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Part I. What has happened in terms of some of the unique elements of shift in diet, activity, obesity, and other measures of morbidity and mortality within different regions of the world?

Is obesity replacing or adding to undernutrition? Evidence from different social classes in Brazil

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Abstract

Objective: To describe time trends in under- and overnutrition in different regional and income strata of the child and adult population of Brazil.

Design: Nation-wide surveys conducted in 1975, 1989 and 1996/7 in probabilistic samples of 1–4-year-old children and adults 20 years and over. Time trends refer to stunting, wasting and overweight prevalences among children and age-adjusted underweight and obesity prevalences among adults (95% confidence intervals included).

Subjects: Individuals examined by each survey in each age group ranged from 1796 young children in 1996 to 78 031 adults in 1975.

Setting: North-eastern and south-eastern regions of Brazil.

Results: Undernutrition indicators declined intensively and continuously among children and adults in all region and income strata. Obesity remained low and relatively stable among children, but increased intensively and continuously in all regions and income strata among adult males. Obesity also increased intensively and continuously among adult women from the less economically developed region of Brazil (the north-eastern region) and among lower-income women from the more developed region (the south-eastern region). Higher-income women from the more developed region had a significant increase in obesity from 1975 to 1989, followed by a significant decline from 1989 to 1997.

Conclusions: Undernutrition in young children is being controlled in Brazil without evidence of increasing obesity. However, obesity is rapidly replacing undernutrition in most gender, region and income strata of the adult population. Adult obesity is already more frequent than adult undernutrition in the more economically developed region, among all higher-income groups, and also among lower-income women living in the more developed region. These lower-income women are significantly more exposed than their higher-income counterparts to both undernutrition and obesity.

Keywords
Obesity
Undernutrition
Social classes
Nutrition transition
Brazil

The process known as nutrition transition refers to major cyclical changes in the nutritional profile of human populations produced by modifications in both dietary and nutrient expenditure patterns and determined basically by interplay of economic, demographic, environmental and cultural changes occurring in the society[1]. Outstanding changes in economic, demographic, environmental and cultural factors have been registered in the last quarter of the 20th century in most developing countries, but the impact of these changes on the nutritional profile of their populations is still to be fully assessed[2]. The relative burden of disease represented by under- and overnutrition, the pace of the transition process among children and adults, and the distinct effects on the social classes are still unclear in these countries. Brazil is placed in a privileged position when the description of the nutrition transition process is concerned for several reasons. First, demographic, socio-economic, environmental and cultural changes have been impressive in Brazil in the last quarter of the 20th century[3]. Second, the availability of repeated, nationally representative cross-sectional surveys provides a basis for the careful

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understanding of secular trends of the nutritional profile of its population. Third, Brazil's size and economic heterogeneity, in particular between the less developed north-eastern region and the more developed south-eastern region, makes it possible to study stages of the nutrition transition at different levels of economic development. Fourth, the large range of incomes existing in both the less developed and the more developed region provides a basis for examining the dynamics of the nutrition transition among the relatively poorer and richer social strata within each region.

This paper complements and updates previous analyses on specific aspects of the nutrition transition in Brazil[4–13].

Methods

Data used in this paper come from four successive nationwide surveys undertaken in Brazil in 1975, 1989, 1996 and 1997. The four surveys were executed by, or with the support of, the federal agency in charge of national statistics in Brazil (the Instituto Brasileiro de Geografia e Estatística – Ibge) using similar probabilistic, census-based, multi-stage, stratified clustering sampling procedures[14–17]. The most recent survey was restricted to the north-eastern and south-eastern regions of Brazil. Therefore, to allow proper comparisons, all trend analyses presented here will consider only the sample of households studied by the four surveys in those two regions. The north-eastern and south-eastern regions are, respectively, the least and the most economically developed regions in the country (1995 per capita gross domestic product (GDP) of US$1728 and US$4913, respectively)[18]. Together they concentrate 70% of the total Brazilian population (28% and 42%, respectively) according to the demographic census of 2000. The number of households sampled in these two regions was 36 105 in 1975, 14 602 in 1989, 8922 in 1996 and 11 033 in 1997. Time-trend analyses will focus on the young children (1 to 4 years old) studied in 1975, 1989 and 1996, and adults (20 years old and over) studied in 1975, 1989 and 1997. The coverage of the anthropometric examinations performed on children and adults ranged from 91% to 99% in the four surveys. The number of individuals examined by each survey, in each age group (pregnant women excluded), ranged from 1796 young children in 1996 to 78 031 adults in 1975. Further information on sampling, as well as on collection of the anthropometric and socio-economic data, can be found elsewhere[4,7,11,12].

