

The stage of nutrition transition in different Brazilian regions

Lenise Mondini and Carlos Augusto Monteiro

Núcleo de Pesquisas Epidemiológicas em Nutrição e Saúde e
Departamento de Nutrição da Faculdade de Saúde Pública,
Universidade de São Paulo, São Paulo, SP Brazil.

SUMMARY. The stage of nutrition transition in different Brazilian regions. The stage of nutrition transition in Brazil at the end of the 1980s was evaluated using the data from a nationwide cross-sectional anthropometry survey in Brazil in 1989 (Pesquisa Nacional sobre Saúde e Nutrição-PNSN). Comparable estimates of undernutrition and obesity were produced for children from 6 to 35 months old (n=3,641), adult males from 20 to 64 years old (n=14,235) and adult females from 18 to 64 years old (n=15,669). Body Mass Index (kg/m²) was employed to assess both undernutrition and obesity in adults and weight-for-age (undernutrition) and weight-for-height (obesity) indices were used for children. The 5th and 95th centiles of the distribution of these indices in a reference population were used as limits for the diagnosis of undernutrition and obesity, respectively. Ordering the frequency of the problems in the population showed obesity in women and undernutrition in children to be the two main nutritional disorders in the country. These two problems are the most frequent in the urban population of the North, Northeast and Center-West regions, and in the Southeast and Center-West rural regions. Obesity leads among both adults and children in the urban areas of the Southeast and South regions, and in the rural South. Only in the rural Northeast, the poorest region in the country, undernutrition leads among children, men and women. This mosaic of situations determines the need for a complete reassessment of traditional nutrition policies and programs employed in the country.

INTRODUCTION

Both under and overnutrition are important nutritional disturbances that undermine the health of individuals. Undernutrition leads to growth retardation, high vulnerability to infectious diseases, physical and functional impairments, and lower work capacity (1-3). Obesity is associated with an increased incidence of cardiovascular disease, diabetes mellitus and cancer (4).

The relevance of each of these two problems in a specific society and, therefore, the greater or lower priority assigned to controlling them will depend essentially on the prevalence each problem reaches in the population.

Undernutrition has very often been assumed to be a relevant problem for developing countries while obesity is important in developed societies. However, the reality is far more complex. Firstly, neither developed nor developing countries are homogeneous units for under and overnutrition prevalences. For example, the significant difference between the high rate of obesity in the USA and that observed in the Canada or England (5), or the great magnitude of undernutrition in countries of sub-Saharan Africa when compared to countries of South America (6).

Also, in developing countries enormous economic contrasts mean that different regions and social strata may be subject to different degrees of vulnerability to nutritional imbalances. In each stratum, the magnitude of undernutrition and overnutrition may also be very different for children and adults and between men and women. The last and most essential aspect to consider has to do with the simultaneous reduction of undernutrition and increase in obesity observed in developing societies showing a rapid and intense shift in their economic pattern and demographic structure, a phenomenon which makes part of the "nutrition transition" (7).

Trends of reduction in undernutrition and increase of obesity have been demonstrated in Brazil between the 1970's and 1980's (8). These trends have been attributed to aspects related to economics, and to

demographic changes which have occurred in the country over recent decades. In this period a moderate improvement in family income and a rapid process of urbanization with expansive public services have been observed, along with changing diet and physical activity patterns of the population.

In a previous work we have demonstrated that distinct income groups in Brazil were in different stages of the nutrition transition (9). The specific aim of the present article is to measure and qualify the stage of nutrition transition in different regions of the country at the end of the 1980's and to discuss its implications for health and nutrition policy planning.

SOURCE AND ANALYSIS OF DATA

Data were obtained from a nationwide cross-sectional anthropometric survey in Brazil undertaken in 1989 (Pesquisa Nacional sobre Saúde e Nutrição - PNSN) by the Brazilian Agency for national statistics - the Brazilian Institute of Geography and Statistics - IBGE (10).

Multi-stage stratified clustering sampling was used in the survey. The survey consisted of 14,455 households, representative of all urban and rural areas of the Brazilian regions, except the Northern rural area, because of low demographic density and difficulty of access. Adult males from 20 to 64 years of age (n=14,235), adult females from 18 to 64 years of age (n=15,669), excluding pregnant women, and children 6 to 35 month-old (n=3,641) were included in this study (Table 1).

These age groups were selected essentially to facilitate interpretation of anthropometric indicators of undernutrition and obesity. Adults over 64 were excluded because height measurement may be not enough accurate in the elderly population. Males between 18 and 20 years old were excluded because of evidence showing a late weight gain in younger adult males, reflecting the final stages of maturation (11).

Anthropometric indices were employed to assess the nutritional status of adults and children. Body Mass Index -BMI (weight expressed in kg by height expressed in m²) was used to assess both

TABLE 1
Distribution of individuals in the sample by regions, Brazil, 1989.

