*Anthropometric normality in adults: the geographical and socio-economic paradox of the nutritional transition in Brazil**

Normalidade antropométrica de adultos: o paradoxo geográfico e socioeconômico da transição nutricional no Brasil*

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Abstract

Objectives: to consolidate secondary data and provide some as yet unpublished information on changes in the nutritional status of Brazilian children, and, principally, adults, from an anthropometrical point of view as evaluated in the course of the most recent surveys, laying emphasis on geographical and socio-economic features.

Methods: tables and graphs were used to consolidate data published by the Brazilian Institute of Geography and Statistics and from other sources, along with estimates for results not included in these original documents. Preliminary data from two as yet unpublished studies were also included.

Results: it was shown that, alongside the decline in malnutrition in children there are signs of an epidemic increase in obesity and overweight in adults. This is characteristic of the change in epidemiological profile associated with the nutritional transition. There is an apparent paradox that the highest frequencies for normal anthropometric measurements in adults were found in the poorer North and Northeast regions of Brazil. These results were even found in localities with very low indices for human development in the Northeast region. The best anthropometric situation for adult populations in Brazil was found in families with a low income (less than ¼ of one minimum wage per household per capita, with a prevalence rate twice as high among adult males in comparison with the higher household income group).

Conclusions: the results for nutritional anthropometry among adults, showing more normal measurements among the low-income population, reflect a peculiar phase in epidemiological terms in the process of the nutritional transition in the country, which constitutes a paradox arising in these specific circumstances, which is probably temporary.

Key words *Anthropometry, Nutritional transition, Adult*

Resumo

Objetivos: consolidar dados secundários e algumas informações ainda inéditas sobre a evolução antropométrica de estado nutricional de crianças brasileiras e, principalmente de populações adultas avaliadas em inquéritos mais recentes, enfatizando-se aspectos geográficos e socioeconômicos.

Métodos: foi feita uma consolidação em tabelas e gráficos, de publicações do Instituto Brasileiro de Geografia e Estatística e de outras fontes, com estimativas adicionais de resultados não incluídos nos trabalhos originais. Incorporação de dados preliminares de duas pesquisas ainda não publicadas.

Resultados: demonstra-se que, ao lado do declínio da desnutrição em crianças assinalou-se uma expansão epidêmica do sobrepeso e obesidade em adultos, caracterizando a mudança de perfis epidemiológicos que demarcam a transição nutricional. O aparente paradoxo de que as freqüências mais elevadas de normalidade antropométrica em adultos foram encontradas nas regiões mais pobres do Norte e Nordeste do Brasil, resultados que se reproduzem, em localidades com índices muito baixos de desenvolvimento humano do Nordeste. Descreve-se que, a melhor situação antropométrica de populações adultas no Brasil foi encontrada nas famílias de mais baixa renda (menos de ¼ de salário mínimo familiar per capita, com uma razão de prevalência duas vezes maior entre os homens adultos quando comparados com o grupo de renda familiar mais elevada).

Conclusões: os resultados da antropometria nutricional de adultos, favorecendo as populações de baixa renda, refletem um momento epidemiológico peculiar do processo de transição nutricional do país, configurando um paradoxo circunstancial e provavelmente temporário.

Palavras-chave *Antropometria, Trasição nutricional, Adulto*

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In the last 50 years, the pattern of morbidity and mortality in the world has undergone profound changes, which have been unique in terms of the pace of change in comparison with other periods in human history. In descriptive terms, the basic variables that characterize the new situation and its tendencies can be summed up by the enormous reduction in mortality among infants and young people, a marked decline in the birth rate, and, as a consequence of this, a rise in the share of the population that is adult or elderly. In the more specific case of disease, there are signs of a rapid change to a pattern of morbidity and mortality whereby people, principally children, are affected by chronic non-transmissible diseases associated with obesity, dyslipidemias and other disorders caused by unhealthy lifestyles and eating habits. These characteristics suggest that the changes form part of a process that has been known, for the last 40 years, as the epidemiological transition.[1,2]