Height-for-age and weight-for-height indices expressed as *Z*-scores of the international growth reference (HAZ and WHZ, respectively) were used to assess children's nutritional status; stunted, wasted and underweight children corresponded to HAZ < -2, WHZ < -2 and WHZ > 2, respectively[19]. Body mass index (BMI), or the weight in kg divided by the squared height in metres, was employed to assess the nutritional status of adults[19]. Underweight adults corresponded to BMI $< 18.5\,kg\,m^{-2}$ and obese adults to BMI $\geq 30.0\,kg\,m^{-2}$ (World Health Organization[19]).

Time-trend analyses will consider changes in the prevalence (and corresponding 95% confidence intervals) of stunted, wasted and overweight children and underweight and obese adults. The analyses will be performed first for the combined north-eastern and south-eastern populations (hereafter referred to as a proxy of the Brazilian population); then separately for each region; and finally for region-specific quartiles relative to the per capita family income (in 1975, 1989 and 1997) or the number of goods in the household (in 1996).

All statistical analyses of this study were carried out using STATA[20]. All estimates took into account the sampling weights and the sampling design effects on standard errors (and confidence intervals) resulting from the complex, stratified, clustered sample design employed by each survey. Estimates of adult underweight and adult obesity were age-adjusted by the direct method to the gender-specific age distribution observed in the last survey in order to control for ageing trends across the surveys existing in the case of the adult population. The statistical significance of changes over time in child and adult nutritional status was assessed by grouping the individual data files of each survey into one single data file and running logistic regression analyses in which the undernutrition or overweight/obesity status was the dependent variable and the survey year was the independent variable (age group was a control variable for all analyses involving the adult population). Tests for linear trends in the logistic models were calculated by unfactoring the independent variable (the survey year).

Results

Trends in young children

Table 1 presents time trends in the gender-combined prevalence of child stunting, wasting and overweight. For the entire country, stunting decreases continuously throughout the surveys (34.3%, 18.2% and 11.4%, respectively; $P < 0.0001$ for linear trend) while wasting decreases in the first period (from 4.6% to 1.5%; $P < 0.0001$) and remains low and relatively constant in the second period (2.0% in 1996). Similar patterns of change, e.g. strong continuous reductions in stunting along the three surveys and apparent control of wasting already exhibited in 1989, are seen in all regional and income strata. The prevalence of child overweight for the entire country is relatively low and does not change significantly among the three surveys: 3.3%, 3.1% and 4.0%, respectively. Higher rates of child overweight are seen among the higher-income children from the more developed south-eastern region, but neither do these rates change significantly among the three surveys (i.e. 6.8%, 10.3% and 8.6%, respectively).

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Table 1 Secular trends in the prevalence (%) of stunted, wasted and overweight 1–4-year-old children by region and income group – Brazil, 1975–1996

Region and income group	Stunted			Wasted			Overweight		
	1975	1989	1996	1975	1989	1996	1975	1989	1996
North-eastern	47.1 (45.9–48.4)	29.9 (27.3–32.6)	19.0 (16.6–21.5)	4.1 (3.6–4.7)	1.8 (1.0–2.5)	2.6 (1.6–3.6)	2.9 (2.5–3.3)	1.5 (0.8–2.2)	2.7 (1.8–3.7)
25% poorest	60.8 (58.3–63.2)	42.4 (37.4–47.5)	28.8 (25.0–32.5)	5.0 (3.9–6.0)	2.6 (0.9–4.2)	3.4 (1.8–5.0)	2.4 (1.7–3.2)	1.2 (0.1–2.3)	2.3 (1.0–3.6)
25% richest	26.2 (24.0–28.4)	8.6 (4.9–12.3)	2.4 (0.3–5.1)	2.8 (2.0–3.6)	1.0 (0.0–2.2)	0.0 –	3.3 (2.5–4.1)	2.8 (0.8–4.7)	6.9 (2.1–11.6)
South-eastern	22.7 (21.7–23.8)	8.0 (5.7–10.3)	4.8 (3.1–6.5)	5.0 (4.4–5.5)	1.3 (0.2–2.4)	1.5 (0.5–2.5)	3.7 (3.1–4.0)	4.5 (2.7–6.3)	5.2 (3.4–6.9)
25% poorest	39.9 (37.7–42.1)	17.3 (11.6–22.9)	7.2 (4.3–10.2)	6.5 (5.4–7.7)	2.0 (0.0–4.5)	1.9 (0.3–3.4)	2.9 (2.1–3.7)	2.1 (0.0–4.6)	4.0 (1.8–6.2)
25% richest	6.0 (4.8–7.3)	3.4 (0.4–7.3)	3.0 (0.6–6.5)	2.5 (1.6–3.3)	0.9 (0.0–2.8)	1.2 (1.2–3.7)	6.8 (5.3–8.3)	10.3 (4.8–15.8)	8.6 (2.8–14.4)
Brazil	34.3 (33.5–35.1)	18.2 (16.5–20.0)	11.4 (9.9–12.8)	4.6 (4.2–5.0)	1.5 (0.9–2.2)	2.0 (1.3–2.7)	3.3 (3.0–3.6)	3.1 (2.1–4.1)	4.0 (3.0–5.1)

