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Prevalence of overweight and obesity and associated factors, Brazil, 2006

ABSTRACT

OBJECTIVE: To estimate the prevalence of overweight and obesity and factors associated.

METHODS: The study analyzed data referring to individuals aged 18 years or older interviewed through the system *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL – Telephone-based surveillance of risk and protective factors for chronic diseases), carried out in the Brazilian capitals and Federal District in 2006. For 49,395 individuals, the body mass index (BMI) was used to identify overweight (BMI ≥ 25 kg/m^2) and obesity (BMI ≥ 30 kg/m^2). Prevalence and prevalence ratios were presented according to sociodemographic variables, level of schooling, health condition/comorbidities, and self-evaluation of health, stratified by sex. Poisson regression was employed for crude and age-adjusted analyses.

RESULTS: The prevalence of overweight was of 47% for men and 39% for women, obesity was around 11% for both sexes. Direct association was observed between overweight and level of schooling among men and inverse association among women. Obesity was more frequent among men living with a partner and was associated neither with level of schooling nor skin color. The prevalence of overweight and obesity was higher among black women and women who lived with a partner. The presence of diabetes, systemic arterial hypertension and dyslipidemias, as well as the subject perceiving his/her health as regular or poor, were also reported by the interviewees with overweight or obesity.

CONCLUSIONS: While approximately one out of every two interviewees was classified as being overweight, obesity was reported by one out of every ten interviewed subjects. Socioeconomic and demographic variables, as well as reported morbidities, were associated with overweight and obesity. These results were similar to the ones found in other Brazilian studies.

DESCRIPTORS: Obesity, epidemiology. Overweight, epidemiology. Socioeconomic Factors. Chronic Disease, prevention & control. Health Surveys. Brazil. Telephone interview.

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INTRODUCTION

Chronic problems associated with obesity can be grouped into: cardiovascular diseases, insulin resistance conditions, some types of cancer and gallbladder disease.[14] Obese individuals present at least twice the chance of developing diabetes, insulin resistance, dyslipidemia, apnea, gallbladder disease, hypertension, coronary artery disease, osteoarthritis, and gout.[14] These associations and the increasing growth in the prevalence of obesity, as well as of other risk factors for chronic noncommunicable diseases (CNCD), such as physical inactivity, smoking, high blood pressure and cholesterol, are responsible for a large part of the health costs.[15]

The prevalence of obesity has increased in high and low income countries, among adults, adolescents and children. In high income countries, obesity affects mainly the less advantaged population;[13] in developing countries, obesity prevalence is greater in the higher income population.[6] However, in the Brazilian population, greater occurrence of obesity among the poor has been recently observed.[7]

In Brazil, national surveys show that the prevalence of overweight and obesity has increased in the adult population in a different way according to sex. In the period 1974-75, obesity among men tripled and, among women, who at the beginning of the period presented higher prevalence, there was a 50% increase in the period 2002-03.[a] This increase in the prevalence of obesity in women concentrated in the period from 1974-75 to 1989, when the two first national surveys were carried out (*Estudo Nacional da Despesa Familiar* – National Study on Family Expenses - and *Pesquisa Nacional de Saúde e Nutrição* – National Survey on Health and Nutrition). Regarding overweight, the women also began the period with higher prevalence, but in 2002-03 the frequency of overweight was similar in men and women. Analyzing the evolution of this prevalence in relation to socioeconomic level, there was an increase in the occurrence of obesity for all income categories among men but only among the poorest women. On the other hand, among higher income individuals, there was a decrease in the prevalence of obesity and overweight. The association between these outcomes and lower level of schooling has also been observed in other populations of many countries.[3]

The aim of the present study was to estimate the prevalence of overweight and obesity, assessing the associated factors and the BMI effect on the occurrence of self-referred morbity.

METHODS

Cross-sectional study that used data from the system of *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL - Telephone-based surveillance of risk and protective factors for chronic diseases), based on a probabilistic sample of the population of adults (≥18 years) living in households served by fixed telephone lines in the Brazilian capitals and Federal District. Sample size was calculated to study the prevalence of the main risk factors for chronic noncommunicable diseases. To ensure a 95% confidence level and a maximum error of two percentage points for the estimates, it was necessary to study at least 2,000 individuals in each city.

