

Body Mass Index and Hypertension in Adult Subjects in Brazil's Midwest

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Abstract

Background: Overweight and obesity are an important public health problem in society, due to the growth in all age groups and their association with various chronic diseases, especially hypertension

Objective: To investigate possible factors associated with changes in body mass index (BMI).

Methods: Study developed in the city of Nova Andradina, State of Mato Grosso do Sul, with 369 subjects registered in the Family Health Strategy Program in 2007. Data were collected at the subjects' homes, by using a semi-structured interview and by an anthropometric assessment. In the analysis of data, we used the Chi-square and Mantel Haenszel tests, for categorical responses, and ANOVA and Tukey tests, for continuous responses

Results: The prevalence of overweight and obesity was 33.3% and 23.0%, respectively. Most of the individuals had the following characteristics: they were female (85.4%), physically inactive (89.7%), their waist-hip ratio (WHR) was inadequate (83.7%) and they had some chronic health problem (31.9%), especially hypertension. Risk factors for overweight and obesity may be linked to variables such as widowed status, inadequate WHR, lower income and health problems. On the other hand, high blood pressure may be linked only to obesity.

Conclusion: The percentage of people that were overweight and those who did not do exercises in Nova Andradina indicates that these issues are also an important challenge for the health sector in smaller cities. Therefore, it is urgent that multidisciplinary intervention programs be implemented in primary health care. (Arq Bras Cardiol 2011; 96(1): 47-53)

Keywords: Body mass index; hypertension; adults; MGS, Brazil.

Introduction

Overweight and obesity are major public health problems in society, because, besides being linked to a number of chronic-degenerative diseases, their gradual increase occurs continuously from childhood to adulthood, which may be an epidemic process.

In recent years, the control of obesity has been a major challenge for researchers and health professionals. Despite awareness raising campaigns for prevention and control, the number of overweight Brazilians (BMI \geq 25) and obese Brazilians (BMI \geq 30) has increased significantly. It is estimated that, in Brazil, 38.8 million people aged 20 years or older are overweight. This number corresponds to 40.6% of the population in this age group, 10.5 million of whom are obese¹.

This is worrisome because studies indicate that many modern diseases – cardiovascular diseases, renal diseases,

digestive diseases, diabetes, hepatic and orthopedic problems – are associated with excess body fat. The incidence of such diseases is two times higher among obese men and four times higher among obese women, compared to the non-obese population².

Overweight and obesity, associated with low level of education and insertion in the black race, are the factors linked to hypertension frequently found in Brazilian studies³. Hypertension, in turn, is one of the most important causes of morbidity/mortality and a predominant risk factor for development of cardiovascular disease⁴. Hypertension is even the leading cause of early cardiovascular mortality worldwide, especially due to cerebral vascular accident (CVA)⁵.

Some information that is relevant to know about obesity is the location of body fat deposits, since the excessive concentration in the waist area (central or android obesity) is linked to several metabolic disorders and increased risk of morbidity and mortality, resulting from atherosclerotic disease and its consequences, such as coronary artery disease^{6,7}.

The aim of this study was to investigate the prevalence of overweight, obesity and possible health-associated factors in subjects listed in the Family Health Program in the city of Nova Andradina, State of Mato Grosso do Sul, Brazil.

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Methods

This is an observational and cross-sectional study and it was carried out in the city of Nova *Andradina*, which has a total population of 38,847 inhabitants and it is located in the southeast of *Mato Grosso do Sul* State.

With respect to health facilities, the previously mentioned municipality has four hospitals, two of which are public and two that are private. The municipality has six basic healthcare units (BHU), which have a family health team (FHT) and which serve 72.1% of the urban population. Among the subjects registered in the FHS, 73.4% are between 15 and 59 years-old, 16.9% are between one and 14 years-old, 8.3% are over 60 years-old, and 1.4% consists of children that are less than one year of age. This distribution corresponds to that found in the city in general⁸, which reinforces its representativeness.

The calculation of the size of the sample to be studied was based on the total number of individuals over 15 years of age registered in the FHS (this is the age range that could be retrieved from the data base), with an estimation error of 5% and 95% of confidence interval, plus 20% for possible losses. A proportional stratification was used to define the number of individuals from each team that should be included in the study. After that, the teams were asked to provide a list of all registered families, to be randomly selected in each team.

