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original article

Prevalence and factors associated with overweight in adults - Brazil, 2008-2009

Prevalência e fatores associados ao excesso de peso em adultos - Brasil, 2008-2009

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Abstract – The worldwide overweight prevalence showed a rapid increase in recent decades, featuring a true global epidemic. The aim of this study was to determine the overweight prevalence (BMI ≥ 25kg/m^2) and possible associations with socioeconomic and demographic indicators for adults in Brazil. This epidemiological study analyzed data from the population of adults aged 20-59 years (n = 101 308 637) included in the 2008-2009 Brazilian Family Budget Survey (POF) conducted in all geographic regions of Brazil. The nutritional status assessment used the Body Mass Index, which was categorized as normal weight and overweight according to cutoff points recommended by the World Health Organization. As socioeconomic and demographic indicators, sex, age, color-race, education, income, and geographic region were analyzed. Crude and adjusted Poisson regression was performed. The results showed that the overweight prevalence was 47.7%, and the groups with the highest prevalence were adults aged 20-59 years, males, black skin color, schooling from 6 to 9 years , income of 1/4 ≥ minimum wage <1/2 and living in Southern Brazil. Almost half of adults in Brazil are overweight. Strategic actions aimed at reducing the overweight prevalence among adults in Brazil are needed to combat the obesity epidemic.

Key words: Cross-sectional studies; Obesity; Overweight.

Resumo – *A prevalência mundial de excesso de peso apresentou um rápido aumento nas últimas décadas, caracterizando uma verdadeira epidemia mundial. O presente estudo teve como objetivo verificar a prevalência de excesso de peso (IMC ≥ 25kg/m^2) e as possíveis associações com indicadores socioeconômicos e demográficos em adultos do Brasil. Para esse estudo epidemiológico foram analisados os dados da população de adultos de 20 a 59 anos (n = 101.308.637) que integraram a Pesquisa de Orçamentos Familiares 2008-2009 (POF) realizada em todas as regiões geográficas do Brasil. Para a verificação do estado nutricional foi empregado o Índice de Massa Corporal que foi categorizado em peso normal e excesso de peso conforme os pontos de corte recomendados pela Organização Mundial de Saúde. Como indicadores socioeconômicos e demográficos analisou-se o sexo, idade, cor-raça, escolaridade, renda e região geográfica. Realizou-se regressão de Poisson, bruta e ajustada. Os resultados mostraram que a prevalência de excesso de peso foi de 47,7%, sendo que os grupos com maiores prevalências foram os adultos de 20 a 59 anos, do sexo masculino, de cor-raça negra, com escolaridade de 6 a 9 anos, renda de 1/4 ≥ salário mínimo < 1/2 e da Região Sul. Quase a metade dos adultos do Brasil apresenta excesso de peso. Ações estratégicas que visem diminuir a prevalência de excesso de peso em adultos do Brasil são emergentes para combater a epidemia da obesidade.*

Palavras-chave: *Estudos transversais; Obesidade; Sobrepeso.*

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INTRODUCTION

The World Health Organization[1] has estimated that in 2008, 1.4 billion people worldwide were overweight (Body Mass Index - BMI ≥ 25 kg/m²), and the estimate for 2015 is an increase of 900 million people. In addition, a survey with 88% of the global population estimated that for 2030, 3.3 billion people around the world will be overweight[2].

In Brazil, estimates also indicate an increase in overweight prevalence among adults. From 1975 to 2003, for example, the overweight prevalence increased from 25% to 40%, approximately[3,4]. Brazilian recent surveys have shown an increase in these values. The Surveillance of Risk and Protective Factors for Chronic Diseases by Telephone Interviews, 2011, showed that overweight ranged from 39.8% to 55.4% in the entire adult population of the 26 state capitals and Federal District[5].

There are several health complications from overweight such as hypertension, cardiovascular diseases, type-2diabetes mellitus, some types of cancer, psychological and orthopedic problems, social problems and early mortality[6]. Besides these health complications, excess weight causes high costs to health systems. In the United States of America (USA), overweight-associated cardiovascular diseases generated a direct cost of US$ 147 billion in 2009[7]. In the United Kingdom (UK), over £$ 3 billion were spent by the public health system with overweight[8]. In South Korea, the total costs represented 3.7% of national health expenditures in 2005[9].

