DIFFERENT CLASSIFICATIONS OF BODY MASS INDEX AND PREVALENCE OF CARDIOVASCULAR DISEASES IN AN ELDERLY POPULATION IN SOUTHERN BRAZIL

DIFERENTES CLASSIFICAÇÕES DE ÍNDICE DE MASSA CORPORAL E PREVALÊNCIA DE DOENÇAS CARDIOVASCULARES EM UMA POPULAÇÃO DE IDOSAS DO SUL DO BRASIL

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ABSTRACT

The Body Mass Index (BMI) is used to assist in the diagnosis of nutritional status, being associated with classic cardiovascular risk factors, such as, for example, Systemic Arterial Hypertension (SAH), *Diabetes Mellittus* (DM), dyslipidemia and also correlated with general and cardiovascular mortality. However, different BMI classifications are recommended for the elderly, with different cutoff points suggested by the World Health Organization (WHO), Pan American Health Organization (PAHO) and Lipschitz. Therefore, this study aimed to verify the prevalence of classic cardiovascular risk factors in elderly women according to three different BMI classifications (WHO, PAHO and Lipschtiz). This is a cross-sectional study, which evaluated elderly women aged ≥60 years, living in the South of Brazil. Socio-demographic data (age, education and occupation) and the prevalence of classic cardiovascular risk factors (SAH, dyslipidemia, DM and obesity) were collected using a standardized questionnaire. For anthropometric assessment, weight, height and BMI were calculated. 288 elderly women participated in the study, with an average of 67.61±5.78 years old. Elderly women had a high prevalence of excess weight, corresponding to 50%, 68,40% and 44,44% for BMI references according to Lipschitz, WHO and PAHO, respectively. Regarding the cardiovascular risk factors evaluated, the most prevalent ones found were systemic arterial hypertension (63.2%), dyslipidemia (37.2%) and diabetes mellitus (16%). BMI classified by WHO and PAHO were associated with hypertension and DM. The Lipschitz classification was significant only for DM.

Keywords: Chronic, body mass index, elderly person, hipertension, diabetes.

RESUMO

O Índice de Massa Corporal (IMC) é utilizado para auxiliar no diagnóstico do estado nutricional, estando associado aos fatores de risco cardiovascular clássicos, como, por exemplo, à Hipertensão Arterial Sistêmica (HAS), ao Diabetes Melittus (DM), à dislipidemia e também correlacionado à mortalidade geral e cardiovascular. Entretanto, diferentes classificações de IMC são recomendadas para os idosos, sendo os pontos de corte distintos sugeridos pela Organização Mundial da Saúde (OMS), Organização Pan-Americana de Saúde (OPAS) e por Lipschitz. Desta forma, este estudo teve por objetivo verificar a prevalência de fatores de risco cardiovasculares clássicos em idosas de acordo com três diferentes classificações do IMC (OMS,

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OPAS e Lipschtiz). Trata-se de um estudo transversal, que avaliou idosas com ≥60 anos de idade, residentes no Sul do Brasil. Dados sócios demográficos (idade, escolaridade e ocupação) e a prevalência de fatores de risco cardiovasculares clássicos (HAS, dislipidemia, DM e obesidade) foram coletadas com auxílio de um questionário padronizado. Para avaliação antropométrica foram utilizados: peso, estatura e calculado o IMC. Participaram do estudo 288 idosas, com média de 67,61±5,78 anos. As idosas apresentaram elevada prevalência de excesso de peso correspondendo a 50%, 68,40% e 44,44% para as referências de IMC de acordo com Lipschitz, OMS e OPAS, respectivamente. Em relação aos fatores de risco cardiovasculares avaliados, as mais prevalentes encontradas foram à hipertensão arterial sistêmica (63,2%), a dislipidemia (37,2%) e o diabetes mellitus (16%). O IMC classificado pela OMS e OPAS foram associados à HAS e DM. A classificação de Lipschitz apresentou significância apenas para DM.

Palavras-chave: *Crônico, índice de massa corpórea, pessoa idosa, hipertensão, diabetes.*

INTRODUCTION

In the elderly, the analysis of body composition becomes increasingly important, as, with aging, body changes occur that can interfere with the nutritional status of this population. Some changes in body composition are observed during the aging process, such as an increase in fat mass and a decrease in lean mass (KONIECZNA *et al.*, 2019).