Three hundred and sixty-nine (369) families were randomly selected. Among such families, only one individual was interviewed. When there was more than one resident that met the inclusion criteria – to be 18 years of age or older and to be physically and mentally fit to answer the questionnaire –, a simple drawing of lots was carried out. If there were no individuals that met the inclusion criteria at the time of the visit, up to four return visits were paid to the residence. After that, if there were still no individuals that met the criteria, the randomly selected family was replaced. The questionnaire with open and closed questions was based on the purposes of the study and it was subsequently pre-tested with eight subjects. This questionnaire was evaluated for clarity by five health professionals, who were professors at a higher education institution.

The data were collected at the subjects' houses by using a semi-structured interview and by measuring weight, height and hip and waist circumference, according to the specific recommendations for each case.

The response or endpoint variable was the classification of BMI. The cutoff points proposed by the World Health Organization (WHO) were used as criterion for diagnosing the nutritional status. Individuals with BMI < 25 were classified as normal/normal weight; those who had BMI between 25.0 and 29.9 were categorized as overweight; and those with BMI ≥ 30.0 were classified as obese⁹. The independent variables were: sex (dichotomous), age (in completed years), marital status (married, single, divorced and widowed), level of education (illiterate, incomplete and complete primary school degree; incomplete and complete high school degree; and higher education degree), physical activity (dichotomous), chronic health problem (dichotomous), types of health problem and waist-hip ratio - WHR (appropriate or inappropriate) obtained by dividing the waist (cm) and hip

(cm) perimeters. The cut-off points established to differentiate the appropriate values from the inappropriate values of WHR were 0.8 for females and 1.0 for males.

In the analysis of data, we used the Chi-square and Mantel Haenszel tests, for categorical responses, and ANOVA and Tukey tests, for continuous responses.

The development of the study followed the ethical guidelines governed by Resolution No. 196/96 of the National Health Council, and the project was approved by the Standing Committee on Ethics in Research with humans, in the State University of *Maringá* (Opinion No. 356/2006). All participants signed a free and informed consent form in duplicate.

Results

Most of the individuals studied were female and (85.4%) were between 18 and 89 years of age. Among men, the mean age was 45.3 years and, among women, the mean age was 40.7 years. Most subjects did not do physical activities (89%) and had inadequate WHR (84%). The prevalence of overweight and obesity was 33.3% and 23.0%, respectively. The prevalence of chronic health problem was 32%, with highest incidence of hypertension. The Tukey's multiple comparison test showed that the average income of overweight subjects was lower than the income of normal subjects.

The presence of hypertension increases with age and with weight gain. A univariate analysis revealed a significant relationship between presence of hypertension and the variables age and nutritional status (Table 1).

With respect to the univariate analysis, it is possible to observe, in Table 2, that the "gender", "level of education" and "physical activity" variables are not significantly associated with BMI. However, the variables "marital status", "WHR", "health problem" and "type of health problem" may be associated with BMI. With respect to the variables that were not associated with BMI, some aspects are relevant: with respect to sex, less than half of the women (41.9%) are at normal weight, while this rate is of 53.7% for men. It is worth highlighting that only 35% of the individuals aged between 40 and 59 years are at normal weight, and that the proportion of physically active individuals and physically inactive individuals whose weight is normal is similar (42.1 and 43, 8%, respectively).

Table 3 shows that the widowed status is a risk factor for overweight, since the Mantel-Haenszel odds ratio was 2.35 times higher. In the evaluation of the widowed category, compared to the married and divorced categories, there was no association. However, the widowed individuals were 5.29 times more likely to be overweight than the single individuals. Individuals with inadequate WHR and health problems have, respectively, 2.50 and 1.74 times more chance of being overweight. Hypertension was not associated with overweight.

