Obesity Trends in Latin America: Transiting from Under- to Overweight

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ABSTRACT Latin America is undergoing a rapid demographic and nutritional transition. A recent WHO/PAHO survey on obesity in the region revealed an increasing trend in obesity as countries emerge from poverty, especially in urban areas. In contrast, in middle income countries, obesity tends to decline as income increases; this is especially so in women. Dietary changes and increasing inactivity are considered the crucial contributory factors that explain this rise. The end result is a progressive rise in overweight and obesity, especially in low income groups who improve their income and buy high fat/high carbohydrate energy-dense foods. Intake of these foods increases to the detriment of grains, fruits and vegetables. Most aboriginal populations of the Americas have changed their diet and physical activity patterns to fit an industrialized country model. They now derive most of their diet from Western foods and live sedentary and physically inactive lives. Under these circumstances they develop high rates of obesity, insulin resistance and type 2 diabetes. Supplementary feeding programs are common in the region; the number of beneficiaries significantly exceeds the malnourished. Weight-for-age definition of undernutrition without assessment of length will overestimate the dimension of malnutrition and neglect the identification of stunted overweight children. Providing food to low income stunted populations may be beneficial for some, although it may be detrimental for others, inducing obesity especially in urban areas. Defining the right combination of foods/nutrients, education and lifestyle interventions that are required to optimize nutrition and health is a present imperative. J. Nutr. 131: 893S–899S, 2001.

KEY WORDS: • obesity • Latin America • aboriginal population • diabetes • supplementary feeding programs

OBESITY TRENDS IN LATIN AMERICA

Latin America is undergoing a rapid demographic and nutritional transition. Significant changes in the causes of death have occurred over a relatively short period of time. As an example of this, Figure 1 illustrates the trends in causes of death by disease categories in Guatemala, Mexico, Chile and Uruguay (1). These data give a clear indication of how death from infections is on the decline while death from noncommunicable chronic disease is on the rise. Guatemala has recently initiated the transition while Mexico is clearly in the midst of the process. Chile has recently finished the period of rapid change while Uruguay can be considered to be in the posttransition phase. In the absence of systematically collected data on distribution of causes of death, these categories serve as a proxy indicator of type of malnutrition present at the population level. As obesity rises, deaths from cardiovascular disease and cancer also increase; conversely, if death from infection predominates, malnutrition tends to be high and obesity low.

Information on obesity trends in Latin America is limited to specific country data for selected countries and to data obtained from the Demographic and Health Surveys Institute for Resource Development (DHS/IRD). Martorell et al. (2) reviewed DHS surveys conducted since 1982 and evaluated the prevalence of obesity in women and children. The mean value for obesity in women for the eight countries evaluated was 8–10%. Table 1 summarizes results for five countries using a BMI cutoff of ≥ 30 kg/m² according to WHO or a BMI index of ≥ 27.3 following USA Hanes I (3). The lowest prevalence was found in Honduras while the highest is found in Bolivia and Peru, depending on cutoff point defined. In the case of children under 5 yo of age a weight-for-height > 1 SD was considered as overweight, and > 2 SD as obesity. The lowest figures are found in Bolivia while the highest are found in the Dominican Republic. An increasing prevalence of obesity in women was found in countries with higher per capita income and in those with lower rates of stunting in children. A recent PAHO/WHO publication on obesity in Latin America (4) revealed an increasing trend for obesity as countries emerge.
from poverty, especially in urban areas. In contrast, in middle income countries, obesity tends to decline as income increases; this is especially so in women.