REGION	MEN		WOMEN		CHILDREN	
	n	%	n	%	n	%
NORTH						
- Urban	1,732	12.2	2,004	12.8	485	13.3
- Rural	-	-	-	-	-	-
NORTHEAST						
- Urban	1,505	10.6	2,016	12.9	400	11.0
- Rural	1,558	10.9	1,597	10.2	636	17.5
SOUTHEAST						
- Urban	1,648	11.6	1,910	12.2	292	8.0
- Rural	1,687	11.9	1,577	10.1	394	10.8
SOUTH						
- Urban	1,553	10.9	1,843	11.8	319	8.8
- Rural	1,650	11.6	1,642	10.5	385	10.6
CENTER-WEST						
- Urban	1,502	10.5	1,888	12.0	373	10.2
- Rural	1,400	9.8	1,192	7.6	357	9.8
BRAZIL	14,235	100.0	15,669	100.0	3,641	100.0
- Urban	7,940	55.8	9,661	61.7	1,869	51.3
- Rural	6,295	44.2	6,008	38.3	1,772	48.7

undernutrition and obesity in adults and weight-for-age (undernutrition) and weight-for-height (obesity) were used in the case of children. Age was always based on birth certificates or equivalent documents. Trained teams measured weight using calibrated, portable micro-electronic scales with individuals wearing light clothes and no shoes. Portable stadiometers were used to measure height of adults and older children and length of infants and toddlers.

The normative model was used to diagnose both undernutrition and obesity. With a view to ascribing identical specificity to the diagnosis of both events, the 5th and 95th centiles of the distribution of anthropometric indices in a reference population were used as cut-offs. In the case of weight-for-age (5th centile) and weight-for-height (95th centile) in children, the international NCHS/WHO reference was adopted (12).

In the absence of an internationally recommended reference for adult BMI, the adult Brazilian high-income population (individuals studied by the PNSN survey with a monthly per capita family income equivalent to US\$ 78 or plus) was adopted as reference. Gender and

age-specific 5th centiles of the BMI distribution in the high-income Brazilian population were used as cut-offs to assess the prevalence of adult undernutrition. A single gender-specific (but not age-specific) BMI cut-off were used to assess the prevalence of adult obesity: the one corresponding to the 95th centile of high-income Brazilians with ages from 18 to 24 years (females) or from 20 to 24 years (males). The age restriction was essential to secure that the reference population was free from obesity. Table 2 displays the BMI values employed as cut-offs for the diagnosis of both adult undernutrition and obesity.

Estimates of undernutrition and obesity in children, men and women are presented for the whole country and for its main regions. Brazil is divided in five macro-regions: North, Northeast, Center-West, Southeast and South. North and Northeast are the poorest regions in the country. They have a Gross Domestic Product equivalent to US\$ 2,000 per capita and near 45% of its population with income below the poverty line. South and Southeast are the richest regions having a GDP per capita around to US\$ 4,000 and near 20% of its population below poverty line. The Center-West is both geographically and economically situ-

TABLE 2
Body Mass Index (kg/m^2) cut-offs employed in the diagnosis of adult undernutrition and obesity.

AGE GROUP (years)	UNDERNUTRITION ⁽¹⁾		OBESITY ⁽²⁾	
	MALES	FEMALES	MALES	FEMALES
18 - 19	-	17.2	28.4	27.7
20 - 24	18.4	17.6	28.4	27.7
25 - 29	19.2	18.3	28.4	27.7
30 - 39	19.6	19.3	28.4	27.7
40 - 49	19.3	19.4	28.4	27.7
50 - 59	20.0	20.0	28.4	27.7
60 - 64	19.9	20.1	28.4	27.7

(1) Gender and age-specific 5th centile of the BMI distribution of high-income Brazilians.

(2) Gender specific 95th centile of the BMI distribution of young high-income Brazilians.

ated between the poor North/Northeast and the rich South/Southeast (13).

THE SITUATION OF THE GENERAL POPULATION

Table 3 displays comparable prevalences of undernutrition and obesity in the Brazilian population. Among children, undernutrition is more common than obesity (about 1.5 times) being similar the prevalence in both sexes. Among adults an opposite situation is observed being the excess of obesity slight in men (1.1 times) and stronger in women (2.6 times). In absolute terms, female obesity (20.0%) and child

undernutrition (13.1%) are the two most frequent events. Undernourished adults, obese children and obese men are less frequent in the country (around 8%-9%).

THE SITUATION OF THE URBAN POPULATION IN DIFFERENT REGIONS

Table 4 presents comparable prevalences of undernutrition and obesity in urban populations of different Brazilian regions.