From the electronic roll of residential lines provided by the telephone companies, 5,000 telephone lines were systematically drawn, stratified according to region or prefix. These lines were re-drawn and divided into 25 replicas, reproducing the same proportion of lines per region or telephone prefix, and were integrally used in a sufficient number until the necessary interviews were conducted in each city. To each eligible telephone line, all the dwellers of the household aged ≥18 years were listed and one of them was drawn to answer the interview. Further information on the sampling procedure and the methods employed in the above-mentioned survey are described in other publications.[8,b]

The telephone interviews were conducted between August and December 2006. The questionnaire was administered through the use of computers for the reading of questions and register of answers. This questionnaire approached information on demographic and socioeconomic characteristics; characteristics of the dietary and physical activity pattern; reported weight and height; consumption frequency of cigarettes and alcohol; self-rate of the health status and reference to a previous medical diagnosis of some diseases, among other questions.

In the 27 studied cities 54,369 individuals were interviewed by VIGITEL. The exclusion of 487 pregnant women in the occasion of the interview and of 4,487 people who did not inform weight and/or height resulted in 49,395 valid interviews for the present study, 20,622 (41.7%) men and 28,773 (58.3%) women. Of the overall number, 61% were younger than 45 years.

Self-reported weight and height were used to calculate the body mass index (BMI – weight in kilograms divided by height in meters squared). The analyzed

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[a] Instituto Brasileiro de Geografia e Estatística. Pesquisa de orçamentos familiares 2002-2003. Análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. Rio de Janeiro; 2004.
[b] Ministério da Saúde. VIGITEL 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre freqüência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2006. Brasília; 2007.

outcomes were: overweight (BMI ≥25 kg/m²); obesity (BMI≥30 kg/m²); and BMI in four categories (<25; 25 to 29.9; 30 to 34.9; and ≥ 35 kg/m²).

The explanatory variables are: age (18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, ≥65 years); level of schooling (up to four, five to eight, nine to 11 or ≥12 years); skin color (white or non-white); stable union (yes/no); diabetes (yes/no); arterial hypertension (yes/no); infarction, stroke or cerebrovascular accident (yes/no); dyslipidemia (yes/no); osteoporosis (yes/no); self-rate of health as poor or regular (yes/no).

Crude and adjusted analyses were stratified by sex, except for the association of the BMI categories with reported morbidities. The prevalence of overweight and obesity was calculated, as well as the respective confidence intervals according to age. To analyze the associations of overweight and obesity with level of schooling, skin color and marital status, Poisson regression was used, crude and adjusted for sex, age and level of schooling between the BMI categories. The reported morbidities were also analyzed through Poisson regression, considering the absence of disease as reference category. All the analyzes considered the weighting factor attributed to the interviewees to correct the following conditions: higher chance of drawing an individual living in a household with more than one telephone line; lower chance of drawing an individual living in a household with higher number of dwellers; and to increase the sample's representativeness in relation to the sociodemographic composition of each municipality.[10]

As the interviews were conducted by telephone, the signed consent document was replaced by the verbal consent provided during the telephone contacts with the interviewees. VIGITEL was approved by the National Committee for Ethics in Research with Human Beings of the Ministry of Health.

RESULTS

Overweight was more prevalent among men and the prevalence of obesity was similar among men and women. However, overweight and obesity were more prevalent among older women (55 years or more). The prevalence of overweight and obesity increased with age up to 54 years among men and 64 years among women (Table 1).

Analyzing the association of some sociodemographic variables with overweight, it was observed that lower level of schooling protected men against it. Inversely, higher prevalence of overweight was observed among women with lower level of schooling (Table 2). There was no crude association between overweight and skin color for both sexes. However, after adjusting for age, prevalence of overweight was 12% higher among non-white women when compared to white women (p=0.001). Men and women who lived in a stable union had higher chance of presenting overweight (Table 2).

Table 3 shows the associations between obesity and sociodemographic variables. Among men, only the marital status showed association with obesity. Living in a stable union represented a risk of obesity that was approximately two times higher. Although this effect was lower when adjusted for age, the association remained significant. Among women, the effects of lower level of schooling and of non-white skin color were higher for obesity than for overweight, while the risk of living in a stable union was similar for both outcomes.