Selected country data demonstrate increasing rates for obesity in adults (BMI > 30) over the past two decades for Brazil and the past decade in Chile; this is depicted in Figure 2A, and B for women and men (5,6). Similar trends are observed for Costa Rica, Barbados and other Caribbean countries. A study by Sichieri et al. (7) using a BMI $\geq 30$ found 4.8% obesity for men and 11.7% in Brazilian adult women. In Costa Rica the prevalence of overweight in 1996 was 45.9% using a BMI $\geq 25$ (8). Atalah (9) in Santiago, Chile, reports a prevalence of 20.5% in men and 38% in women in 1993 using a BMI of 27 as a cutoff limit. Sinha (10) from Barbados reports a prevalence of obesity of 16% in men and 38% in women in 1981 using a BMI $\geq 27$, indicating that for the Caribbean, obesity rates in 1995 were 7–20% for men and 22–48% for women.

In this current issue Monteiro reports regional data within Brazil, which demonstrates the interaction between educational level, urban/rural residence and socioeconomic level in defining obesity trends over the past two decades. In Mexico Lerman Garber et al. (11) demonstrate in a cross-sectional study of adults older than 35 y of age a higher prevalence in urban areas relative to rural areas. Trends demonstrate a progressive rise in obesity rates, especially in urban women; rates of increase are highly variable between and within countries (12). In general as income increases so does the prevalence of obesity; dietary changes and progressive inactivity are considered the crucial contributory factors that explain this rise.

OLD AND NEW CONDITIONING FACTORS FOR OBESITY

Lifestyle changes in the general population

The nutrition transition brings about significant dietary changes as presented by Popkin et al. in this same issue. Increases in total fat, animal protein and fat consumption are the most prominent. As income increases in transitional countries, so does the consumption of high fat foods, including industrially processed hydrogenated fats. Processed foods are usually more expensive in the rural areas, whereas the converse is true for natural foods such as grains, fruits and vegetables. Progressive urbanization and the mass media may contribute to the shift in diet of rural migrants who abandon their staple plant food–based diets, favoring processed foods and animal food products. These factors affect children and adolescents as well. If the change in diet is accompanied by a sedentary lifestyle and physical inactivity, the combination is perfect to trigger increasing adiposity. Energy balance and fat stores strictly follow the laws of thermodynamics, whether people are urban or rural, rich or poor. The end result is a progressive rise in overweight and obesity, especially in low income groups who improve their income and buy high fat/high carbohydrate energy-dense foods. Sweet and salty high fat foods show marked consumer preference in the urban supermarket; intake of these foods increases to the detriment of grains, fruits and vegetables. On a positive note, recent trends demonstrate that high income countries are reducing the consumption of fat, possibly in response to the existence of public health–based dietary guidelines.

TABLE 1
Prevalence of obesity in women and children in Latin America

<table>
<thead>
<tr>
<th>Country (year)</th>
<th>% Children weight-for-height</th>
<th>% Women BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$&gt; 1 \text{SD}$</td>
<td>$&gt; 2 \text{SD}$</td>
</tr>
<tr>
<td>Bolivia (1994)</td>
<td>13.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Colombia (1995)</td>
<td>21.6</td>
<td>9.2</td>
</tr>
<tr>
<td>Peru (1996)</td>
<td>22.8</td>
<td>9.4</td>
</tr>
<tr>
<td>Honduras (1996)</td>
<td>18.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Dominican Republic (1996)</td>
<td>23.3</td>
<td>12.1</td>
</tr>
</tbody>
</table>

1 From Ref. 2 [Martorell et al. (1998)].
Recent data from several urban centers including data obtained in Santiago, Chile, demonstrate that television viewing and a child’s preference for certain TV commercials has a direct relationship with snack food consumption and other food purchased by children at school (13). The relative contribution of dietary change vs. physical inactivity in determining the increasing rates of obesity in children in transitional societies cannot be quantified in a precise manner. Furthermore, attempting to do this would be futile, because preventative strategies should address both. Recommendations to prevent obesity are presently integrating dietary advice, increasing physical activity and weight monitoring. The challenge of preventing obesity is yet to be tackled effectively in urban societies.