The Body Mass Index (BMI) is used to assess whether an individual's weight is adequate or not according to their height, therefore it is calculated based on height and body mass [BMI=weight (kg)/height² (m²)] (OLIVEIRA and CALDEIRA, 2016). This index has been recommended to diagnose excess body fat and obesity, which are important risk factors for the development of Chronic Non-Communicable Diseases (NCDs) such as Systemic Arterial Hypertension (SAH), dyslipidemia, Diabetes Mellitus (DM) type 2, osteoarthritis, some types of cancer and Cardiovascular Diseases (CVD) (LARANJEIRA; DUARTE; ALVES, 2019).

However, the BMI categorization recommended for the elderly population is different. The BMI values suggested for diagnosing overweight and obesity are different from those recommended by the World Health Organization (WHO), (WORLD HEALTH ORGANIZATION, 2000); by the Pan American Health Organization (PAHO), (PAN AMERICAN HEALTH ORGANIZATION. PAHO, 2016); and by Lispchtz, the latter being the BMI classification suggested for the elderly by the Brazilian Ministry of Health. (MINISTRY OF HEALTH, 2023). Therefore, the objective of this study was to evaluate, in elderly people from the interior of southern Brazil, the prevalence of classic cardiovascular risk factors according to three BMI classifications.

MATERIAL AND METHODS

This is a cross-sectional study, which evaluated a sample of 288 elderly patients aged ≥ 60 years, living in the South of Brazil and who were undergoing Bone Densitometry using Dual

Emission X-ray Absorptiometry (DXA) , in a clinic specialized in diagnostic imaging in Palmeira das Missões (RS), between June 2016 and April 2017.

This study was part of a larger project, which was approved by the Research Ethics Committee (CEP) of the Federal University of Santa Maria (UFSM). The elderly women who agreed to carry out the study signed an informed consent form (MAZOCCO *et al.*, 2020). Sociodemographic data (age, education and occupation) prevalence of chronic diseases related to cardiovascular health (hypertension, dyslipidemia, diabetes mellitus and obesity) were assessed with the aid of a standardized questionnaire, applied by the interviewer.

For anthropometric assessment, the indices used were: weight, height and BMI. The elderly women were evaluated wearing only a hospital gown, barefoot and measured on a calibrated Welmy scale (110 CH). Height was measured using the stadiometer on the scale, with participants standing, arms and head aligned at their sides, heels together and the occipital and gluteal regions touching the vertical ruler of the scale. BMI was calculated using the Quetelét equation (QUÉTELET, 1870), dividing weight (kg) by height squared (m2). To classify BMI, the WHO references were used (WORLD HEALTH ORGANIZATION, 2000): Underweight: $\leq$ 18.5 kg/m2, Normal weight: 18.5-24.9 kg/m2, Overweight: 25- 29.9 kg/m2 and Obesity: $\geq$ 30 kg/m2; Lipschitz (LIPSCHITZ, 1994): Underweight: < 22 kg/m2, Eutrophic: 22-27 kg/m2 and Overweight: > 27 kg/m2; OPAS (ORGANIZACIÓN PANAMERICANA DE LA SALUD, 2002): Underweight: < 23 kg/m2, Normal weight: 23-28 kg/m2, Overweight: $\geq$ 28 - < 30 kg/m2 and Obesity: $\geq$ 30 kg/m2.

The collected data were entered into an Excel spreadsheet and sent to the SPSS version 25 program for statistical analysis. Quantitative variables were described by mean and standard deviation and categorical variables by frequencies and percentages. The T test was used to evaluate the association between quantitative variables. For categorical data, the Chi-square test was used. A significance level of 5% was considered.

RESULTS

The sample evaluated 288 elderly women, with a mean age of 67.61 $\pm$ 5.78 years, with a minimum age of 60 and a maximum of 88 years.

Table 1 presents the sociodemographic and cardiovascular health characteristics of the elderly women in the sample. Regarding marital status, most elderly women were married (60.1%) and had between four and eight years of education (44.1%). The most prevalent chronic cardiovascular diseases evaluated were hypertension (63.2%), dyslipidemia (37.2%) and DM (16%).

Table 1 - Sociodemographic and cardiovascular health characteristics of the 288 elderly women in the sample.

Variables	N	%
Marital Status		
Married	173	60,1
Single	17	5,9
Separated	98	34
Education		
<4 years of study	104	36,1
4 to 8 years of study	127	44,1
>8 years of study	57	19,8
Systemic Arterial Hypertension		
No	106	36,8
Yes	182	63,2
Dyslipidemia		
No	181	62,8
Yes	107	37,2
Diabetes Mellitus		
No	242	84
Yes	46	16

Table 2 presents the association between the BMI classified by the WHO and the prevalence of cardiovascular pathologies evaluated in the sample. It was found that this BMI classification was significantly associated with hypertension (p = 0.015) and DM (p = 0.000).