As it is a systemic phenomenon, the epidemiological transition has ramifications in various fields of health, including, maybe principally, nutrition. In fact, in so far as nutritional *status* can easily be measured using sensitive indicators and data that is easy to collect and analyze, in addition to sufficiently perspicacious reflection on living conditions, it has become an especially useful tool for expressing the degree of adjustment of the population to the physical, biotic and social ecosystems it inhabits.[3]

Thus, the existence of time-series information representing the state of nutrition from an anthropometric point of view makes it possible to read with some confidence the evolution of human development over time, across geographical space and according to heterogeneous social strata. This is especially useful for the description and analysis of the situation in Brazil, as it has historically been one of the most unequal countries in the world[4,5] thereby exposing its population to different risks, which manifest themselves in the health/disease system.[6,7] It should, furthermore, be pointed out that, alongside hugely asymmetrical social and economic development, Brazil is one of the countries where the nutritional transition has been occurring most rapidly in the past 30 years,[3,8] and this evidently does not match the slow pace of the evolution of income, primarily in the years between 1980 and 2000, which economic analysts consider to be two practically lost decades.

This study thus aims to analyze the evolution of the nutritional *status* of adults, and briefly survey the situation among children, as a way of illustrating the most striking features of the process of nutritional transition in the context of the social and economic situation in Brazil. It thus consolidates the most important data published over the last thirty years - beginning in 1974/1975-as a way of building up a retrospective view of the epidemiological dynamic related to geographical variables (macro-regions, and the dichotomy between urban and rural areas) and socio-economic conditions, as expressed in the distribution of household income.

Some results

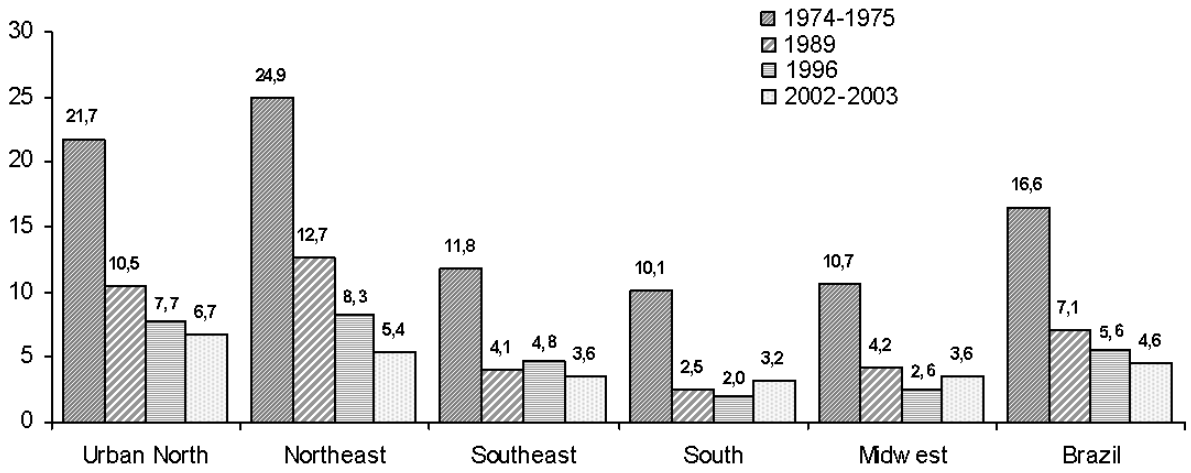
Since 1974/1975, a continual decline in the prevalence of malnutrition among children has reduced the occurrence of the problem from 16.6% to 4.6% (2002/2003) nationwide, thus representing a reduction of 75%, this figure being greater in the Northeast, which is the poorest region in the country, which saw a decrease of 78.3%. When last surveyed (2002-2003), the prevalence of malnutrition, measured according to the weight/age index, was practically under control in the South, Southeast and Midwest regions, and significantly reduced in the North and Northeast (Figure 1). In 1974/1975, the *deficit* in the weight/height relation in adults was already virtually under control, with a residual prevalence of malnutrition only in adult men from the rural parts of the Northeast. Since then, a rise of epidemic scale has occurred in the frequency of overweight and obesity, at first more rapidly among women, but more recently also among men. Among adult women, the Body Mass Index (BMI) ≥30 has begun to decline in recent years, contrary to the development that is occurring among men, so that the tendency is for the difference between men and women to level out in the short term.

