billion (Bolling and Somwaru 2001). These shifts have been accompanied by marketing of brands and shifts in cultural norms that have influenced tastes (Chopra, Galbraith and Darnton-Hill 2002). Urbanization is associated with occupations that involve spending more time away from home (Popkin and Bisgrove 1988). Thus in many urbanized countries, intakes of processed foods, ready-to-eat meals and snacks, and street vendor, restaurant and fast food meals have increased (Regmi and Gehlar 2001). These eating patterns are associated with the higher intakes of fat, sugars and energy.

Elsewhere we have written about some of the reasons for the large shifts in edible oil consumption in developing countries (Drewnowski and Popkin 1997). Technological breakthroughs in the development of high-yield oilseeds and in the refining of high-quality vegetable oils greatly reduced the cost of baking and frying fats, margarine, butter like spreads, and salad and cooking oils in relation to animal-based products (Williams 1984). Worldwide demand for vegetable fats was fueled by health concerns regarding the consumption of animal fats and cholesterol. Furthermore, a number of major economic and political initiatives led to the development of oil crops not only in Europe and the US, but in South East Asia (palm oils) and in Brazil and Argentina (soybean oils) (USDA 1966).

Delgado has written perceptively about the ASF revolution in low-income developing countries, or the increase in demand for and production of meat, fish, and milk (Delgado et al. 1999, 2001; Delgado 2003). As relative commodity prices decrease and incomes increase, people usually increase the diversity of their diet and shift into higher priced commodities and processed convenience foods. While average income growth explains overall growth, urbanization and population growth also help to explain the greater increase in ASF demand in developing countries relative to developed countries. From 1975 to 1999, animal products drove the expansion of production in developing countries, which now account for more than half the world's meat production (Delgado 2003). In contrast, growth in ASF production in the developed world is now flat—the market is saturated. Since 81 percent of the world's people live in developing countries, small shifts in their diets result in huge changes in the world market. Since 1970 relative prices of food have dropped considerably, most dramatically for beef (Delgado 2003). Due to market saturation and technological changes that increase productivity, the ASF revolution is projected to level off by 2020.

In many countries, we also observed large increases in consumption of sugar. Sugar is the world's predominant sweetener but there are marked increases also in consumption of high fructose corn syrup (Bray, Nielson and Popkin 2004). Increasing sugar and sweetener use has been linked with

industrialization, and with the proliferation of processed foods and beverages that have sugar added to them (e.g. tea, coffee, cocoa, soft drinks). Elsewhere we review in far more detail the way the world's diet has changed with respect to added caloric sweeteners (Popkin and Nielsen 2003).

As shown using data from China these emerging, potentially adverse dietary patterns are especially marked in urban areas. Compared to rural dwellers, urban residents continue to consume higher levels of fats and animal foods, along with lower intakes of vegetables. However, the dietary effects of urbanization and globalization appear to be expanding into areas designated as rural. With marked increases in oils and ASF consumption in rural areas, the disparity between urban and rural intakes has become smaller over time. Rural consumption of these foods is particularly high in areas that are highly urbanized in terms of infrastructure and resources. In a companion paper, we explore dietary patterns in different urban contexts in greater detail (Mendez, Du and Popkin 2003). Only areas with very low levels of urbanicity have maintained traditional diets, low in fat and animal source foods. "Urban" dietary patterns are likely to become more common throughout developing countries as the process of rural development—or increased urbanicity in rural areas—continues.

Disturbingly, there is evidence that the adverse changes in dietary intakes associated with urbanization are taking place at all levels of SES, and likely contribute the rising levels of low-income obesity observed in some developing countries. In China, although low-income adults consumed lower levels of animal foods and oils than higher-income adults, the rate of increase ASF and edible oil consumption is, overall, faster in low-income groups. Relatively high levels of overweight were observed in low SES women in numerous developing countries, resulting in relatively small disparities in overweight between high and low SES groups.

These dietary shifts have occurred along with increased sedentarism in occupational activity and commuting, as well as in the nature of leisure time activity (e.g. from increased television watching) (Bell, Ge and Popkin 2001, 2002; Hu et al. 2002, Tudor-Locke et al. 2002). Because of their tendency to promote over-consumption, the dietary changes currently taking place in developing countries may help to explain energy imbalance and obesity, as individuals fail to adapt their energy intakes to match reduced energy expenditure levels. Together, these shifts in diet and activity have contributed to the rising obesity observed throughout the developing world, at all income levels and increasingly in rural areas. The high speed of change is also a concern, as individuals exposed to undernutrition earlier in life are also making these dietary shifts. Individuals with very poor nutrition in early life may be at greater risk of adverse consequences including diabetes, cardiovascular disease or weight gain from these dietary shifts (Barker 2001; Schroeder, Martorell and Flores 1999; Sawaya et al. 2003; Reddy 2002).