See text for definitions; 95% confidence intervals in parentheses.

The relative importance of problems associated with young children underfeeding (mostly stunting in Brazil) and young children overfeeding (overweight) clearly changed throughout the surveys. For instance, country-wide there were 10 cases of child stunting to one case of overweight in 1975 while, in 1996, the same ratio was reduced to 3:1. Changes were more pronounced in the more developed south-eastern region, where the ratio of six cases of stunting to one case of overweight was replaced by an equilibrium between the two events, and changed more dramatically among the higher-income children from the least developed region, where eight cases of stunting to one case of overweight was reversed to almost three cases of overweight to one case of stunting. Yet, it should be noted that in 1996 the average child living in the country's less developed north-eastern region was still seven times more susceptible to stunting than to overweight (and 12 times more susceptible to stunting if he/she belonged to the lower-income group).

Trends in adults

Time trends in the age-adjusted prevalence of underweight and obesity among adults are presented in Tables 2 and 3. All results are presented separately for males and females since these trends differed by gender. Prevalence is age-adjusted according to the age distribution in the 1997 survey; 95% confidence intervals are in parentheses.

The underweight and the obesity trends in men are clearly opposite. For the whole country, the prevalence of underweight declines among the three surveys from 8.3% to 5.0% (1975 to 1989) and then to 3.5% (1997); while obesity increases from 2.1% to 4.1% and then to 6.4% ($P < 0.0001$ for linear trend in both cases), respectively. Similar trends of continuous reduction in underweight and

Table 2 Secular trends in the prevalence (%) of underweight and obesity in male adults by region and income group – Brazil, 1975–1997

Region and income group	Underweight*			Obese†		
	1974/75	1989	1996/97	1974/75	1989	1996/97
North-eastern	7.9 (7.5–8.4)	5.2 (4.4–5.9)	4.2 (3.3–5.1)	1.2 (1.1–1.4)	2.4 (1.9–3.0)	4.4 (3.5–5.3)
25% poorest	7.8 (6.8–8.7)	4.8 (3.4–6.2)	5.5 (3.1–8.0)	0.7 (0.4–0.9)	0.8 (0.4–1.2)	1.8 (0.9–2.7)
25% richest	7.5 (6.7–8.3)	3.5 (2.2–4.8)	2.6 (1.6–3.5)	2.5 (2.1–3.0)	5.1 (3.6–6.7)	8.4 (6.3–10.5)
South-eastern	8.7 (8.3–9.1)	4.8 (4.1–5.5)	2.9 (2.2–3.6)	2.9 (2.7–3.2)	5.8 (5.0–6.6)	8.4 (7.2–9.6)
25% poorest	13.0 (12.1–14.0)	7.7 (6.2–9.2)	3.3 (1.9–4.7)	1.6 (1.2–1.9)	2.9 (2.1–3.7)	3.8 (2.2–5.3)
25% richest	4.1 (3.5–4.7)	2.9 (1.7–4.2)	2.0 (0.9–3.1)	5.4 (4.7–6.0)	8.2 (6.1–10.4)	10.2 (7.6–12.7)
Brazil	8.3 (7.9–8.7)	5.0 (4.2–5.7)	3.5 (2.8–4.3)	2.1 (1.9–2.3)	4.1 (3.5–4.8)	6.4 (5.3–7.4)

* Body mass index $< 18.5\,kg\,m^{-2}$.
† Body mass index $\geq 30\,kg\,m^{-2}$.
Prevalence is age-adjusted according to the age distribution in the 1997 surveys; 95% confidence intervals in parentheses.