Among urban children, undernutrition far exceeds obesity in the poor North and Northeast regions (near 4 times). In the rich South

TABLE 3
Prevalence (%) of undernutrition and obesity by sex in children and adults. Brazil, 1989.

SEX	CHILDREN		ADULTS	
	UNDERNOURISHED	OBESE	UNDERNOURISHED	OBESE
MALE	13.4 (11.1 - 15.7)	8.5 (6.4 - 10.6)	8.3 (7.5 - 9.1)	9.5 (8.6 - 10.4)
FEMALE	12.9 (10.6 - 15.2)	9.6 (7.3 - 11.8)	7.6 (6.9 - 8.2)	20.0 (18.8 - 21.1)
TOTAL	13.1 (11.3 - 14.9)	9.0 (7.4 - 10.6)	7.9 (7.1 - 8.6)	15.0 (13.6 - 16.4)

Note: See text for the criteria employed in the diagnosis of undernutrition and obesity. Confidence intervals (95%) in parenthesis, taking into account sampling design effect.

and Southeast regions child obesity is twice as frequent as child undernutrition. In the Center-West there is a relative equilibrium between obesity and undernutrition.

Among urban males, obesity exceeds undernutrition in all regions except in the poor Northeast where there is a slight predominance of undernutrition. Obesity in females far exceeds undernutrition in all five Brazilian regions. The ratio obesity:undernutrition among urban women reaches 4 to 1 in the rich South and Southeast regions.

THE SITUATION OF THE RURAL POPULATION IN DIFFERENT REGIONS

Table 5 shows comparable prevalences of undernutrition and obesity in rural populations of different Brazilian regions.

Among rural children, undernutrition exceeds obesity near 5 times in the Northeast region and near 2 times in the Center-West and Southeast. Only in rural South child obesity exceeds child

TABLE 4
Prevalence (%) of undernutrition and obesity by urban regional strata in children and adults. Brazil, 1989.

URBAN REGIONS	CHILDREN		WOMEN		MEN	
	Undernourished	Obese	Undernourished	Obese	Undernourished	Obese
NORTH	22.5 (17.3-27.7)	5.9 (3.4-8.3)	7.7 (6.2-9.2)	18.6 (16.9-20.3)	6.2 (5.1-7.3)	10.8 (8.9-12.8)
NORTHEAST	18.6 (13.8-23.5)	4.3 (2.1-6.5)	9.0 (7.4-10.6)	16.7 (14.7-18.7)	8.8 (6.9-10.6)	7.2 (5.6-8.8)
SOUTHEAST	6.9 (3.1-10.6)	13.2 (10.0-17.4)	5.8 (4.7-6.9)	22.5 (20.1-24.9)	8.0 (6.5-9.5)	11.5 (9.5-13.6)
SOUTH	5.1 (2.1-8.1)	14.5 (10.3-18.7)	4.5 (3.4-5.6)	24.2 (21.9-26.6)	4.1 (3.0-5.3)	15.4 (13.6-17.3)
CENTER-WEST	7.7 (4.9-10.4)	6.3 (3.5-9.2)	7.4 (6.1-8.7)	17.6 (15.6-19.5)	5.9 (4.8-6.9)	11.0 (9.1-12.9)
URBAN BRAZIL	10.4 (8.0-12.8)	10.2 (8.0-12.5)	6.5 (5.7-7.2)	21.1 (19.7-22.4)	7.4 (6.4-8.3)	11.2 (10.0-12.5)

undernutrition.

Among rural males, undernutrition exceeds obesity in near 7 times in Northeast and near 3 times in Center-West and Southeast. Only in rural South male obesity is more frequent than male undernutrition. However, obese females far exceed undernourished females in all regions but the Northeast.

DISCUSSION

The distribution of energy imbalances in children and adults of different Brazilian regions indicates a mosaic of situations, which suggest three stages of the process of nutrition transition.

The first stage occurs in the poorest country's region, the rural Northeast, where the process of nutrition transition has practically not

TABLE 5
Prevalence (%) of undernutrition and obesity by rural regional strata in children and adults.
Brazil, 1989.

RURAL REGIONS	CHILDREN		WOMEN		MEN	
	Undernourished	Obese	Undernourished	Obese	Undernourished	Obese
NORTHEAST	25.3 (22.0-28.6)	5.5 (3.6-7.4)	15.9 (13.9-17.8)	9.4 (7.6-11.2)	12.2 (9.9-14.5)	1.7 (1.0-2.5)
SOUTHEAST	13.8 (9.5-18.2)	5.0 (2.7-7.3)	8.6 (6.8-10.4)	20.0 (17.3-22.9)	13.0 (10.9-15.1)	4.7 (3.3-6.0)
SOUTH	5.6 (3.1-8.0)	11.0 (8.0-14.1)	6.7 (5.1-8.4)	23.9 (21.3-26.4)	6.6 (5.0-8.3)	8.2 (6.6-9.7)
CENTER-WEST	13.2 (8.6-17.8)	6.8 (4.4-9.3)	10.0 (8.2-11.8)	17.3 (14.8-19.7)	10.8 (8.3-13.3)	4.6 (3.1-6.0)
RURAL BRAZIL	18.9 (16.7-21.1)	6.4 (5.1-7.7)	11.6 (10.4-12.7)	15.9 (14.6-17.3)	11.1 (9.9-12.3)	4.2 (3.5-4.8)

yet begun. Undernutrition is the major nutritional problem in children and adults, and obesity is restricted, albeit rarely, to adult women.