In addition to obesity, the dietary changes associated with urbanization and globalization are of great concern because of the implications for risk of obesity-related chronic disease. Large increases in the prevalence of numerous obesity-related chronic diseases have been documented around the developing world, including diabetes and cardiovascular diseases (Kumanyika et al. 2002; Yusuf et al. 2001). A large body of evidence, including data from clinical trials, shows that diets lower in meats and fats, and richer in fruits and vegetables, reduce blood pressure and risk of diabetes incidence as much or more than costly pharmacological treatments (Knowler et al. 2002; Vollmer, Sacks and Svetkey 2001).

Researchers working in many developing countries have begun to move beyond documenting shifts in obesity, to also document the dietary and activity shifts underlying the ongoing nutrition transition. Studies in several other developing countries have described dietary trends similar to those described here (e.g. Shetty 2002; Kosulwat 2002). The need to develop policies appropriate for the current nutrition climate, in which overweight has become a major health issue in developing countries, has been highlighted (Uauy and Kain 2001). In a few countries, policies and programmes to shift dietary practices in developing countries to address obesity in addition to undernutrition are being put in place, although the effectiveness of these efforts is yet unknown (Coitinho, Monteiro, Wolney and Popkin 2002; Zhai et al. 2002).

As part of its National Plan of Action for Nutrition, China has developed important educational tools such as the Chinese pagoda, a set of dietary guidelines for Chinese residents (Zhai et al. 2002). Schools have been asked to increase time allotted to physical activity. The government has used subsidies to promote urban vegetable consumption in northern areas of China, and to promote rural gardens. Promotion of pulse consumption has been identified as a strategy for maintaining protein quality, while providing as an alternative to meats as a source of protein (Leterme and Carmenza Muñoz 2002). As part of its nutrition plan, China has developed policies to increase soybean production and consumption (Zhai et al. 2002). While meat production has nearly kept pace with rising demand and consumption, however, increases in soybean production and consumption to date have been relatively small (Geissler 1999). Despite the large shifts in consumption and availability, meat imports were 1.7 percent of the total supply in 1990, and 3.6 percent in 2001 (FAO 2001). Meanwhile, estimated availability of pulses in China remains fairly low – 36.6 grams/capita/day in 2001 (FAO 2001) – as do mean reported intakes of pulses in recent surveys (39.0g/day in 1991 and 44.6g/day in 1997, among CHNS adults).

Brazil has also developed a new national food nutrition policy, addressing the emergence of obesity rather than underweight as the major problem of adult malnutrition (Coitinho, Monteiro and Popkin 2002; Monteiro, Conde and Popkin 2004). In addition to continuing efforts to combat malnutrition, components of this policy include development of nutrition labels, regulation of health claims about foods, and the regulation of school meals, but their effectiveness remains unknown. However, even before those policies were implemented, there was a marked decline in the rates of increase in obesity among high SES women (Monteiro et al. 2000). The researchers suggested that intensive mass media attention paid to the epidemic of obesity may have contributed to the decline. Television and print media programmes provided extensive information on the consequences of obesity, as well as on obesity prevention measures.

Developing countries may benefit from preventive measures that minimize further adverse shifts in diet, rather than attempting to reverse shifts after new dietary patterns are even more established as cultural norms. Given that adverse dietary and activity patterns appear to be widespread geographically and socioeconomically, strategies with broad reach are appropriate, such as the use of mass media. The experience in Brazil suggests that mass media nutrition education efforts may be effective for reaching some population groups.

Another important component of obesity prevention may involve working with the food industry. In the U.S., increases in portion sizes in commercial food products may have contributed to higher intakes of energy-dense foods, and exceed standard serving sizes (Young and Nestle 2003; Nielsen and Popkin 2003). Working with or regulating the restaurant and supermarket industries to maintain appropriate portion sizes may help to minimize excess intakes. Pricing has also been shown to play a key role in food choices in both developed and developing countries (French 2003; Guo et al. 1999). The use of subsidies or other incentives to ensure that fresh fruits and vegetables are affordable may help to promote healthier food choices. Since high intakes of meats are associated with increased risk of hypertension and cardiovascular disease, more effective policies, developing countries should continue to explore agricultural and educational policies that promote the production and consumption of pulses as protein substitutes.