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Table 3 Secular trends in the prevalence (%) of underweight and obesity in female adults by region and income group – Brazil, 1975–1997

Region and income group	Underweight*			Obese†		
	1974/75	1989	1996/97	1974/75	1989	1996/97
North-eastern	16.0 (15.4–16.6)	9.5 (8.5–10.5)	7.6 (6.6–8.7)	4.1 (3.9–4.4)	7.8 (6.9–8.7)	12.5 (11.1–13.8)
25% poorest	17.6 (16.3–18.9)	11.2 (9.0–13.3)	9.6 (6.7–12.4)	3.1 (2.5–3.6)	5.2 (3.8–6.7)	7.7 (5.2–10.2)
25% richest	12.4 (11.4–13.3)	6.1 (4.6–7.7)	5.6 (4.1–7.1)	6.7 (6.0–7.4)	9.8 (7.9–11.6)	14.5 (12.1–16.8)
South-eastern	10.8 (10.3–11.2)	5.4 (4.6–6.1)	5.4 (4.5–6.3)	7.8 (7.5–8.2)	14.0 (12.8–15.2)	12.3 (11.0–13.6)
25% poorest	13.9 (12.9–14.8)	6.4 (5.1–7.6)	8.9 (6.8–11.1)	6.1 (5.5–6.7)	11.2 (9.5–13.0)	14.1 (11.4–16.9)
25% richest	6.8 (6.1–7.5)	4.3 (2.9–5.8)	3.1 (1.9–4.3)	7.9 (7.2–8.7)	14.4 (11.8–17.0)	8.9 (6.7–11.2)
Brazil	13.4 (12.9–13.9)	7.5 (6.6–8.3)	6.5 (5.6–7.5)	6.0 (5.7–6.3)	10.9 (9.9–12.0)	12.4 (11.0–13.7)

* Body mass index $<18.5\,kg\,m^{-2}$.
† Body mass index $\geq 30\,kg\,m^{-2}$.
Prevalence is age-adjusted according to the age distribution in the 1997 survey; 95% confidence intervals in parentheses.

increase in obesity are observed for most regions and income strata of the adult male population.

Decreasing underweight and increasing obesity also exist among women, but only from 1975 to 1989. In this period, underweight declines among all women from 13.4% to 7.5% ($P < 0.0001$), while obesity increases from 6.0% to 10.9% ($P < 0.0001$). Much lower and less significant additional reductions in female underweight (from 7.5% to 6.5%) and additional increases in obesity (from 10.9% to 12.4%) occur from 1989 to 1997.

The region and income stratification confirms the general tendency towards the reduction of female underweight and also the tendency towards the increase of female obesity in the first period. But female obesity trends from 1989 to 1997 differ strongly according to region and income level. In this period, female obesity increases significantly in the less developed north-eastern region (from 7.8% to 12.5%) while it actually tends to decline in the more developed region (from 14.0% to 12.3%). Within the less developed region, obesity presents minor and less significant increases among lower-income women (from 5.2% to 7.7%), but major and statistically significant increases among higher-income women (from 9.8% to 14.5%). Within the more developed region, obesity tends to increase among lower-income women (from 11.2% to 14.1%) but declines significantly among higher-income women (from 14.4% to 8.9%). Obesity also increases significantly among the intermediate-income groups from the less developed region and tends to decrease among the intermediate-income groups from the more developed region (data not shown).

The recent trends in the prevalence of female obesity shifted the distribution of obesity by income group and region in Brazil. The average woman from the less developed region in 1997, contrary to what was observed in 1975 and 1989, is now equally as susceptible to obesity as her counterpart living in the more developed region; and in the more developed region, the lower-income women (and no longer the higher-income women) are the group most vulnerable to obesity. Actually, in 1997, lower-income women in the more developed region were significantly more susceptible than higher-income women to both underweight (8.9% vs. 3.1%, $P < 0.05$) and obesity (14.1% vs. 8.9%, $P < 0.0001$). This simultaneous higher vulnerability of the lower-income women to both under- and overnutrition in 1997 is also seen when the whole BMI distribution (expressed as *Z*-scores relative to the age-specific BMI distribution in 1989) is considered (Fig. 1).