Given these tendencies, the most recent survey was used to calculate mathematically the prevalence of eutrophy (or normal anthropometric variables) by, in effect, gauging the current situation in comparison with the desired objective of health interventions and in terms of living conditions. This can be estimated by adding up the deviations resulting from weight for height deficit (low weight) and those resulting from excess (overweight and obesity) and subtracting this sum from 100%.

Table 1 thus shows that the prevalence of low weight in adults is predominantly in women from rural areas, with no significant epidemiological differences from region to region. It is worth noting that obesity is two to four times more prevalent than low weight and that this is true for all parts of the country,

Figure 1

Evolution of the prevalence of weight for age (W/A) deficit* in children aged under five years, by region. Brazil (1974-1975, 1989, 1996 and 2002-2003).



* W/A *deficit*=<-2 standard deviations from the National Center of Health Statistics table.
Source: Brazilian Institute of Geography and Statistics (IBGE); 2006.[9]

from the poorest regions of the North and Northeast to the richest in the South, Southeast and Midwest.

The most surprising figures were those for the prevalence of normal anthropometric measurements among adults. The higher frequencies for eutrophy, measured according to the weight/height (BMI) relation were found among men in the regions known to be the poorest, namely the North and Northeast, with 65.9% and 71.2% respectively, while the lowest percentages were registered in the richer regions.

Table 2 illustrates the nutritional *status* of men and women in Brazil by household *per capita* income expressed in minimum wages. Overweight and obesity are consistently correlated with increased income in the case of men, rising from 2.7% for up to ¼ of one minimum wage to 13.5% for the over five minimum wages bracket. Among women, variations between the income groups are practically inexistent according to the latest evaluation.

In the specific case of the prevalence of normal anthropometric measurements, the highest occurrence of eutrophy (71.5%) was found in the lowest income group, i.e. those with an income of up to ¼ of one minimum wage (MW) *per capita*. In the next economic category (¼ - ½ of one minimum wage), 65.6% of men were classified as anthropometrically normal, compared with only 29.0% for the highest income group. Among women there were less evident differences from one income bracket to another, and in the contrast between the two tendencies in terms of normality, as measured by the U-distribution: which declines from the lowest income stratum up to two minimum wages *per capita*, and then rises steadily up to the highest income group.

Table 3 shows the preliminary results of surveys carried out in two typical poor communities (both with a Human Development Index (HDI) below the tenth percentile for the respective regions): Gameleira, Zona da Mata Sul de Pernambuco, with a single-crop sugar-cane farming economy and São João do Tigre, in Cariris Velhos, in the State of Paraíba, in the Semi-Arid Zone of the Northeast. The extreme social and economic vulnerability of these communities was one of the fundamental criteria used to select them for this study of eating habits and nutrition, which covered representative samples of families living in both town and countryside.

As shown in Table 3, the prevalence of malnutrition (BMI <18.5) was a very rare finding, especially among people aged 40 years or over. However, the occurrence of overweight and obesity for the two groups taken together represented between 32.4% and 58.5% of the results. In both municipalities, again taking the two age groups together, more than 50% of the cases studied were anthropometrically normal, a figure practically identical to that for obesity and overweight.

Table 1

Prevalence of weight deficit, excess weight, obesity and normal anthropometric measurements in Brazilian adults of both sexes, by macro-region (2002-2003).