Tastes and preferences begin to be established in early life (Hill 2002). Therefore, schools may provide an important opportunistic venue through which preferences for more healthy options can be encouraged. Workplaces also provide an opportunity to encourage or provide opportunities for exercise and healthier diets, and efforts in some countries have targeted work sites (Doak 2002). Dietary policies should be accompanied by programmes to address country-specific barriers to maintaining high levels of physical activity, such as efforts to facilitate safe active commuting, and the promotion of physical activity during leisure-time.

## References

Ahmad, O.B., Boschi-Pinto, C., Lopez, A.D., Murray, C.J., Lozano, R. and Inoue, M. 1999. *Age standardization of rates: a new WHO standard*. GPE Discussion Paper Series No. 31. Geneva,World Health Organization.

Barker, D., ed. 2001. *Fetal Origins of Cardiovascular and Lung Disease*. New York, Marcel Dekker, Inc.

Bell, C., Ge, K. & Popkin, B.M. 2001.Weight gain and its predictors in Chinese adults. *Int Jour. Obes. Relat. Metab. Disord.*, 25(7): 1079–86.

Bell, C., Ge, K. & Popkin, B.M. 2002. The road to obesity or the path to prevention? Motorized transportation and obesity in China. *Obes. Res.,* 10(4): 277–83.

Boerma, J.T. & Sommerfelt, A.E. 1993. Demographic and Health Surveys (DHS): Contributions and limitations. *World Health Stat. Qtly,* 46: 222–26.

Bolling, C. & Somwaru, A. 2001. U.S. food companies access foreign markets though direct investment. *Food Rev*., 24(3): 23–28 (available at http://www.ers.usda.gov/publications/ FoodReview/septdec01/)

Bray, G.A., Nielsen, S.J. & Popkin, B.M. 2004. Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. *Amer. Jour. of Clinical Nut*., 79(4): 537–43.

Chopra, M., Galbraith, S. & Darnton-Hill, I. 2002. A global response to a global problem: The epidemic of overnutrition. *Bull. World Health Org.,* 80: 952–58.

Coitinho, D., Monteiro, C.A. & Popkin, B.M. 2002. What is Brazil doing to promote healthy diets and active lifestyles? *Public Health Nutr.,* 5(1A): 263–67.

Cook, P. & Kirkpatrick, C. 1997. Globalization, regionalization and third world development. *Regional Studies,* 31(1): 55–66.

Cornia, G.A. 2001. Globalization and health: Results and options. *Bull. World Health Org.*, 79: 834–41.

Delgado C.L. 2003. Rising consumption of meat and milk in developing countries has created a new food revolution. *Jour. Nutr*., 133: 3907S–3910S.

Delgado, C., Rosegrant, M., Steinfeld, H., Ehvi, S. & Courbois, C. 1999. *Livestock to 2020: The next food revolution.* Food, Agriculture, and the Environment Discussion Paper 28. Washington DC, International Food Policy Research Institute.

Delgado, C., Rosegrant, M., Steinfeld, H., Ehvi, S. & Courbois, C. 2001. Livestock to 2020: The next food revolution. *Outlook on Agr.,* 30(1): 27–29.

Doak, C. 2002. Large-scale interventions and programmes addressing nutrition-related chronic diseases and obesity: Examples from 14 countries. *Public Health Nutr.,* 5(1A): 275–77.

Dollar, D. 2001. Is globalization good for your health? *Bull. World Health Org*., 79(9): 827–33.

Drewnowski, A. & Popkin, B.M. 1997. The nutrition transition: New trends in the global diet. *Nutr. Rev.,* 55(2): 31–43.

Du, S., Lu, B., Zhai, F. & Popkin, B.M. 2002a. A new stage of the nutrition transition in China. *Public Health Nut.,* 5(1A): 169–74.

Du, S., Lu, B., Zhai, F. & Popkin, B.M. 2002b. The nutrition transition in China: A new stage of the Chinese diet. *In:* B. Caballero & B.M. Popkin, eds. *The Nutrition Transition: Diet and Disease in the Developing World*. London, Academic Press, pp. 205–22.

Entwisle, B., Henderson, G.E., Short, S., Bouma, J. & Fengying, Z. 1995. Gender and Family Businesses in Rural China. *Amer. Sociol. Rev.* 60: 36–57.

Evans, M., Sinclair, R.C., Fusimalohi, C. & Liava'a, V. 2001. Globalization, diet, and health: An example from Tonga. *Bull. World Health Org.,* 79(9): 856–862.

Food and Agricultural Organization of the United Nations. Food Balance Sheets (available at http://apps.fao.org). Data extracted June, 2002. Rome, FAO.

French, S.A. 2003. Pricing effects on food choices. *Jour. Nutr.,* 133(3): 841S–843S.