The relative importance of underweight and obesity clearly changed among the surveys for both men and women. In 1975, for the whole country, there were two to four cases of adult underweight to one case of obesity, while in 1996 there were almost two obese adults to one underweight adult. This pattern of excessive underweight being replaced by excessive obesity was found in most regions and income strata of the country. Two exceptions were lower-income adults from the less developed region, particularly males, for whom underweight remained more frequent than underweight, even in 1996, and the higher-income adults from the more developed region, for whom obesity was already more frequent than underweight in 1975.

Discussion

Brazil, along with other middle-income countries in Latin America, Asia and the Middle East, is far advanced. Although Brazil has almost doubled its total population in this study's focused time period (from 93 million in 1970 to 170 million in 2000), the rate of change has greatly slowed down from nearly 3% per year in the 1960s to less than 1.5% in the 1990s. In the same period, fertility rates

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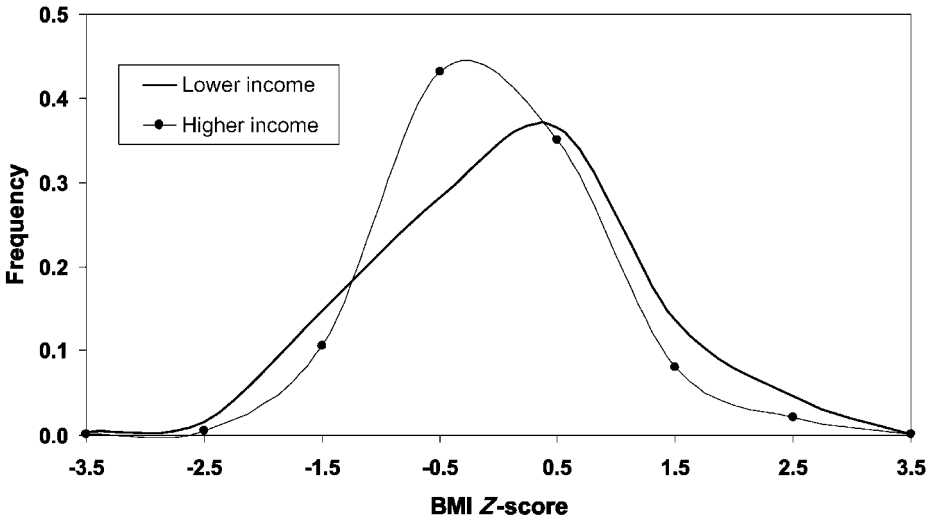

Fig. 1 BMI distribution in Brazilian women from the south-eastern region: lower- versus higher-income group in 1997

reduced from 5.8 births per woman to only 2.3, the proportion of Brazilians over 60 years of age augmented from 4% to 10%, and the urbanisation rate increased from 56.0% to 81.2%. The expansion of the Brazilian gross domestic product (GDP) and the increase in the average family income (particularly in the 1970s, when both the GDP and family income were doubled) were also relevant from 1970 to 2000. Not less important was the continuous expansion in occupations within the services sector, and to a lesser extent within industry, to the detriment of agricultural occupations. Finally, it is also important to recognise the great expansion that occurred in the public infrastructure and essential services (communications, transport, energy supply, water supply, health care and education) during the period, and also the higher public access to durable goods (cars, refrigerators, TV sets and other household assets). However, a known, but undesirable, characteristic of Brazilian society (i.e. the enormous interpersonal and interregional concentration of wealth) did not improve in the period from 1970 to 1999. For instance, during this period, the 10% of richest individuals in the country had an average income 15 to 20 times higher than that of the 40% of poorest individuals. And the average person in the less developed north-eastern region had an income two to three times lower than the average person in the more developed south-eastern region[3].

Carefully designed, and adequately implemented, nation-wide probabilistic surveys undertaken at three intervals within the period 1975–1997 indicated that the nutritional profile of the Brazilian population did respond to the intense demographic, economic, environmental and cultural changes that occurred in the country. Clear declining trends in undernutrition were documented for young children and adults, throughout the country and among all regional and income strata. Fortunately, there was no evidence that undernutrition (stunting and wasting) in young children in any regional or income strata had been replaced by obesity. Elsewhere we show that among older children aged 6–10 years and to a lesser extent among adolescents, child obesity is increasing rapidly[21]. However, in the case of the overall male adult population, and for women in the less developed region, increasing trends in overweight and obesity were simultaneous to the decreasing trends in undernutrition. An interesting situation was documented in the more developed region of the country where recent trends pointed to the increase of obesity among the lower-income women while obesity decreased among the higher-income women.