Region	Male			Female		
	Total	Location of household		Total	Location of Household	
		Urban	Rural		Urban	Rural
		Deficit				
Brazil	2.8	2.7	3.5	5.2	5.1	6.1
North	2.4	2.5	2.2	5.2	5.2	5.1
Northeast	3.5	3.3	4.0	6.2	5.9	7.2
Southeast	2.8	2.7	4.2	5.0	4.9	6.2
South	2.0	1.9	2.3	3.7	3.7	3.6
Midwest	2.4	2.3	3.3	6.2	6.2	6.3
		Normality*				
Brazil	47.2	43.8	62.9	41.7	41.8	40.5
North	54.0	49.8	65.9	49.2	49.2	49.3
Northeast	56.9	50.8	71.8	43.3	42.7	45.2
Southeast	42.8	41.3	56.8	40.5	40.7	37.7
South	41.7	39.7	50.0	37.8	39.5	28.6
Midwest	45.6	43.8	56.4	46.1	46.9	39.5
		Excess weight				
Brazil	41.1	43.8	28.5	40.0	39.9	40.7
North	35.9	38.7	28.0	35.0	34.8	35.7
Northeast	32.9	37.8	21.0	38.8	39.4	36.8
Southeast	44.4	45.7	32.0	40.7	40.5	43.1
South	46.2	47.7	40.0	43.4	42.4	49.2
Midwest	43.4	44.9	34.2	37.1	36.4	42.5
		Obesity				
Brazil	8.9	9.7	5.1	13.1	13.2	12.7
North	7.7	9.0	3.9	10.6	10.8	9.9
Northeast	6.7	8.1	3.2	11.7	12.0	10.8
Southeast	10.0	10.3	7.0	13.8	13.9	13.0
South	10.1	10.7	7.7	15.1	14.4	18.6
Midwest	8.6	9.0	6.1	10.6	10.5	11.7

Source: Brazilian Institute of Geography and Statistics (IBGE); 2004.[10]

* The frequencies for normal measurements were obtained from mathematical estimates, such as difference (x-100%) from the sum of deficit, overweight and obesity, in relation to the total distribution.

Table 2

Prevalence of deficit, overweight, obesity and normal anthropometric measurements in adult men and women in Brazil according to income strata (2002-2003).

Household *per capita* income (minimun wage-Brazil)	Male				Female			
	Weight deficit	Normal*	Overweight	Obesity	Weight deficit	Normal*	Overweight	Obesity
≤ 1/4	4.5	71.5	21.3	2.7	8.5	50.6	32.1	8.8
1/4 l----1/2	4.1	65.6	26.2	4.1	6.4	41.3	39.6	12.7
1/2 l----1,0	3.6	53.5	35.3	7.6	5.6	40.2	41.2	13.0
1l----2,0	3.0	47.5	40.7	8.8	5.4	37.8	42.4	14.4
2 l----5,0	1.8	38.6	48.6	11.0	4.6	40.8	40.9	13.7
>5,0	1.3	29.0	56.2	13.5	3.3	49.3	35.7	11.7

Source: Brazilian Institute of Geography and Statistics (IBGE); 2004[10]

* The frequencies for normal measurements were obtained from mathematical estimates, such as difference (x-100%) from the sum of deficit, overweight and obesity, in relation to the total distribution.

Table 3

Body mass index for adults in two municipalities in the Northeast (Zona da Mata in the State of Pernambuco and Cariri in the State of Paraíba).

Localities/Age brackets	Classification and prevalence of body mass index (BMI)							
	<18.5		≥18.5 <25.0		≥ 5.0		Sample	
	n	%	n	%	n	%	n	%
Gameleira (Pernambuco)								
20-39 years	17	3.4	319	64.2	161	32.4	497	100.0
40 +	6	2.8	110	51.6	97	45.5	213	100.0
Total	23	3.2	429	60.4	258	36.3	710	100.0
São João do Tigre (Paraíba)								
20-39 years	12	3.4	185	52.3	157	44.4	354	100.0
40 e +	2	1.6	49	39.8	72	58.5	123	100.0
Total	14	2.9	234	49.0	229	48.0	477	100.0

Source: Batista Filho et al. Estado nutricional de adolescentes. [11]

Discussão

The simplest way of illustrating the nutritional transition is to look at the situation for diseases related to poverty for the dominant pattern of overweight/obesity and the cluster of co-morbidities associated with these conditions. Represented thus, the transition from one model to the other follows almost exactly the same epidemiological course as that for energy and protein nutrition, taking as a base the curve plotted between malnutrition and obesity. Other manifestations of a nutritional nature or not, would probably exhibit a similar trend.