Table 4 shows that the widowed status is a risk factor for obesity, because the Mantel-Haenszel odds ratio was 5.02 times higher. When we assess the widowed category, in comparison with the divorced category, there is no significant association. However, widowed individuals, in comparison with married and single individuals, have 2.09 and 3.83 times more chance of being obese, respectively. Individuals with inadequate WHR and

health problems have, respectively, 3.21 and 2.50 times more chances of being obese. Hypertension is a factor associated with obesity, i.e., individuals with hypertension are 3.62 (odds ratio) times more likely to be obese.

Discussion

Several studies indicate an increase in overweight and obesity in different regions of Brazil^{10,11}, as well as high prevalence of individuals classified as sedentary¹²⁻¹⁴, which is not different from what was found in this study.

Cross-sectional epidemiological studies show that there is a trend towards an increase in overweight and obesity in Brazilian adults of both sexes, but it is possible to note stability in the prevalence of obesity among women with medium and high level of education, and among those women whose economic conditions are better¹⁵.

Data from the Household Budget Survey (POF 2002-2003)¹ indicate prevalence of 40.6% of overweight in adults, with 8.9% of men and 13.1% of women that were obese. In southern Brazil, in the city of Pelotas, State of Rio Grande do Sul, a study identified the prevalence of 53.1% of overweight, comprising 33.7% of overweight and 19.4% of obesity¹⁶.

Physical activity, in turn, has been highlighted as a factor of primary prevention, a therapeutic support for various chronic diseases¹⁷, and there is enough evidence to consider that the effect of aerobic physical activity on the prevention and control of obesity is positive¹⁸. However, in this study, no relationship was observed between physical activity and BMI. Maybe, the large number of sedentary individuals has impaired the identification of factors that could explain such fact more clearly.

A study conducted in the city of Pelotas showed that two thirds of the female population was sedentary. The incidence of this situation was about 1.5 times higher among women in the lowest income stratum (0-3 salaries), and almost two times higher among illiterate women, compared to women with 12 or more years of study¹⁹.

The age of the subjects under study was not significantly associated with overweight and obesity. A factor which may have interfered in this matter was the small variation in mean age (between 40 and 44 years, i.e., very close to each other). The literature shows that the increase in age may be a relevant factor in the development of obesity²⁰. In general, this occurs because excess weight is determined by a decrease in basal metabolism and, also, due to the natural loss of muscle mass, which occurs as the person gets older²¹. A study conducted with individuals aged 18 to 59 years, in the city of São Paulo, for example, noted a trend towards an increase in obesity with age in both sexes, although it did not point out any significant differences between the sexes²².

The "marital status" variable was significantly associated with overweight and obesity, but the widowed status corresponded to 2.35 times higher odds of overweight and five times higher odds of obesity, when compared to the "single" category. This fact leads to the conclusion that age was a confounding variable for the "BMI/widowed status" relationship, because, in general, the person is widowed at an older age and in fact, the average age of widowed individuals was higher - 61 years-old.

Among studies that investigated the issue, there is no consensus on the direction of the association between marital status and the issue of overweight and obesity. However, a study conducted in the city of Belo Horizonte found no relationship between overweight and age, and marital status (to have a partner), in both sexes; between obesity and age, and marital status (to have a partner), in males; it only found the association with age among women²⁰.

In this study, no association was found between BMI distribution and the level of education. This finding differs from other studies, which show prevalence of overweight and obesity in individuals with low level of education^{23,24}.

In Brazil, national surveys showed a substantial change in the centennial trend of obesity, according to the population's educational levels. Initially, the prevalence of

Table 1 - Univariate analysis for factors associated with the presence of hypertension in individuals registered in the Family Health Program, city of Nova Andradina, State of Mato Grosso do Sul, 2007

Variables	Hypertensive		Non- hypertensive		Total		p
	N	%	N	%	N	%	
Age group							0,00000
Up to 39 years of age	22	6.0	166	45.0	188	51.0	
40 – 59 years of age	36	9.8	95	25.7	131	35.5	
60 and over	22	5.9	28	7.6	50	13.5	
Total	80	21.7	289	78.3	369		
Nutritional status							0.0017
Normal	31	8.4	130	35.2	161	43.9	
Overweight	28	7.6	95	25.7	123	33.3	
Obesity	21	5.7	64	17.3	85	22.8	
Total	80	21.7	289	78.32	369		