In most situations, regional and social gaps in undernutrition, unfavourable to the less developed regions and to lower-income individuals in general, remained unchanged or even increased throughout the surveys. An auspicious exception to this occurred with the evolution of undernutrition among young children from the more developed region, where the gap in both child stunting and child wasting between lower- and higher-income groups was substantially reduced among the surveys. The association between income and overweight/obesity remained positive along the three surveys among all age, region and income groups, with the single exception of adult females living in the more developed south-eastern region. In this particular group of women, a slight positive association between income and obesity existing in 1975 was reversed in 1997 into a significant negative association. Since the negative association between income and undernutrition was not changed throughout the surveys, lower-income women of the south-eastern region were, in 1997, significantly more susceptible than the higher-income women to both undernutrition and obesity.

The relative importance of under- and overnutrition was perhaps the characteristic that most changed among the surveys. In 1975, cases of undernutrition in children and

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adults largely predominated over cases of overweight/obesity. The only exception to this occurred in the higher-income stratum, within the more developed south-eastern region, where undernutrition and overweight/obesity were in equilibrium. Yet, in 1997, cases of overweight/obesity were more common than undernutrition among higher-income children and adults, from both regions, and also among lower-income women from the more developed south-eastern region.

The declining trends in undernutrition among young Brazilian children, and the relatively low and stable prevalence of overweight in this group, agree with trends reported for most developing countries in the same period[22–24]. In the United States, an increase in overweight among young children has been demonstrated for girls, but not for boys[25]. Reports on trends in undernutrition among adults are rare in both the developed and the developing countries, and usually not based on comparable representative surveys, which precludes an adequate comparison with the results in this paper. The increasing trends in adult obesity observed prior to 1997 in Brazilian males, and prior to 1989 in Brazilian females, agree with trends reported by the various population-based studies undertaken in the developed countries, and the few made in developing countries[26–28]. However, the trends in female obesity observed from 1989 to 1997 in the more developed south-eastern region of Brazil – increasing obesity rates in lower-income groups and decreasing rates in higher-income groups – was not described in any developing country. Actually, an extensive review of studies, in both the developing and the developed countries, made by the International Obesity Task Force[26] identified a situation – but only in Finland – where declining obesity in adults (also women from higher socio-economic status) had been well documented[29]. The scarcity of studies relative to changes over time in the social distribution of both under- and overnutrition and also in the ratio between these two events, in both the developing and the developed countries, make the comparison of our results difficult. One review of studies on child overweight in developing countries identified that, at one determined point in time, countries with higher rates of wasting tended to have lower rates of overweight, and vice versa, but no data on time trends were provided for the individual countries[23].

Identification of the specific variables and mechanisms responsible for the changes documented in the nutritional profile of the Brazilian population is a complex task. In this respect, we should refer to plausibility of hypotheses rather than strict hypothesis verification. Elsewhere we have demonstrated that reductions in young child undernutrition in Brazil could be attributed to a moderate increase in family income, combined with an exceptional expansion in the public provisions of health, sanitation and education services. These are both factors facilitated by favourable demographic changes, which include the rapid urbanisation of the country and substantial declines in fertility rates[4,8]. The same factors could explain at least part of the reduction in undernutrition among adults described in the present study.

The world-wide trend towards increased obesity has been attributed, in both the developed and the developing countries, to rapid declines in energy expenditures related to shifts towards much less physically demanding occupations and sedentary leisure activities. Equally important for many countries may have been the shift towards a much higher fat, energy-dense diet. In developing countries in particular, marked increases in urbanisation and income, coupled with the increased penetration of the Western culture, certainly favoured shifts in diet and physical activity conducive to obesity[2]. All of these factors are probably underlying the increase of overweight/obesity documented in Brazil prior to 1997 among male adults and, prior to 1989, among female adults. As in most countries, there is no specific secular trend information in Brazil on patterns of physical activity, although the expansion of the services sector of the economy is in line with increasingly less physically demanding occupations (individuals employed in the services sector increased from 29% in 1970 to 55% in 1999, while those employed in agriculture declined from 55% to 25%)[3]. The enormous increase in the proportion of Brazilian households with TV sets (24% in 1970 and 88% in 1999) could indicate trends towards more sedentary leisure activities and higher exposure to the Western diet and lifestyles[3]. Secular trend data on dietary intake in Brazil – only available at the family level and restricted to metropolitan areas of the country – point, in the period from 1975 to 1987, to an increase of 2 to 7 percentage points in the proportion of energy relative to fat intake[13]. The relative stability of overweight observed among Brazilian children below 5 years of age is consistent with the relatively higher energy requirements of this group, and the higher capacity of self-regulation of the energy intake observed in younger children[30,31].