In Brazil, 8% of the Gross Domestic Product (GDP) is annually spent with health[10]. Expenditures with all diseases related to overweight, including hospitalizations, medical visits and medications are around US$ 2.1 billion per year, and this amount does not include indirect costs of treatment such as transportation, caregivers, work absenteeism, early retirement and death[11].

In this regard, initiatives to combat and prevent overweight are urgent worldwide. Therefore, population surveys are the first step to help identifying overweight prevalence and encourage future intervention/guidance policies in the population. Furthermore, the identification of demographic and socioeconomic factors associated with this outcome can identify subpopulations more vulnerable to having excess weight. About demographic and socioeconomic aspects, systematic reviews have shown that depending on the location investigated, overweight-related factors can be different[12,13].

Given the above, the present study aimed to estimate the overweight prevalence and evaluate possible associations between this outcome and demographic and socioeconomic indicators in adults throughout Brazil.

METHODOLOGICAL PROCEDURES

This analytical, cross-sectional study used secondary data of public domain, regarding the 2008-2009 Brazilian Family Budget Survey (POF) conducted

by the Brazilian Institute of Geography and Statistics (IBGE) between May 19, 2008 and May 18, 2009 in partnership with the Ministry of Health (which helped in the evaluation and implementation of health policies in the 2008-2009 POF, in particular the nutritional status assessment) and the World Bank (within the Human Development Technical Assistance Loan - HDTAL project). The POF complied with all ethical standards established by the research ethics with humans in Brazil and was approved by the National Health Council[14].

Based on the 2008-2009 POF, a two-stage cluster sampling plan was adopted with geographic and statistical stratification of the primary sampling units, which corresponded to the census tracts of the 2000 Census geographic base, from the structure offered by the master sample designed by IBGE for the Integrated Household Surveys under construction. The secondary sampling units were the permanent domiciles[14].

The allocation of the total census tracts selected in each stratum was proportional to the total number of domiciles. In the 2008-2009 POF, the effective sample size was 4696 sectors, corresponding to an expected number of 59.548 domiciles. The number of domiciles with interview per census tract was established according to the survey area: 12 domiciles in urban areas, 16 in rural areas[14].

In this study, the population of adults aged 20 to 59 years (except pregnant and lactating women) was selected, totaling 101.308.637 individuals of both sexes in the five Brazilian regions. Pregnant and lactating women were excluded from the study because such situations affect their body mass.

The collection and recording of information were directly made in the domiciles selected, along with their residents by assisted interview, with recurrence to the informant's memory during a period of nine consecutive days, by survey agents hired and trained by IBGE through the use of laptops in approximately 70% of the domiciles surveyed. In the remainder, the collection and recording of information were performed with the use of printed questionnaires[14].

Anthropometric measurements of body mass and height were collected by IBGE's survey agents, which were trained to standardize the data collection and followed recommendations contained in the Survey Agent Manual[14]. Body mass was measured using a portable electronic scale with resolution of 100 grams and maximum capacity of 150 kilograms. Height was measured using a KaWe® portable stadiometer for adults, with internal retractable tape measure with accuracy of 0.1 centimeters and length of 300 centimeters[14]. To measure body weight and height, the subjects should is barefoot and wearing light clothing in order not to bias the mass body[14].

From the collection of body mass and height of individuals, BMI was calculated by dividing body mass in kilograms by the squared height in meters. Initially, BMI was classified as underweight (BMI < 18.50kg/m^2), normal weight (18.50 ≥ BMI ≤ 24.99kg/m^2), overweight (25.00 ≥ BMI ≤ 29.99kg/m^2) and obesity (BMI ≥ 30.00kg/m^2), based on cutoffs of WHO[6].

To facilitate interpretation of data and achieve the research objectives, underweight and normal weight categories were grouped into a single category called *Eutrophic* (BMI ≤ 24.99kg/m²). Overweight and obesity were grouped and called *Overweight* (BMI ≥ 25.00kg/m²).