Table 2 - Association between Body Mass Index (BMI), classified according to the World Health Organization (WHO), and the prevalence of cardiovascular pathologies (Palmeira das Missões, 2016-2017).

Pathologies	Pathologies Body Mass Index (WHO)				P*
	Thinness (n = 3) n (%)	Eutrophy (n = 88) n (%)	Overweight (n = 111) n (%)	Obesity (n = 86) n (%)	
Hipertension					0,015
No	1 (0,9)	39 (36,8)	44 (41,5)	22 (20,8)	
Yes	2 (1,1)	49 (26,9)	67 (36,8)	64 (35,2)	
Dyslipidemia					0,227
No	3 (1,7)	57 (31,5)	71 (39,2)	50 (27,6)	
Yes	0 (0)	31 (29)	40 (37,4)	36 (33,6)	
Diabetes					0,000
No	3 (1,2)	81 (33,5)	96 (39,7)	62 (25,6)	
Yes	0 (0)	7 (15,2)	15 (36,6)	24 (52,2)	

BMI, classified by Lipschitz, was only associated with DM (p=0.003) (Table 3).

Table 3 - Association between Body Mass Index (BMI), classified according to Lipschitz,
and the prevalence of cardiovascular pathologies (Palmeira das Missões, 2016-2017).

Pathologies	Body mass index (Lipschitz)			P*
	Thinness (n = 37) n (%)	Eutrophy (n = 107) n (%)	Overweight (n = 144) n (%)	
Hipertension				0,071
No	17 (16)	43 (40,6)	46 (43,4)	
Yes	20 (11)	64 (35,2)	98 (53,8)	
Dyslipidemia				0,278
No	24 (13,3)	72 (39,8)	85 (47)	
Yes	13 (12,1)	35 (32,7)	59 (55,1)	
Diabetes				0,003
No	35,2 (14,5)	95 (39,3)	112 (46,3)	
Yes	2 (4,3)	12 (26,1)	32 (69,6)	

And in relation to BMI classified according to PAHO, a significant association was found between the pathologies of hypertension (p = 0.030) and DM (p = 0.000) (Table 4).

Table 4 - Association between the Body Mass Index (BMI), classified by the Pan American Health Organization
(PAHO), and the prevalence of cardiovascular pathologies in the elderly women in the sample
(Palmeira das Missões, 2016-2017).

Pathologies	Body Mass Index (BMI)				P*
	Thinness (n = 57) n (%)	Eutrophy (n = 103) n (%)	Overweight (n = 42) n (%)	Obesity (n = 86) n (%)	
Hipertension					0,030
No	24 (22,6)	42 (39,6)	18 (17)	22 (20,8)	
Yes	33 (18,1)	61 (33,5)	24 (13,2)	64 (35,2)	
Dyslipidemia					0,291
No	36 (19,9)	70 (38,7)	25 (13,8)	50 (27,6)	
Yes	21 (19,6)	33 (30,8)	17 (15,9)	36 (33,6)	
Diabetes					0,000
No	54 (22,3)	89 (36,8)	37 (15,3)	62 (25,6)	
Yes	3 (6,5)	14 (30,4)	5 (10,9)	24 (52,2)	

DISCUSSION

This study evaluated the classification of three different BMI classifications (WHO, Lipschitz and OPAS) and their association with classic cardiovascular risk factors in a sample of elderly women. It was also found that BMI, classified by the WHO and PAHO, were significantly associated with hypertension and DM, while the classification by Lipschitz only showed significance for DM.

The fact that the sample was composed only of women may reflect their interest in health care. This evidence corroborates the literature that identifies a greater female demand in the use of health services (PIMENTEL *et al.*, 2011). According to the Brazilian Institute of Geography and Statistics

(IBGE), women live on average seven years longer than men, a fact that may justify the greater number of women in studies carried out with elderly people (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2020).

Regarding the age range of the studied group, there was a greater frequency of elderly women aged between 60 and 88 years, which indicates the greater independence that this period of life still confers on this population. The highest prevalence of elderly women participating in this study were married.

Kaplan *et al.*; (2006), demonstrated that marriage is associated with longer survival and that, among the non-married categories, never having been married was the strongest predictor of premature mortality. Thus, regarding education, 44.1% of the 288 elderly women reported having between four and eight years of study. It is known that individuals with a lower level of education tend to have a worse perception of their health status and a greater presence of NCDs (MASSA; DUARTE; CHIAVEGATTO FILHO; 2019).