It is difficult to explain the interruption of the increase in female obesity observed in the period from 1989 to 1997 in the more developed south-eastern region of Brazil, and it is even more difficult to explain the reversal in the obesity prevalence, documented specifically among the higher-income women. Data from the last metropolitan food expenditure survey, undertaken in the country in 1996, indicate that the proportion of energy relative to fat intake had further increased in the relatively poorer cities of the north-eastern region (from 23% in 1987 to 25% in 1996) but remained stable (about 30%) in the richer cities of the south-eastern region[10]. More desegregated analysis of these data by income level will be necessary to assess how changes in diet may explain recent trends in obesity in Brazil. Patterns of leisure-time physical activity were assessed for the first time in the country by the national survey of 1997. In this survey, the practice of regular

physical exercise among women, although restricted to a few individuals, was more frequent in the more developed south-eastern region than in the less developed north-eastern region (9.8% and 5.5%, respectively) and much more frequent in higher-income than in lower-income women (18.0% and 1.3%, respectively). Regardless of the immediate determinants involved with the decline in obesity in the period from 1989 to 1997, governmental public health policies are unlikely to have contributed significantly to it, since only recently have health authorities in Brazil decided to elect the control of obesity as a real priority[32]. Elsewhere, a defence was made for the possibility that the intense informal education work done by Brazilian mass media vehicles, focused on combating sedentary lifestyles and promoting better food habits, could be one of the factors responsible for the decline of obesity among the higher-income (and better educated) women's population from the south-eastern region[7]. The findings of the 1989 national survey, disclosed in 1992, showed that obesity and not undernutrition was the main nutritional problem of the adult population in Brazil. Since then, several major TV networks and leading newspapers and magazines have produced, on an almost weekly basis, extensive information on the health consequences of obesity and the importance of avoiding energy-dense diets and increasing physical activity. Part of the media (particularly TV programmes targeted to the female population) has also been engaged in promoting a sometimes unrealistic thin image for women.

To conclude this article on the description of the nutrition transition in Brazil, it is necessary to say that in July 1999, after a long and productive process of consultations with relevant parts of the civil society (scholars, professional and scientific associations, workers' unions, representatives of private companies, among others) and relevant governmental bodies, the Brazilian Ministry of Health approved a new national food and nutrition policy[32]. This new policy is consistent with the contemporaneous nutritional profile disclosed by the last nation-wide survey and its main goal is the promotion, protection and support of eating practices and lifestyles conducive to optimum nutritional and health status for all. This new policy has ensured continual resources to combat nutritional deficiencies where they still exist, particularly through well-targeted, integrated interventions. It has also initiated courageous actions with great potential to prevent nutritional disorders due to over- or inappropriate feeding, such as the obligatory nutritional labelling of any processed food commercialised in the country, the regulation of health claims for foods, and the inclusion of a minimum of 70% of fresh or minimally processed foods in the multi-million market national school feeding programme[33]. The publicity of soft drinks and other non-healthy foods during TV broadcastings directed to children and adolescents is under study and may also be regulated in the near future. Large-scale changes in the curriculum of public primary and secondary schools are also being implemented to promote healthier eating habits and lifestyles among teachers and students. Another positive characteristic of the new policy is the stimulus to form partnerships with local governments and non-governmental organisations. The best example in this case is perhaps the series of local initiatives, started in cities of the São Paulo state but now spread all over the country, to promote and support physical activities in schools, workplaces and every available public space in the community[34]. Although not yet fully evaluated, it is certain that the recent food and nutrition policy established in Brazil will be an important source of information to all individuals and institutions concerned with the development of policies and programmes consistent with the new nutritional profile found in the developing countries.

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