Although Chile has no national system to monitor the nutritional status in adults, there are data representative of the city of Santiago, where 40% of the population lives. In two surveys on risk factors for chronic diseases carried out in the population over 15 y of age, obesity increased from 6% to 11% and from 14% to 24% in men and women, respectively, over a 4-y period (14,15). Obesity increased with age, was more prevalent in women than in men and was higher in women of low socioeconomic level. In another study carried out in a representative sample in urban Valparaiso, Chile (25–64 y of age) in 1997, obesity prevalence was also high and had a similar distribution to that found in Santiago (16). Changes in the diet and sedentarism are the most probable causes of the increasing trend of obesity in Chile.

Dietary patterns in Chile have changed rapidly, becoming closer to the “Western diet,” high in saturated fat with decreased consumption of grains and other fiber-rich foods (5). A recent analysis of a National Household Survey on Food Expenditure (17) demonstrated that the principal components of food expenditure among the poor are bread, meat and soft drinks. A study on food consumption carried out in Santiago in 1995 demonstrated that 70% of adults consumed less than two fruits and 59% consumed less than two portions of vegetables per day (18). On the other hand, sedentarism is high in Chile and has increased with the progress of urbanization. In 1970 three quarters of the population lived in urban areas; for 1997 this figure is 87%. The number of cars increased from 363,150 in 1970 to 1,969,128 in 1997. TV sets numbered 12,170 in 1970, increasing to > 2 million in 1997 (19). A recent study carried out in Santiago demonstrated that 90% of school-age children watch television during weekdays, and of these 20% watch for more than 3 h daily (5). For Metropolitan Santiago in 1988, 57% of men and 77.4% of women performed less than two 15-min periods of exercise per week, while in 1992 these figures increased to 57.8% in men and to 80.1% in women (20). In Valparaiso for 1997, > 90% of adult women were inactive during their leisure time, which for the low socioeconomic group was 97% (16).

**Lifestyle changes of aboriginal populations and obesity**

Obesity has a complex etiology, resulting from the combined effects of genes, environment, lifestyle and their interactions. Although the genetic background is crucial to explain the susceptibility to most chronic diseases, the modernization and urbanization process affecting aboriginal populations has brought about major changes that are most likely contributing to the high prevalence of obesity and diabetes reported (21). Most aboriginal populations today have changed their diet and physical activity patterns to fit an industrialized country model. They now derive their diet completely or in large part from Western foods and live sedentary and physically inactive lives. Under these circumstances they develop high rates of obesity, insulin resistance and type 2 diabetes (22,23).

The Chilean population is formed by a mixture of Amerindian native groups and descendants of several European migrants. The Mapuche population, the major aboriginal group in Chile, are descendants of Asian migrations that settled in the southern part of the central valley of Chile and extended to Patagonia, both sides of the Andes. A self-assessment questionnaire on ethnicity included in the 1992 Chilean census among people older than 14 y (24) indicated that close to 10% of Chileans identify themselves as “Mapuche.” Economic and social changes have forced a great number of Mapuche to migrate from their original rural conditions in the South of Chile to large urban centers, such as Santiago and its surroundings. Nowadays, nearly one third of the Mapuche live in urban centers (24). In 1985 a high prevalence of obesity, close to 40% in the rural Mapuche population was found. However, this ethnic group had a very low prevalence of type 2 diabetes, < 1% (25). The prevalence of risk factors for chronic diseases has increased dramatically in Chile over the past three decades, in that lifestyle changes and rapid urbanization have occurred. In fact, 15% of adult Chilean men and 23% of women are now obese (14). Considering these changes, we explored whether Mapuche living in large cities like Santiago had also experienced a rise in the metabolic complications of obesity.