The socioeconomic and demographic data used in this study were extracted from the 2008-2009 POF questionnaires: POF 1 - Questionnaire of Domicile and Residents Characteristics (used to investigate the domicile characteristics, relate its residents, and to investigate the characteristics of residents) and POF 5 - Questionnaire of Work and Individual Income (used to record work features; income and deductions with transfers; incomes and deductions on rent, use or exploitation of property and rents, royalties, patents, other income and deductions, and financial applications and withdrawals). Thus, independent variables such as age (20 to 59), sex (male and female); self-reported color (white, black, and brown), schooling (low: ≤ 5; intermediate: 6-9, high: ≥ 10), *per capita* income based on minimum wage (MW) at that time (R$ 415) (≤ 1/4(1) MW; 1/4 ≥ MW < 1/2; 1/2 ≥ MW < 1; 1 ≥ MW < 2; 2 ≥ MW < 5; ≥ 5 MW); domicile region (Northern, Northeastern, Southeastern, Southern, and Midwestern) were defined. Variable age was continuously used in this study, because it was decided to investigate the year-by-year trend of increasing or decreasing the overweight prevalence. The other skin color categories investigated by IBGE (yellow and Indian) were removed from the tables due to the low percentage of the adult population of Brazil included in these categories; however, they were maintained in association analyses.

Descriptive and inferential statistics was applied. Poisson regression analysis was used by means of robust estimation[15] with log link function to assess the association between independent variables and the outcome (overweight: BMI ≥ 25.00kg/m²), in which gross and adjusted prevalence ratio and confidence interval of 95% were estimated. All independent variables showing association with the outcome with $p<0.10$ in the crude analysis were considered for the multivariate analysis.

Data were processed and analyzed using the Statistical Package for the Social Sciences® 18.0 for Windows (SPSS Inc., Chicago, USA).

RESULTS

In the total sample, there was a 2.6% prevalence of underweight, 49.7% normal weight, 33.6% overweight and 14.1% obesity, which demonstrates overweight prevalence (BMI ≥ 25.00kg/m²) of 47.7% (Table 1).

In the unadjusted regression analysis, there were higher odds for overweight (BMI ≥ 25.00kg/m²) with increasing age, among males, black and white skin color, low schooling and low income, living in Midwestern, Southern and Southeastern Brazil (Table 2). The adjusted analyses for all demographic and socioeconomic variables identified that each year of life had a probability of about 2% for the individual to become overweight

(BMI ≥ 25.00kg/m²). In addition, males showed a 10% higher probability of being overweight (BMI ≥ 25.00kg/m²) than females; black and white adults had probability of about 3% and 5%, respectively, of excess weight greater than brown adults; individuals with low schooling level had 3% to 6% higher prevalence of being overweight (BMI ≥ 25.00kg/m²) than those with higher schooling; low-income adults showed approximately 20% higher likelihood of being overweight (BMI ≥ 25.00kg/m²) than higher-income adults, and Brazilians living in the southern region of the country had higher overweight (BMI ≥ 25.00kg/m²) prevalence than those living in Northern Brazil.

Table 1. Sample distribution in relation to socioeconomic and demographic characteristics according to Body Mass Index (BMI). Brazil, 2008-2009 (n = 101.308.637).