Galloway, J.H. 2000. Sugar. *In*: K.F. Kiple & K.C. Ornelas, eds. *The Cambridge World History of Food*. Vol I. New York, Cambridge University Press, pp. 437–49.

Geissler, C. 1999. China: The soyabean-pork dilemma. *Proc. Nutr. Soc*., 58(2): 345–53.

Guo, X., Popkin, B.M., Mroz, T.A. & Zhai, F. 1999. Food price policy can favorably alter macronutrient intake in China. *Jour. Nutr.,* 129(5): 994–1001.

Haddad, L., Ruel, M.T. & Garrett, J.L. 1999. Are urban poverty and undernutrition growing? Some newly assembled evidence. *World Dev*., 27: 1891–1904.

Hill, A.J. 2002. Developmental issues in attitudes to food and diet. *Proc. Nutr. Soc.,* 61(2): 259–66.

Hu, G., Pekkarinen, H., Hanninen, O., Yu, Z., Guo, Z. & Tian, H. 2002. Physical activity during leisure and commuting in Tianjin, China. *Bull. World Health Org.*, 80(12): 933–38.

Knowler, W., Barrett-Connor, E., Fowler, S., Hamman, R., Lachin, J., Walker, E. & Nathan, D. 2002. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New Eng. Journ. Med.,* 346(6): 393–403.

Kosulwat, V. 2002. The nutrition and health transition in Thailand. *Public Health Nutr.,* 5(1A): 183–89.

Kumanyika, S., Jeffery, R.W., Morabia, A., Ritenbaugh, C. & Antipatis, V.J. 2002. Obesity prevention: The case for action. *Int. Jour. Obes.*, 26(3): 425–36.

Lang, T. 1999. Diet, health and globalization: Five key questions. *Proc. of the Nut. Soc.*, 58(2): 335–43.

Leterme, P. & Carmenza Muñoz, L. 2002. Factors influencing pulse consumption in Latin America. *Brit. Jour. Nutr.,* 88(Suppl 3): S251–55.

Mendez, M., Du, S. & Popkin, B.M. 2003. *Urbanization, income and the nutrition transition in China: A case study*. Paper prepared for the FAO technical workshop on *Globalization of food systems: Impacts on food security and nutrition*. 8–10 October 2003. Rome, Italy.

Mintz, S. 1977. Time, sugar, and sweetness. *In:* C. Counihan, & P. Van Esterik, eds. *Food and Culture: A Reader*. New York, Routledge, pp. 357–69.

Monteiro, C.A., Benicio, M.H., Conde, W.L.& Popkin, B.M. 2000. Shifting obesity trends in Brazil. *Eur. Jour. Clin. Nut.*, 54: 342–46.

Monteiro, C.A. , Conde, W.L., Lu, B. & Popkin, B.M. 2004. Obesity and health inequities in the developing world. *Intl. Jour. of Obes. Relat. Metab. Disord.*, 28(9): 1181–86.

Monteiro, C.A., Conde, W.L. & Popkin, B.M. 2004. The burden of disease due to under- and over-nutrition in countries undergoing rapid nutrition transition: A view from Brazil. *Amer. Jour. of Pub. Health,* 94(3): 433–44.

Monteiro, C.A., Wolney, L.C. & Popkin, B.M. 2002. Is obesity replacing or adding to undernutrition? Evidence from different social classes in Brazil. *Publ. Health Nutr.*, 5(1A): 105–12.

Moreno, L.A., Sarría, A. & Popkin, B.M. 2002. The nutrition transition in Spain: A European Mediterranean Country. *Eur. Jour. Clin. Nutr.*, 56(10): 992–1003.

Nielsen, S.J. & Popkin, B.M. 2003. Patterns and trends in food portion sizes, 1977–98. *JAMA*, 289(4): 450–53.

Popkin, B.M. 2002a. An overview on the nutrition transition and its health implications: The Bellagio meeting. *Publ. Health Nutr.,* 5(1A): 93–103.

Popkin, B.M. 2002b. The shift in stages of the nutrition transition in the developing world differs from past experiences! *Publ. Health Nutr.*, 5(1A): 205–14.

Popkin, B.M. & Bisgrove, E.Z. 1988. Urbanization and nutrition in low-income countries. *Food Nutr. Bull.,* 10(1): 3–23.

Popkin, B.M. & Du, S. 2003. Dynamics of the Nutrition Transition toward the Animal Foods Sector in China and its Implications: A Worried Perspective. *Jour. of Nut.,* 133: 3898S–3906S.