[†]Chi-square test (Person)

Table 2 - Univariate analysis for factors associated with overweight and obesity of individuals registered in Family Health Program, city of Nova Andradina, State of Mato Grosso do Sul, 2007

Variable	Normal		Overweight		Obesity		P†
	BMI < 25kg/m ²		BMI ≥ 25kg/m ²		BMI ≥ 30kg/m ²		
	n	%	n	%	n	%	
Sex							0.2589
Female	132	35.8	109	29.5	74	20.0	
Male	29	7.9	14	3.8	11	3.0	
Marital status							0.0508
Married	103	27.9	90	24.4	57	15.4	
Single	34	9.2	9	2.4	14	3.8	
Divorced	14	3.8	10	2.7	5	1.4	
Widowed	10	2.7	14	3.8	9	2.4	
Age							0.1748
18-39	93	25.2	59	16.0	36	9.8	
40-59	47	12.7	45	12.2	39	10.6	
60 or more	21	5.7	19	5.1	10	2.7	
Level of Education							0.1619
Illiterate	12	3.3	11	3.0	9	2.43	
Incomplete primary and middle school degree	90	24.4	73	19.8	53	14.4	
Complete primary and middle school degree	6	1.6	12	3.3	2	0.5	
Incomplete high school degree	13	3.5	10	2.7	3	0.8	
Complete high school degree	27	7.3	13	3.5	13	3.5	
Higher Education degree	13	3.5	4	1.1	5	1.4	
Physical Activity							0.6345
Yes	16	4.3	11	3.0	11	3.0	
No	145	39.3	112	30.4	74	20.1	
WHR*							0.0113
Adequate	36	9.8	17	4.6	7	1.9	
Inadequate	125	33.9	106	28.7	78	21.1	
Health problem							0.0118
Yes	37	10.0	37	10.0	35	9.5	
No	124	33.6	86	23.3	50	13.6	
Type of health problem							0.0073
None	124	33.6	86	23.3	50	13.6	
Hypertension	31	8.4	28	7.6	21	5.7	
Others	6	1.6	9	2.4	14	3.8	

* Waist-hip ratio; † Chi-square test (Person).

obesity was high in general, with a trend towards higher incidence among men and women with a high level of education. In the period between 1989 and 1997, the increase in obesity was higher for uneducated individuals or individuals with a low level of education. Obesity was stable or it had decreased in the strata of women with a

medium or high level of education¹⁵, due, for example, to greater knowledge about the consequences of obesity for the health and because they knew how to prevent it. In addition, this group is under pressure from family and society to keep a thin body image, compatible with current aesthetic values¹⁷.

Table 3 - Univariate analysis for factors associated with overweight in individuals registered in the Family Health Program of the city of Nova Andradina, State of Mato Grosso do Sul, 2007

Variables	OR	OR CI	P*
Marital status	2.35*		0. 01125
Widowed	1		
Married	1.60	0.63; 4.11	
Single	5.29	1.56; 18.52	
Divorced	1.96	0.54; 7.29	
WHR			0. 00621
Adequate	1		
Inadequate	2.50	1.27; 4.94	
Health problem			0. 0495
Yes	1		
No	1.74	1.00; 3.02	
Type of health problem	1.79		0. 0548
Hypertension (HA)	1		
None	1.76	0.91; 3.40	
Others	1.89	0.62; 5.83	

*Chi-square test (Mantel Haenscel).

The association found between the average income of individuals and BMI is explainable. The recent phenomenon observed in several countries results from the influence of social differences on the prevalence of obesity²⁵. In developed countries, groups with lower income and lower level of education are more at risk of being overweight²⁶. It has also been identified that poorer families tend to have high-calorie diets, because they are cheaper²⁴. The fact that this type of diet favors weight gain needs to be discussed among the population, in order to sensitize such population to the importance of using alternative practices in the preparation of meals. The purpose is to lower the costs of the diet and, at the same time, to make it more nutritious and less harmful to health.

Brazilian data show significant differences between men and women regarding the relationship between income and overweight. Among men, the incidence of overweight increases uniformly and intensely as the income increases. Among women, this relationship is less intense and it tends to be curvy, with higher prevalence of overweight in intermediate income classes²⁷.