The next stage can be recognized as the nutrition transition itself. Problems of different nature - in this case, child undernutrition and women's obesity - lead the ranking of nutritional imbalances. This stage is seen in most Brazilian regions including the urban population living in the poor North and Northeast and the rural population of the rich Southeast.

The last stage can be identified as that in which the process of nutrition transition has already been completed, such as when obesity appears as the only epidemiologically relevant problem, both in children and adults. The South (both urban and rural) and the urban Southeast are at this stage.

In Brazil, nutrition interventions, when employed, have been directed exclusively towards controlling and preventing undernutrition in children. Data shown in this study indicate that the control of obesity, particularly among adult women, is fully justified all over the country.

For at least five decades developed countries have promoted programs to control and prevent obesity and other related problems. These actions include public education through health campaigns promoting better food habits and physical activity, as well as manufacturing and food processing related actions, involving the food industry (14). In Brazil the same path might be followed as regards urban areas in the South and Southeast. Of course, in poor regions, as the North and Northeast, and in poor segments of the population in general, educational actions should be combined with other interventions aiming the increased availability of and access to appropriate food.

In contrast to obesity, adult undernutrition is restricted to the

population living in rural areas, particularly that one living in the Northeast. In this case, programs to ensure food security should be employed as well as actions focused on land reform, job's creation and extension of education, health and sanitation services. Child undernutrition remains an important public health problem in North and Northeast and also in rural areas of the Southeast and Center-West regions. In this case, apart from socioeconomic interventions, it is mandatory the universalization of effective preventive actions as breast-feeding promotion, growth monitoring, appropriate management of diarrhea and respiratory infections, and health and nutrition education in general.

ACKNOWLEDGMENTS

The authors thank FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico), Brazil, for research grants.

REFERENCES

1. Pelletier, DL. The relationship between child anthropometry and mortality in developing countries: implications for policy and future research. Ithaca NY, Cornell University, 1991. (Monograph 13).
2. Administrative Committee on Coordination/Subcommittee on Nutrition. Some options for improving nutrition in the 1990s. SCN News, 7 (suppl.), 1991.
3. Ferro-Luzzi, A; Branca, F & Pastore, G. Body mass index defines the risk of seasonal energy stress in the Third World. Eur J Clin Nutr,

- 48 (suppl. 3): S165-S178, 1994.
4. Pi-Sunyer, FX.. Health implications of obesity. *Am J Clin Nutr*, 53: 1595S-603, 1991.
 5. Millar, WJ & Stephens, T. The prevalence of overweight and obesity in Britain, Canada and United States. *Am J Publ Health*, 77: 38-41, 1987.
 6. De Onís, M; Monteiro, CA & Clugston, G The worldwide magnitude of protein-energy malnutrition: an overview from the WHO Global Database on Child Growth. *Bull World Health Org*, 71: 703-12, 1993.
 7. Popkin, BM. Nutrition patterns and transition. *Popul Dev Rev*, 19: 138-57, 1993.
 8. Monteiro, CA; Mondini, L; Souza, ALM & Popkin, BM. The nutrition transition in Brazil. *Eur J Clin Nutr*, 49: 105-13, 1995.
 9. Mondini, L & Monteiro, CA. Relevância epidemiológica da desnutrição e da obesidade em distintas classes sociais: métodos de estudo e aplicação à população brasileira. *Rev Bras Epidemiol*, 1977. (in press).
 10. Fundação IBGE/IPEA/INAN. Pesquisa nacional sobre saúde e nutrição. Brasília, IBGE, 1988.
 11. World Health Organization. Physical status: the use and interpretation of anthropometry. Geneva, 1995. (WHO - Technical Report Series, 854).
 12. Hamill, PVV; Drizd, TA; Johnson, CL; Reed, RB; Roche, AF; Moore, WMM . Physical growth: National Center of Health Statistics percentiles. *Am J Clin Nutr*, 32: 607-629, 1979.
 13. IPEA. Atlas regional das desigualdades. Rio de Janeiro, Instituto de Pesquisa Econômica Aplicada, 1997.
 14. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Geneva, 1990. (WHO - Technical Report Series, 797).