Our studies over the past 5 y have examined the effect of genetic differences on the prevalence of obesity, glucose intolerance and leptin levels in groups with different ethnic backgrounds. Mapuche of rural areas preserving ethnical and cultural distinctive characteristics were compared to Caucasian subjects (Spanish heritage) from the general population of Santiago (26). We found that BMI, gender and insulin were independently associated to leptin levels in Caucasians.
whereas for the Mapuche group, only BMI was associated to leptin after controlling for gender and insulin. The comparison of plasma leptin levels adjusted for BMI, gender and age showed significant ethnic differences. Mean concentration of plasma leptin in Caucasian individuals was approximately twofold higher compared to that of Mapuche subjects. Fasting insulin levels adjusted for age, gender and BMI, indicative of glucose sensitivity, were also significantly higher in Caucasians. Only 4.1% of rural Mapuche were classified as diabetics, compared to 9.8% observed in urban Mapuche and 5.3% in the Caucasian population of Santiago. Glucose intolerance was identified in 3.4% of the rural and in 6.1% of the urban Mapuche. Our study also revealed a higher prevalence of obesity (P < 0.05) in urban Mapuche compared to that in rural natives. Moreover, these data suggest that the change in environment may increase disease susceptibility beyond that observed in Caucasian populations. The early report of a low prevalence of diabetes in the presence of high rates of obesity in the Mapuche was not upheld by our recent studies, suggesting that aboriginal populations lose their protection from the metabolic complications of obesity as they undergo urbanization and lifestyle, including dietary changes (27). Table 2 summarizes these findings.

In contrast to the Mapuche, the Aymara living isolated in the north of Chile, in the Bolivian and Peruvian highlands, have preserved their nomadic primitive agricultural and cultural traditions. They speak their native language and are dependent on subsistence agriculture for most of their survival. They consume a traditional diet composed of indigenous crops such as potatoes, quinoa (a local legume) and some barley. Animal husbandry (domesticated llamas, alpacas and sheep) is their main economic activity (28,29). Moreover, the Aymara rural population has not experienced a massive shift from their traditional ways of living to a modern Western lifestyle. According to the self-identification questionnaire of the 1992 census only 0.5% of Chileans older than 14 y were Aymara (24). Studies conducted in the early 1970s revealed an absence of clinically recognizable diabetes in a large sample of rural Aymara subjects living in their natural ecosystem. Our most recent study of the Aymara conducted in 1997, in a sample of 78 men and 118 women older than 19 y of age, found a prevalence of diabetes of only 1.0%, adjusted for age, and 3.5% glucose intolerance. The low prevalence estimated in the present study is concordant with previous observations (30).

The difference in prevalence of obesity and diabetes between Aymara and Mapuche populations or other indigenous population of the Americas is difficult to interpret. Multiple dietary factors and gene/environment interactions may determine a potential epigenetic effect. However, the low prevalence of type 2 diabetes in Aymara and rural Mapuche subjects (30) is in sharp contrast to the high prevalence of this condition in most aboriginal groups in North America, including the Pima from Arizona and Mexican-American minorities in the United States (21,32). Although the distribution of BMI observed in the Aymara is similar to that in the general population of urban Santiago, mean values of insulin resistance, determined by HOMA, indicate improved glucose tolerance in the Aymara subjects (30). Low mean values of HOMA-IR and insulin levels in Aymara subjects could be in part a consequence of their high level of physical activity and their traditional high complex carbohydrate diet. The prevalence of diabetes in the rural Aymara population who live in high altitudes in the north of Chile is lower than the prevalence in the urban Caucasian population of Santiago, Chile, and much lower than the prevalence in other Amerindian groups from North America. Prevalence of diabetes in this Aymara population is similar to, or slightly lower than, the prevalence reported for the rural Mapuche population. Both populations have preserved a rural physically active lifestyle and have maintained their traditional diet (30).