The relationship between BMI categories and reported morbidities is presented in Table 4. The reported prevalence of diabetes, systemic arterial hypertension (SAH), infarction, stroke or cerebrovascular accident (CVA), dyslipidemia and osteoporosis was higher among individuals with higher BMI. Nevertheless, after adjusting for sex, age and level of schooling, no

Table 1. Prevalence[a] of overweight (BMI≥25 kg/m²) and obesity (BMI≥30 kg/m²) according to age and sex. Brazil, 2006. (N=49,395)

Age (years)	n	Men		n	Women	
		Overweight % (95% CI)	Obesity % (95% CI)		Overweight % (95% CI)	Obesity % (95% CI)
18 to 24	3720	24.9 (23.5;26.3)	4.1 (3.5;4.7)	4326	17.1 (16.0;18.2)	4.5 (3.9;5.1)
25 to 34	4485	48.1 (46.6;49.6)	11.8 (10.9;12.7)	6158	29.4 (28.3;30.5)	8.9 (8.2;9.6)
35 to 44	4708	56.7 (55.3;58.1)	13.6 (12.6;14.6)	6627	43.2 (42.0;44.4)	11.0 (10.2;11.8)
45 to 54	3665	58.8 (57.2;60.4)	16.7 (15.5;17.9)	5159	53.5 (52.1;54.9)	15.1 (14.1;16.1)
55 to 64	2103	55.9 (53.8;58.0)	13.1 (11.7;14.5)	3360	59.1 (57.4;60.8)	20.4 (19.0;21.8)
65 and older	1941	50.1 (47.9;52.3)	11.0 (9.6;12.4)	3143	55.4 (53.7;57.1)	19.7 (18.3;21.1)
Total	20622	47.3 (46.6;48.0)	11.3 10.9;11.7	28773	38.8 (38.2;39.4)	11.5 (11.1;11.9)
p		<0.001	<0.001		<0.001	<0.001

[a] Weighted percentage to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population of each city in the 2000 Demographic Census and considering the population weight of each city.

Table 2. Prevalence[a] and age-adjusted prevalence ratio (PR) of overweight (BMI≥25 kg/m^2) according to level of schooling, skin color and marital status, by sex. Brazil, 2006. (N=49,395)

Variable	Men			Women		
	%	Crude PR (95% CI)	Adjusted PR (95% CI)	%	Crude PR (95% CI)	Adjusted PR (95% CI)
Level of schooling (years)	p<0,001	p<0,001	p<0,001	p<0,001	p<0,001	p<0,001
Up to 4	46.6	0.87 (0.79;0.97)	0.80 (0.72;0.89)	52.7	1.85 (1.68;2.04)	1.46 (1.31;1.62)
5 to 8	46.2	0.86 (0.79;0.95)	0.90 (0.82;0.98)	44.1	1.55 (1.40;1.71)	1.51 (1.37;1.66)
9 to 11	45.3	0.85 (0.79;0.91)	0.92 (0.86;0.99)	31.0	1.09 (0.99;1.19)	1.17 (1.07;1.28)
12 and more	53.4	1	1	28.5	1	1
Skin color	p<0.001	p=0.08	p=0.35	p<0.001	p=0.11	p=0.001
White	49.2	1	1	37.6	1	1
Non-white	46.2	0.94 (0.87;1.01)	0.97 (0.91;1.04)	39.7	1.06 (0.98;1.13)	1.12 (1.06;1.19)
Stable union	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
No	36.3	1	1	31.9	1	1
Yes	56.9	1.54 (1.42;1.67)	1.38 (1.27;1.50)	45.6	1.43 (1.34;1.53)	1.36 (1.27;1.45)

[a] Weighted percentage to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population of each city in the 2000 Demographic Census and considering the population weight of each city.

differences were observed regarding the frequency of infarction, stroke or CVA and osteoporosis between the BMI categories. After the adjustment, for interviewees with BMI ≥35 kg/m^2, the frequency of reported diabetes was more than three times higher than in those with BMI lower than 25 kg/m^2. The prevalence of SAH was approximately three times higher in the group of BMI ≥35 kg/m^2 compared to the group of BMI lower than 25 kg/m^2, and the prevalence of dyslipidemia was two times higher. Also in individuals with high BMI there was greater refer- ence to regular or poor health: this chance was 26% higher for individuals with BMI between 25 and 29.9 kg/m^2, versus 80% among the interviewees with BMI ≥35 kg/m^2, compared to those with BMI < 25 kg/m^2 (Table 4).