Overweight and obese individuals, compared to individuals considered to be normal, were more likely to have health problems. The presence of hypertension alone or associated with other pathologies - like diabetes, cholesterol and depression - showed 3.3 times more chances of risk in obese individuals. However, in overweight individuals, hypertension was not a risk factor.

The association between hypertension and obesity has been confirmed in studies conducted in different regions of

Table 4 - Univariate analysis for factors associated with obesity in individuals registered in the Family Health Program, in the city of Nova Andradina, State of Mato Grosso do Sul, 2007

Variables	OR	OR CI	P*
Marital status	5. 02*		0. 0001
Widowed	1		
Married	12.09	24.78; 31.30	
Single	3.83	1.44; 10.37	
Divorced	2.22	0.72; 6.96	
WHR			0. 00954
Adequate	1		
Inadequate	3.21	1.29; 8.37	
Health problem			0. 0021
Yes	1		
No	2.5	1.37; 4.55	
Type of health problem	3.62		0. 0001
Hypertension (HA)	1		
None	3.34	1.70; 6.60	
Others	4.72	1.22; 19.75	

*Chi-square test and OR (Mantel Haenscel).

the country²⁸⁻³². Worldwide, epidemiological studies have shown that the prevalence of hypertension is much higher among overweight individuals than among those individuals whose weight is normal²¹.

A study conducted in the city of *Fortaleza*, for example, showed that the risk of hypertension was equal to 2.04 and 4.08 for overweight and obesity, respectively, regardless of gender³³. In the city of *Belém do Pará*, data from a telephone survey revealed an association of age and overweight with hypertension in both sexes, in which the risk of hypertension is equal to 1.80 in men and 2.49 in women in pre-obesity, and 6.33 and 3.33 for men and women, respectively, in obesity³⁴.

Thus, weight control is an important measure for reducing the rates of hypertension and, consequently, for promoting the health and for preventing other cardiovascular diseases.

The BMI and WHR variables also showed an association. Compared to the normal subjects classified as baseline, the analysis showed that a person that is overweight is two times more likely to have inadequate WHR, and obese people are three times more likely. A population-based study conducted in the city of Pelotas noted that older white men, living with a partner and with high household income, had larger mean waist circumference. The same happened with older women, who had been pregnant four or more times, lived with a partner and had a low level of educational¹⁹.

With regard to the elderly, a follow-up study conducted over a period of five years with women found that central obesity, represented by the increase in WHR, was a predictor of total mortality in such group³⁵. In another study with the elderly conducted in the city of *Zona da Mata, in Minas*

Geraiis, it was found that the increase in BMI was strongly associated with WHR, because in elderly patients with BMI > 27 kg/m², the incidence of inadequate WHR was higher. It was also noted that inadequate WHR and BMI were positively associated with high incidence of morbidity, and that the risk of abdominal obesity increases with age and it is higher among women³⁶.

Despite some methodological limitations, such as the fact that the study participants were selected among those that were present in the house, which resulted in a sample consisting basically of women, it can be stated that the rate of people that are overweight and those who do not do physical activity in Nova Andradina is high, and it is not much different from what was found in other places in Brazil. Therefore, these issues are a challenge for the health sector also in small towns and in the country's Midwest region.

The adoption of intervention measures for reducing the prevalence of overweight and obesity is quite complex, because these problems are determined by multiple factors. However, the results found indicate that it is imperative to be concerned about such issue, and to get managers and different segments of society to make a joint effort to meet the need for measures to control and combat the rates of obesity and overweight in the city.

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Conclusions

Marital status, income and inadequate WHR acted as risk factors associated with overweight and obesity. Having hypertension alone or together with other pathologies represented 3.3 more chances of risk in obese individuals, but not in overweight individuals.

The implementation of multidisciplinary programs within the Family Health Program, which involves monitoring the individual and collective health status, as well as the stimulus to the adoption of healthier lifestyle habits, such as regular physical activity and change in eating habits, may be an effective measure to reduce risks to health in Nova Andradina's population.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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