In fact, the combination of demographic and nosographic events that characterize the epidemiological transition in the area of nutrition are structural processes peculiar to a specific point in time that derive from great changes in the living conditions of society as a whole: economic, social and spatial changes (especially high rates for migration from rural to urban areas), and changes in the employment market (a movement towards the services sector),

consumer habits, lifestyles (particularly sedentarism), the level of education, the supply, demand and success of basic health care and related conditions (sanitation, housing, sanitary awareness, and so forth). In theory, the transitional process would seem to be the result of a vast and interactive conjunction of factors that have come about as a result of economic and social development. These would appear to be the factors necessary to explain the historical fact that the epidemiological and nutritional transition has only clearly emerged in the past 80 years, and has only in fact become a genuinely new and concrete situation from the 1960s onwards.[12-14]

Bearing these considerations and presuppositions in mind, it is in fact surprising to observe that, in the case of Brazil, many of these necessary underlying factors that determine large-scale changes in the epidemiological profile do not as yet fully exist. In the course of the past 30 years, when the most dynamic phase of the nutritional transition began to be documented, two decades have practically been lost in terms of the growth in national income, as expressed in the *per capita* Gross Domestic Product. The situation has been exacerbated by the fact that social and economic inequality has grown, with the Gini index suggesting that the distribution of goods and services has become even more asymmetrical, indicating a process of gradual exclusion of the less well-off sectors of the population.[7] Furthermore, this social differentiation has been even more marked in the poorest regions of the country. Among the positive factors that could be cited are the expansion of basic health care,[15] the improvement in the levels of education of mothers, and, above all, a marked drop in the birth rate in the last 40 years, substantially altering the economic relation between those (mothers and fathers) responsible for income generation and their dependents. Even so, the rationale behind the large-scale changes that have characterized the nutritional transition in Brazil, with the rapid reversal of the tendency in the course of two generations, is still by no means clear, when it is borne in mind that in more developed countries, the process took around four generations.

The material analyzed in this article illustrates some of the facets of this unexpected and paradoxical situation. It is difficult, for example, to estimate from the comparisons between rich and poor geographical regions whether a practically equal distribution between weight deficit on the one hand and overweight and obesity on the other has been reached. Curiously, in the specific case of normal anthropometric variables (a BMI of between 18.5 and 24.9), it can be seen that there is a higher prevalence of eutrophy in the relation between weight and height in adult populations, according to the most recent findings (2002-2003) in the North and Northeast regions, which are the poorest in the country. The still unpublished results from the two municipalities in the Northeast known to be poor, as evaluated in 2006 (Gameleira, na Zona da Mata de Pernambuco, and São João do Tigre, in the Cariris Velhos microregion, in the arid zone of the State of Paraíba), would seem to confirm the impression that the nutritional transition is a widespread phenomenon, even in geographical areas deliberately chosen because of their conditions of extreme poverty.[11]

This observation is also backed up by analysis of the data which stratifies Brazilian families according to *per capita* income, from the poorest to those with the highest income. In other words, the occurrence of low weight in adult males from the low income stratum (1/4 of one minimum wage or less being considered a state of extreme poverty) would appear to be fully compatible with the expected and desired situation for the populations of more developed countries, even according to international anthropometric benchmarks. Among adult Brazilian women the frequency for low weight (8.5%) is only a little higher than the figure of 5% that is considered to be tolerable, and would be considered only a slight prevalence of deficit. Breaking down the data according to income stratum further corroborates at national level the observation that a higher prevalence of normal anthropometric measurements in adult males is to be found in the lowest *per capita* income bracket, this rate being twice as high as that for those with the highest income. Put starkly, it is among adults with the lowest incomes that the best nutritional conditions are to be found in Brazil, when these are measured according to body mass index, and this observation has already been reported in another document,[16] forming part of a nutritional survey carried out in the Northeast of the country.

At first sight, these results may appear paradoxical. In fact, the situation should be understood as just a snap-shot taken in the course of a rapid nutritional transition that has been going on in Brazil in recent decades. Thus, the picture anthropometric indicators show today would appear to be a projection of geographical, economic and social tendencies that have been traced through the time-series of observations carried out as part of the four large-scale surveys conducted in Brazil. These tendencies point to the disappearance of weight for height deficit, and a more easily controllable nutritional deficit, at least in the preliminary stage. At the same time, the problem of overweight and obesity is spreading, more rapidly in

families with a high income and more slowly among those with a lower income. In 1974/75 there was already practically no epidemiologically significant weight for height deficit among the poorest sectors and the prevalence of obesity and overweight seen today in higher income brackets had not yet emerged. In other words, it would seem that the pace of the spread of overweight and obesity among adults from better-off families can explain the higher prevalence of anthropomorphic normality in the poorest sectors of society.