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Rural Aymara 1</th>
<th>Rural Mapuche 2</th>
<th>Urban Mapuche 2</th>
<th>Urban Caucasian 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td><strong>BMI &lt; 25</strong></td>
<td>53</td>
<td>43.1</td>
<td>34</td>
<td>24.7</td>
</tr>
<tr>
<td><strong>BMI 25–29.9</strong></td>
<td>34</td>
<td>33.8</td>
<td>51</td>
<td>43.2</td>
</tr>
<tr>
<td><strong>BMI &gt; 29.9</strong></td>
<td>13</td>
<td>23.1</td>
<td>15</td>
<td>32.1</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>1.3</td>
<td>1.7</td>
<td>3.2</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Impaired glucose tolerance</strong></td>
<td>2.6</td>
<td>4.3</td>
<td>4.2</td>
<td>3.1</td>
</tr>
</tbody>
</table>

1 From Ref. 30.
2 From Ref. 31.
3 From Ref. 16.

**Nutrition interventions programs: from stunting and underweight to overweight and obesity**

Supplementary feeding programs are a fact of life for most countries in the region. A recent Food and Agriculture Organization survey with data from 19 Latin American countries found that over 20% of the population—or approximately 86 million people out of an estimated 414 million in these countries—receive some level of food assistance benefits from nutrition-related programs (33). In contrast, the number of malnourished in the study countries was 10 million, that is, 12% of total beneficiaries. The explanation for this phenomenon is that nutrition programs have evolved beyond the immediate needs of the malnourished and have become part of social economic benefit demanded by populations living under poverty. Despite the obvious benefits (namely the significant reductions in underweight and wasting that have occurred in most countries), these programs have the potential to affect the trends in obesity rates. Also, stunting remains a problem in this region. In this setting providing food supplements may be beneficial for some, although it may be detrimental for others. Careful selection of beneficiaries of food assistance programs and determining the right combination of nutrients/foods, education and lifestyle interventions, required to optimize...
nutrition and health at each stage of the life cycle, is a problem that cannot be avoided (33).

Chile is often presented as a paradigm of the success of supplementary feeding programs. Indeed, the association between the presence of these massive interventions and the decline in malnutrition in all age groups is there. Unfortunately, these programs may also contribute to the rising prevalence in obesity (34). Specific examples will be given in an effort to show the impact that these assistance programs may have on the prevalence in obesity and to signal the road ahead for other countries undergoing the rapid nutrition transition.

The Chilean supplementary feeding program or “Programa Nacional de Alimentación Complementaria” (PNAC) began in the 1920s as a public milk distribution program for working mothers. It was built into the workers’ social security legislation in 1937 as part of preventive health to protect working class families. The PNAC was significantly strengthened in the 1950s with the creation of the National Health Service (NHS), which provides universal health protection and health services for insured workers and the indigent population. The existence of the PNAC is secured by law and financed by direct contribution of private and public employees and employers. In terms of beneficiaries it has the largest coverage, as well as supplementary food for toddlers and preschoolers; under the Ministry of Education and provides child care as a reinforcement of 150 kcal/d is provided (37). As demonstrated in Figure 4A and B this program has contributed most likely to the notable decrease in stunting observed in the program was compared to the corresponding Z-score upon discharge, 12 mo later. As noted from the data on admission, 93 of 1149 infants had a weight for length below −1 Z, while at the end of a year of receiving the benefit, only 7 remained in that condition. On the other hand, the number of infants who exceeded +1 Z increased from 0 to 117. Those who were within ±1 Z remained basically unchanged, that is, went from 1056 to 1025. The changes observed in the group in terms of length-for-age are depicted in Figure 3; a control group was obtained from nonparticipants in the enhanced PNAC program matched for age and growth indices (36). The data from participants and control infants were analyzed according to stunted (below −1 Z length for age) or nonstunted (length-for-age > −1 Z). As noted, both control and enhanced PNAC stunted groups experienced a small nonsignificant gain in length-for-age. Infants who were not stunted exhibited no change in length Z-score during the year-long evaluation. In summary, the benefit of improving mild underweight in 86 infants was offset by increasing the number of overweight infants by 117. The evidence from length-for-age Z-score suggests that even the stunted exhibited no gain from the program as compared to a control group that did not receive the benefit. Moreover, presently the significance of being mildly underweight should be reassessed in light of the emergence of a new paradigm of growth, in which more is not necessarily better. What is clear from this evaluation is that, stunted or normal children are provided additional food, they will gain weight to exceed the median reference value.