In relation to BMI, it was found that elderly women had a high prevalence of excess weight according to the Lipschitz, WHO and PAHO references respectively. It is known that excess weight can generate unfavorable health conditions, being an important risk factor for various health problems, such as NCDs (TAVARES *et al.*, 2018), which are characterized as a set of pathologies , having a non-infectious origin and may result in functional disabilities (FIGUEIREDO; CECCON; FIGUEIREDO, 2021). In 2017, through data collected by the Global Burden of Diseases (GBD), they came to the conclusion that CVDs were responsible for 28.8% of total deaths among NCDs (BARROSO *et al.*, 2020).

Ribeiro and Oliveira (2010) demonstrated that CVDs are the main causes of morbidity and mortality in the world. Because of this, we evaluated four main risk factors for chronic cardiovascular diseases: hypertension, dyslipidemia, DM and obesity.

In our study, all different BMI classifications showed an association of this index with DM, which is an important and growing health problem for all countries. The WHO estimates that high blood glucose is the third most important factor in the cause of premature mortality, surpassed only by increased hypertension and tobacco use (SOCIEDADE BRASILEIRA DE DIABETES, 2019-2020).

In relation to SAH, only the WHO and PAHO BMI were associated with this pathology. Our data corroborate the study by Neumann *et al.* (2014), in which they demonstrated a higher prevalence of hypertension and DM in overweight elderly people, compared to eutrophic or malnourished individuals. However, we were concerned that the Lipschtz BMI, which is the BMI recommended for the elderly by the Brazilian Ministry of Health, did not find an association with SAH, while the other BMIs evaluated did. It is known that hypertension is considered the main modifiable risk factor with an independent, linear and continuous association with CVD, Chronic Kidney Disease (CKD) and premature death (BARROSO *et al.*, 2020). If the results of this BMI were unable to verify the association with hypertension and knowing that this pathology is prevalent in the elderly and associated with

cardiovascular diseases, we question whether this would be the best BMI to be recommended for the elderly in Brazil?

Regarding the BMI cutoff point, overweight and obese adults should be advised that the higher the BMI, the greater the risk of developing CVD, DM 2 and all-cause mortality (DIRETRIZES BRASILEIRAS DE OBESIDADE, 2016). Obesity stands out as one of the main complicating factors for the development of CVD (LOUREIRO *et al.*, 2020). According to PAHO, in 2019, more than 672 million adults were obese, a fact that partly explains CVD as the main causes of death, responsible for 31% of deaths globally. Of these deaths, it is estimated that 85% occur due to heart attacks and strokes (PAN-AMERICAN HEALTH ORGANIZATION, 2016).

Studies have shown that excess adipose tissue, especially the concentration in the central region of the body, is associated with systemic inflammation, directly contributing to increased cardiovascular morbidity and mortality (IKEOKA; MADER; PIEBER, 2010; LOUREIRO *et al.*, 2020). The possible mechanism for this relationship between central adiposity and cardiovascular risk factors can be justified by the fact that intra-abdominal adipocytes are prone to releasing their free fatty acids directly into the portal vein, exposing the liver to high concentrations of fatty acids free, which can induce hyperinsulinemia, dyslipidemia and hypertension. In addition, adipose tissue, especially abdominal tissue, secretes substances (adipokines) that can promote the development of NCDs (SONG *et al.*, 2014).

Assessment using BMI can be a good indicator of the nutritional status of elderly people, especially if associated with anthropometric measurements that express the composition and distribution of body fat, such as measuring waist circumference (VICENTE and TEIXEIRA, 2022). Furthermore, it is a simple, quick and easy indicator to apply, having a high correlation with body fat, that is, the higher the BMI, the greater the likelihood of the individual having hypertension, DM and CVD. However, not every high BMI indicates excess body fat, as this index does not separately evaluate body compartments (SAMPAIO *et al.*, 2012).

CONCLUSION

In a sample of elderly women from southern Brazil, it was found that BMI, categorized by the WHO and PAHO, were significantly associated with hypertension and DM, while the BMI classification by Lipschitz only showed an association with DM.

Although BMI has its limitations, it is a simple, inexpensive index that can be used in clinical practice for the nutritional monitoring of elderly people as a tool to help prevent overweight, obesity and, consequently, the development of risk factors, cardiovascular diseases, such as diabetes and high blood pressure.

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