DISCUSSION

The present study shows the frequency of overweight and obesity according to demographic and socioeco- nomic variables and some chronic morbidities, based on information supplied by VIGITEL. These results

Table 3. Prevalence[a] and age-adjusted prevalence ratio (PR) of obesity (BMI≥30 kg/m^2) according to level of schooling, skin color and marital status, by sex. Brazil, 2006. (N=49,395)

Variable	Men			Women		
	%	Crude PR (95% CI)	Adjusted PR (95% CI)	%	Crude PR (95% CI)	Adjusted PR (95% CI)
Level of schooling (years)	p<0,001	p=0,08	p=0,69	p<0,001	p<0,001	p<0,001
Up to 4	12,5	1,07 (0,82;1,39)	0,98 (0,74;1,27)	19,1	2,54 (2,05;3,14)	1,96 (1,56;2,45)
5 to 8	11,6	0,99 (0,79;1,27)	1,03 (0,83;1,29)	12,4	1,65 (1,32;2,06)	1,59 (1,27;1,99)
9 to 11	9,8	0,83 (0,70;1,00)	0,92 (0,77;1,11)	8,1	1,07 (0,88;1,31)	1,16 (0,95;1,42)
12 and more	11,7	1	1	7,5	1	1
Skin color	p<0,001	p=0,75	p=0,43	p<0,001	p=0,09	p=0,006
White	11,1	1	1	10,7	1	1
Non-white	11,4	1,03 (0,87;1,22)	1,07 (0,90;1,27)	12,1	1,13 (0,98;1,31)	1,22 (1,06;1,40)
Stable union	p<0,001	p<0,001	p<0,001	p<0,001	p<0,001	p<0,001
No	7,4	1	1	9,6	1	1
Sim	14,3	1,94 (1,58;2,37)	1,73 (1,38;2,17)	13,4	1,40 (1,21;1,60)	1,32 (1,15;1,53)

[a] Weighted percentage to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population of each city in the 2000 Demographic Census and considering the population weight of each city.

Table 4. Prevalence[a] and prevalence ratio, crude and adjusted for sex, age and level of schooling, of reported morbidity according to body mass index. Brazil, 2006. (N=49,395)

Variable	Body mass index			
	<25 kg/m²	25 to 29.9 kg/m²	30 to 34.9 kg/m²	≥35 kg/m²
	n = 28.278	n = 15.313	n = 4.385	n = 1.419
Diabetes				
Prevalence (%)	3.2	6.2	10.9	16.5
Crude PR (95% CI)	1	1.98 (1.65;2.38)	3.44 (2.73;4.34)	5.21 (3.63;7.48)
Adjusted PR (95% CI)	1	1.52 (1.26;1.82)	2.40 (1.90;3.04)	3.65 (2.41;5.50)
Systemic arterial hypertension				
Prevalence (%)	13.6	27.5	39.2	54.5
Crude PR (95% CI)	1	2.03 (1.87;2.21)	2.89 (2.61;3.20)	4.02 (3.55;4.55)
Adjusted PR (95% CI)	1	1.66 (1.53;1.80)	2.22 (2.02;2.44)	2.97 (2.56;3.44)
Infarction, stroke or CVA				
Prevalence (%)	2.4	3.0	3.2	4.4
Crude PR (95% CI)	1	1.25 (0.90;1.75)	1.35 (0.91;2.00)	1.81 (1.02;3.21)
Adjusted PR (95% CI)	1	0.94 (0.68;1.31)	0.92 (0.63;1.35)	1.36 (0.77;2.38)
Dyslipidemia				
Prevalence (%)	11.0	22.1	28.6	29.7
Crude PR (95% CI)	1	2.00 (1.82;2.19)	2.59 (2.30;2.92)	2.69 (2.18;3.32)
Adjusted PR (95% CI)	1	1.69 (1.54;1.85)	2.09 (1.86;2.35)	2.14 (1.68;2.73)
Osteoporosis				
Prevalence (%)	3.5	4.3	6.5	8.5
Crude PR (95% CI)	1	1.22 (1.02;1.46)	1.86 (1.46;2.36)	2.41 (1.66;3.50)
Adjusted PR (95% CI)	1	0.91 (0.76;1.09)	1.20 (0.96;1.51)	1.18 (0.80;1.74)
Poor or regular health				
Prevalence (%)	28.9	37.6	50.5	59.1
Crude PR (95% CI)	1	1.30 (1.22;1.39)	1.75 (1.62;1.89)	2.05 (1.84;2.28)
Adjusted PR (95% CI)	1	1.26 (1.18;1.34)	1.61 (1.48;1.75)	1.80 (1.60;2.03)