Variables	BMI				Total
	Eutrophic (BMI < 25.0 kg/m²)		Overweight (BMI ≥ 25.0 kg/m²)		
	n(%)		n(%)		
Sex					
Male	24766998	50.1	24624902	49.9	49391900
Female	28209767	54.3	23706970	45.7	51916737
Color-race					
White	25027210	50.2	24835306	49.8	49862516
Black	4431797	51.7	4146719	48.3	8578516
Brown	23517758	54.9	19349847	45.1	42867605
Schooling					
0 to 5 years	17014835	49.6	17305763	50.4	34320598
6 to 9 years	9860077	53.2	8670350	46.8	18530427
≥ 10 years	26101853	53.9	22355759	46.1	48457612
Income					
≤ 1/4(1)* MW	2995146	62.2	1818345	37.8	4813491
1/4 ≥ MW <1/2	7204321	59.3	4939498	40.7	12143819
1/2 ≥ MW < 1	13081247	55.0	10720805	45.0	23802052
1 ≥ MW < 2	14090940	50.2	13999998	49.8	28090937
2 ≥ MW < 5	11172271	48.1	12037453	51.9	23209724
≥ 5 MW	4432841	47.9	4815773	52.1	9248614
Region					
Midwestern	3974331	52.6	3582436	47.4	7556768
Southern	7139918	47.7	7833379	52.3	14973297
Southeastern	22645866	51.0	21749801	49.0	44395667
Northeastern	15254918	56.5	11722050	43.5	26976969
Northern	3961731	53.5	3444206	46.5	7405937
Age					
20 to 59 years**	35.01	11.04	39.79	10.74	37.29(11.16)
Total	52976765	(52.3)	48331872	(47.7)	101308637

*(1) Even without income; **Mean and standard deviation values for each BMI category are shown.

Table 2. Unadjusted and adjusted prevalence ratio (PR) for overweight (BMI ≥ 25 kg/m^2) according to socioeconomic and demographic characteristics. Brazil, 2008-2009.

Variables	Unadjusted PR (CI95%)	p	Adjusted PR* (CI95%)	p
Age	1.020 (1.020-1.020)	< 0.001	1.019 (1.019-1.019)	< 0.001
Sex				
Male	1.092 (1.091-1.092)	< 0.001	1.104 (1.103-1.104)	< 0.001
Female	1		1	
Color-race				
White	1.103 (1.103-1.104)	< 0.001	1.033 (1.033-1.034)	< 0.001
Black	1.071 (1.070-1.072)	< 0.001	1.055 (1.054-1.055)	< 0.001
Brown	1		1	
Schooling				
0 to 5 years	1.093 (1.092-1.093)	< 0.001	1.030 (1.030-1.031)	< 0.001
6 to 9 years	1.014 (1.014-1.015)	< 0.001	1.067 (1.067-1.068)	< 0.001
≥ 10 years	1		1	
Income				
≤ 1/4(1)** MW	1.378 (1.377-1.380)	< 0.001	1.241 (1.239-1.243)	< 0.001
1/4 ≥ MW <1/2	1.373 (1.371-1.375)	< 0.001	1.265 (1.264-1.267)	< 0.001
1/2 ≥ MW < 1	1.319 (1.318-1.321)	< 0.001	1.230 (1.228-1.231)	< 0.001
1 ≥ MW < 2	1.192 (1.191-1.194)	< 0.001	1.142 (1.141-1.143)	< 0.001
2 ≥ MW < 5	1.077 (1.075-1.078)	< 0.001	1.057 (1.055-1.058)	< 0.001
≥ 5 MW	1		1	
Region				
Midwestern	1.019 (1.018-1.020)	< 0.001	0.963 (0.961-0.964)	< 0.001
Southern	1.125 (1.124-1.126)	< 0.001	1.013 (1.012-1.014)	< 0.001
Southeastern	1.053 (1.053-1.054)	< 0.001	0.959 (0.958-1.960)	< 0.001
Northeastern	0.934 (0.934-0.935)	< 0.001	0.934 (0.933-0.934)	< 0.001
Northern	1		1	

CI95%: confidence interval 95%; PR: Prevalence Ratio; *Poisson regression analysis adjusted for all independent variables; **(1) Even without income.

DISCUSSION

The main finding of this study was that overweight (BMI ≥ 25.00kg/m^2) affected 47.7% (33.6% overweight and 14.1% obese) of the Brazilian adult population and was more prevalent with advancing age, being male, in black-white adults and with low schooling and low income, and residents in southern Brazil. This study is characterized by using data from the latest Brazilian survey with representative sample of adults from all geographic regions of the country. This allowed us identifying the Brazilian population in terms of excess weight and which population subgroups have been most affected by this outcome.