A separate example is drawn from the National Nurse’s Schools Council Program (JUNJI). It was created in 1971 under the Ministry of Education and provides child care as well as supplementary food for toddlers and preschoolers; coverage is close to 50% of those in need. It also provides social assistance to the family when required. In 1990 approximately 100,000 children under 5 y attended JUNJI. Of those, 95% were preschoolers from 2 to 5 y of age, and the rest, infants under 2 y old. The food distributed covers either 58% or 75% of the children’s daily caloric needs depending on whether they attend for half or full day. The calorie contribution is divided by age groups as follows: under 12 mo, 800 kcal; 12 to 24 mo, 950 kcal; 2 to 3 y, 1050 kcal; 3 to 5 y, 1150 kcal. If a nutritional deficit is detected a reinforcement of 150 kcal/d is provided (37). As demonstrated in Figure 4A and B this program has contributed most likely to the notable decrease in stunting observed in

Table 3 provides the results of a controlled evaluation conducted by Kain et al. (35) in a group of 1149 infants in which weight-for-length Z-score categorization on entry into

<table>
<thead>
<tr>
<th>Weight for length on entry</th>
<th>Weight for length after 12 months in the program</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ −1</td>
<td>−1 to 0</td>
<td>&gt; 0 to ±1</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>259</td>
<td>26</td>
</tr>
<tr>
<td>11</td>
<td>151</td>
<td>318</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>475</td>
</tr>
</tbody>
</table>

1 From Ref. 35 [Kain et al. (1994)].
the preschool population during the past decade. The percentage of children below 2 SD in terms of weight-for-age and height-for-age has dropped significantly, while those with mild underweight are 5% of the total. Concomitantly over the same period (Fig. 4B), we observe that mean weight for age has increased progressively for 6-y-olds entering primary schools, more in girls than in boys. We also evaluated the change in percentage of children over 2 Z in weight-for-height between March (school entrance) and November (final month of school year) for each age group under JUNJI’s program. We observed, as shown in Figure 5, a rise in obesity rates during the school year, progressively higher with each age cohort. Finally, we obtained retrospective data from 8086 children who had been measured every year under standardized conditions to evaluate this cohort, mimicking a longitudinal follow-up (38). This is summarized in Table 4, demonstrating that at the time of entry into the program a total of 408 exceeded +2 Z in terms of weight-for-height, whereas 3 y later 1211 exceeded that limit. That is a threefold increase in the number of obese children over a 3-y period. During this same period, the number of overweight children (over +1 Z) went from 1440 to 2160, that is, a 50% increase. On a more positive note the program is presently adapting the food provided to the current nutritional profile of the preschool population. Currently, sugar and saturated fat content of the ration have been lowered, skimmed milk is being provided and additional fresh fruits and vegetables have been added, favoring the supply of calcium, micronutrients (iron and zinc) and fiber (39).

We conclude that Latin America is undergoing a rapid nutritional transition with a progressive increase in the prevalence of obesity. The trends are most prominent among urban poor women, although they affect both genders. The responsible factors are changes in lifestyle and diet, which are similar to those observed in industrialized societies. In addition the protective environment of rural aboriginal populations has been lost, demonstrating that these groups are possibly more sensitive to the metabolic derangement associated with obesity. Finally, we consider that nutrition intervention programs, especially in stunted populations, have the potential for aggravating the obesity epidemic. Weight-for-age definition of undernutrition in children without assessment of length will overestimate the dimension of malnutrition and neglect the identification of stunted overweight children. As malnutrition rates fall, the need to prevent overweight and obesity should be considered of equal importance to the eradication of undernutrition.

**LITERATURE CITED**