[a] Weighted percentage to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population of each city in the 2000 Demographic Census and considering the population weight of each city.
CVA: Cerebrovascular accident

will be used as baseline to analyze the evolution of this morbidity in the adult population living in Brazilian capitals.

The prevalence of overweight and obesity that was found was similar to that obtained by *Pesquisa de Orçamentos Familiares* (POF – Family Budget Survey) in 2003/2003.[a] Among the studied men, prevalence was higher in the different age groups. On the other hand, the frequencies of overweight and obesity among the studied women were lower than those observed in POF 2002/2003, with differences between age groups. In women up to 34 years of age, overweight prevalence was lower than the one obtained in 2002/2003. Among women aged 35 or older, the reported frequency of overweight was higher than the

frequency measured by POF. Concerning obesity, the results of the present study were similar, with higher prevalence reported by women aged 65 or older. These differences may derive from the form in which the data were obtained: directly measured in POF, while the BMI calculated with reported weight and height is underestimated only by women.[10]

In relation to the socioeconomic and demographic variables, the inverse relationship between level of schooling and the nutritional outcomes had been observed in the female population living in the Northeast and Southeast regions of Brazil.[4] Among men, an analysis of the evolution of obesity in these regions of the country showed a decrease in the positive relationship between level of schooling and risk of obesity.[5] Al-

though no association was observed between level of schooling and obesity in the men who participated in the present study, lower frequency of overweight was observed in the groups with lower level of schooling.

Differences in the prevalence of obesity and overweight in relation to the skin color of the studied individuals were described in a telephone-based survey carried out in the United States.[2] In Brazil, however, a study with employees of a university showed higher weight gain from the age of twenty onwards in black women aged between 30 and 70, and no association between skin color and weight gain among men.[1] The results of the present study corroborate these findings: the prevalence of overweight and obesity, adjusted for the interviewees' age, was higher among non-white women, and no difference was observed among men.

The relationship between stable union and the occurrence of obesity or overweight is consistent with results of representative studies of the population of the United States,[9,12,13] and the higher risk for Brazilian individuals who live in a stable union is being presented for the first time.

The influence of obesity on chronic diseases is well established.[14] The findings of the present study confirm results about the magnitude of the BMI effect on diabetes, systemic arterial hypertension and dyslipidemia, with relative risks for two or more, even based on self-reported morbidity in a survey that was carried out by telephone. For infarction, stroke or CVA, no association was observed with BMI. Thus, low frequencies of these events might be a consequence of information bias, or of survival bias, in which people with these diseases who died or presented serious sequels were not included in the study. Due to the low preva-

lence of infarction, stroke or CVA, or of osteoporosis, slight differences in magnitude might not have been detected, as opposed to the verification of differences in the risk of occurrence of diabetes among obese or overweight individuals.

Like in the study in which the population of the United States was interviewed by telephone,[2] the results of the present study showed association between BMI and greater chance of rating health as poor or regular, indicating that the obese individual had a risk approximately two times higher of rating his/her health as poor or regular.

The similarity between the prevalence of overweight and obesity obtained in the present study and in a representative sample of the Brazilian adult population, weighed and measured in another study,[a] suggests the validity of this kind of survey in the assessment of the frequency of risk factors for chronic diseases. Although the differences in relation to the last survey may have resulted from information bias, they may be related to real increases in the prevalence among men and to a certain stability among women. Local studies with specific populations in different regions of the country can contribute to clarify this question. On the other hand, it is possible to assess the trend and evolution of this prevalence with the periodic conduction of telephone-based surveys.

To conclude, the present study identified factors associated with obesity and overweight, subsidizing the establishment of measures of prevention and control by means of public policies relying on periodicity and short interval to obtain this information by means of telephone-based surveys.

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