This study showed a trend of increasing overweight prevalence with increasing age, indicating that each year lived represented a probability around 2% for the individual to become overweight (BMI ≥ 25.00kg/m^2). This phenomenon has been observed both when overweight is measured by BMI[16], as when measured by anthropometric indicators[17,18]. Possible

explanation for this finding is related to the common process of aging that affects physiological aspects associated with the accumulation of body fat, such as reduced metabolism and hormonal changes that may contribute to increased adiposity levels[19]. However, aging itself does not justify the increase in overweight. Other factors that were not investigated in this study, such as inadequate lifestyle (sedentary lifestyle, poor eating habits, stress) may increase the magnitude with which increasing age is associated with overweight / obesity[20].

Males were more likely to become overweight than females. Similar results were observed in other studies[4,5,16]. The literature emphasizes that males are more vulnerable to modifiable health risk factors compared to females, such as alcohol use, smoking and poor eating habits[20]. This is alarming when considering the lower use of health services by males, especially for health prevention, and the increased morbidity and mortality rates caused by cardiovascular diseases when compared with females[21].

Black and white Brazilian adults had a higher overweight prevalence than brown adults. Brazil is an interbred country, which features various ethnic racial characteristics. Color-race can be considered a feature that reflects the socioeconomic conditions in low- and middle-income countries[22]. Given that black subject (poorest part of the Brazilian population) had higher odds of being overweight, it could be inferred that such individuals are impacted from health inequities and require macro-structural modifications to change this overweight scenario[23]. For white skin color individuals, one possible explanation for the high overweight prevalence compared to those of brown skin color may be the socioeconomic status, since in Brazil, white skin color individuals compose the population with more financial resources in different geographical regions[23].

Inverse association between schooling and excess weight was observed after adjustment for other demographic and socioeconomic variables. This characteristic was shown in systematic reviews of studies on obesity and socioeconomic status in adults[12,13]. Schooling is considered a proxy of people's socioeconomic status and is constantly reported in studies on health inequities[20,23]. Socioeconomic conditions are considered distal causes of diseases; therefore, the socioeconomic status is an important determinant of the health status of populations[13].

As occurred for education, low-income individuals had higher overweight prevalence compared to those of higher income. Previous studies also showed this condition[12,13]. One of these studies analyzed data related to adults from different continents around the world and reported that low-income people and those with low socioeconomic status have worse access to health services for the diagnosis and treatment of chronic diseases such as obesity, when compared to individuals of higher income and higher socioeconomic status[24]. In Brazil, low-income individuals often face barriers in health care services, including inability to afford health care services provided by the private sector, lack of money to purchase drugs and lack of transportation to move to health services. Moreover, they can

still be affected by the lack of access to media, being unaware of the services that may be disclosed in the media[25]. Thus, campaigns of prevention and treatment of obesity and greater social justice in terms of access to education, employment and health services can help low-income people to fight and prevent obesity.

Adults living in southeastern Brazil were more likely to be overweight than those living in northern Brazil. One of the possible explanations for this finding may be the cultural characteristics of each region. Brazil's government considers the Southern regions of Brazil as the most developed in the country, while the northern region is the less socially and economically developed[26]. Economic development has been associated with some features considered obesogenic, such as sedentary activities (i.e. watching TV, using the computer, playing video games etc..), eating habits (high consumption of processed foods), insufficient practice of activity physical and stress[27].

One limitation of this study was the use of secondary data, which are susceptible to information record problems. However, the team of data collection and recording of information was trained by specialized technicians to decrease chances of such errors. Furthermore, the cross-sectional design of the study does not allow establishing a cause and effect relationship between independent and dependent variables. Longitudinal studies are relevant because they estimate useful measures for assessing the significance of the disease in the community and are valuable for the planning of health services[28].

CONCLUSION

It was concluded that overweight (BMI ≥ 25.00kg/m²) affects almost half of the adult Brazilian population, being more pronounced with increasing age, black and white individuals, those with low education level and low income and those living in southern Brazil. Such findings are worrisome because the overweight prevalence (BMI ≥ 25.00kg/m²) is increasing compared to previous surveys. Thus, changes in the macro-structure of the Brazilian society, for example, better income distribution, educational opportunity to the entire population and access to health information for all social classes can reduce the overweight prevalence and the impact of this disease on the Brazilian health system.

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