Finally, this discussion should be mentioned should be put in a clearer perspective. The transition is unlikely to follow a straight line from malnutrition among children to obesity and overweight among adults. The ideal objective would be that of achieving eutrophy, or normal anthropometric measurements, for both groups by the end of the process. In this respect, it is only at the present point in the transition that the nutritional status among the poorest members of society is better than that of those with a higher income. It is at this point in time important to consolidate and improve this state of affairs for all biological and social groups and all geographical areas, not as a simple process of transition, but as a target for policies, programs and strategic actions aiming to achieve food security and nutritional well-being for all.

References

1. Frederiksen H. Feedbacks I economic and demographic transition. Science. 1969; 166: 837-47.
2. Omran AR. The epidemiologic transition: a theory of the epidemiology of opulation change. Milbank Mem Fund Q. 1971; 49: 509-38.
3. Monteiro CA, Mondini L, Souza ALM, Popkin BM. Da desnutrição para a obesidade: a transição nutricional no Brasil. In: Monteiro CA, organizador. Velhos e novos males da saúde no Brasil: a evolução do país e suas doenças. 2. ed. São Paulo: Haucitec; 2000. p. 247-55.
4. UNICEF (Fundo das Nações Unidas para a Infância). A infância brasileira nos anos 90. Brasília, DF; 1998.
5. PNUD (Programa das Nações Unidas para o Desenvolvimento). Atlas do Desenvolvimento Humano no Brasil [on line]. Disponível em: http://www.pnud.org.br/atlas/ [2007 Set 05].
6. Silva MGC. Economia da saúde: da economia à tomada de decisão. In: Rouquayrol MZ, Almeida Filho N, editores. Epidemiologia & saúde. 6. ed. Rio de Janeiro: Medsi; 2003. p. 533-65.
7. Iunes RF. Mudanças no cenário econômico. In: Monteiro CA, organizador. Velhos e novos males da saúde no Brasil: a evolução do país e de suas doenças. 2. ed. São Paulo: Hucitec; 2000. p. 33-60.
8. Batista Filho M, Rissin A. A transição nutricional no Brasil: tendências regionais e temporais. Cad Saúde Pública. 2003; 19 (Supl 1): 181-91.
9. IBGE (Instituto Brasileiro de Geografia e Estatísticas). Pesquisa de orçamentos familiares no Brasil, 2002/2003. Antropometria e análise do estado nutricional de crianças e adolescentes no Brasil. Rio de Janeiro; 2006.
10. IBGE (Instituto Brasileiro de Geografia e Estatísticas). Pesquisa de orçamentos familiares 2002-2003. Análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. Rio de Janeiro; 2004.
11. Batista Filho M, Oliveira JS, Maia SR, Veras ICL, Lemos MCC, Andrade, SLLS, Viana Junior MJ, Lira PIC. Estado nutricional de adolescentes e adultos em duas localidades de baixo índice de desenvolvimento humano (IDH) e elevada prevalência de insegurança alimentar. (In press, 2007)
12. Fries JF. The Compression of morbidity. Health Society. 1983; 61: 397-419.
13. Olshanski SJ, Ault AB. The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases. Milbank Mem Fund Q. 1986; 64: 355-91.
14. Barreto ML, Carmo EH. Mudanças em padrões de morbimortalidade: conceitos e métodos. In: Monteiro CA, organizador. Velhos e novos males da saúde no Brasil: a evolução do país e de suas doenças. 2. ed. São Paulo: Hucitec; 2000. p. 7-32.
15. Benicio MHD'A, Monteiro CA, Rosa TEC. Evolução da desnutrição, da pobreza e do acesso a serviços públicos em dezesseis estados. In: Monteiro CA, organizador. Velhos e novos males da saúde no Brasil: a evolução do país e de suas doenças. 2. ed. São Paulo: Hucitec; 2000. p. 141-53.
16. Batista Filho M. Sustentabilidade alimentar do semi-árido brasileiro. Recife; IMIP; 2005. (Série Publicações Científicas Instituto Materno Infantil Prof. Fernando Figueira-IMIP, n. 11).

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