Popkin, B.M., Ge, K., Zhai, F., Guo, X., Ma, H. & Zahoor, N. 1993. The nutrition transition in China: A cross-sectional analysis. *Eur. Jour. Clin. Nutr.,* 47(5): 333–46.

Popkin, B.M. & Nielsen, S.J. 2003. The sweetening of the world's diet. *Obes.Res.,* 11(11): 1325–32.

Reardon, T., Timmer, C.P. & Berdegue, J.A. 2003. The rise of supermarkets in Latin America and Asia: Implications for international markets for fruits and vegetables. *In*: A. Regmi & M. Gehlhar, eds. *Global Markets for High Value Food Products*. Agricultural Information Bulletin, United States Department of Agriculture-Economic Research Service. Washington DC, USDA.

Reddy, K.S. 2002. Cardiovascular diseases in the developing countries: Dimensions, determinants, dynamics and directions for public health action. *Publ. Health Nutr.*, 5(1A): 231–37.

Regmi, A. & Gehlar, M. 2001. Consumer preferences and concerns shape global food trade. *Food Rev.*, 24(3): 2–8.

Rivera, J.A., Barquera, S., Campirano, F., Campos, I., Safdie, M. & Tovar, V. 2002. Epidemiological and nutritional transition in Mexico: Rapid increase of non-communicable chronic diseases and obesity. *Publ. Health Nutr.,* 5(1A): 113–22.

Rolls, B.J. 2000. The role of energy density in the overconsumption of fat. *Jour. Nutr.*, 30(2S): 268S–271S.

Sachs, J.D. & Warner, A. 1995. *Economic Reform and the Process of Global Integration*. *Brookings Papers on Economic Activity*, 25th Anniversary Issue. 1: 1–118.

Sawaya, A.L., Martins, P., Hoffman, D. & Roberts, S.B. 2003. The link between childhood undernutrition and risk of chronic diseases in adulthood: A case study of Brazil. *Nutr. Rev.*, 61(5 Pt 1): 168–75.

Schroeder, D.G., Martorell, R. & Flores, R. 1999. Infant and child growth and fatness and fat distribution in Guatemalan adults. *Amer. Jour. Epidemiol.*, 149(2): 177–85.

Shetty, P.S. 2002. Nutrition transition in India. *Publ. Health Nutr.,* (1A): 175–82.

Stookey, J.D., Mendez, M.A., Adair, L.S. & Popkin, B.M. 2003. *Measuring urbanization and its potential impact on health: The China case*. (Chapel Hill, NC unpublished manuscript)

Tudor-Locke, C., Neff, L.J., Ainsworth, B.E., Addy, C.L. & Popkin, B.M. 2002. Omission of active commuting to school and the prevalence of children's health-related physical activity levels: The Russian Longitudinal Monitoring Study. *Child Care Health Dev.,* 28(6): 507–12.

Uauy, R. & Kain, J. 2002. The epidemiological transition: need to incorporate obesity prevention into nutrition programmes. *Public Health Nutr*., 5(1A): 223–29.

United Nations Population Division. 2002. World Urbanization Prospects: The 2001 Revision available at http://www.un.org/esa/population/publications/wup2001/ WUP2001Annextab.pdf).

United States Department of Agriculture. 1966. *U.S. Fats and Oils Statistics, 1909–1965*. Statistical Bulletin No. 376. ERS. Washington DC, USDA.

United States Department of Agriculture-Center for Nutrition Policy and Promotion. 2000. *Dietary Guidelines For Americans* (available at http://www.health.gov/dietaryguidelines/ dga2000/document/contents.htm).

Vollmer, W.M., Sacks, F.M. & Svetkey, L.P. 2001. New insights into the effects on blood pressure of diets low in salt and high in fruits and vegetables and low-fat dairy products. *Curr. Control Trials Cardiovasc. Med.*, 2(2): 71–74.

Williams, G.W. 1984. Development and future direction of the world soybean market. *Quar. Jour. Intl. Agr.*, 23: 319–37.

World Bank. 2001. *World Development Report 2000/2001: Attacking Poverty*. New York, Oxford University Press.

Young, L.R. & Nestle, M. 2003. Expanding portion sizes in the US marketplace: Implications for nutrition counseling. *Jour. Amer. Diet. Assoc.,* 103(2): 231–34.

Yusuf, S., Reddy, S., Ounpuu, S. & Anand, S. 2001. Global burden of cardiovascular diseases: Part I: General considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation,* 104(22): 2746–53.

Zhai, F., Fu, D., Du, S., Ge, K., Chen, C. & Popkin, B.M. 2002. What is China doing in policy-making to push back the negative aspects of the nutrition transition? *Publ. Health Nutr.* 5(1A): 269–73.