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OBESITY IS NOT ASSOCIATED WITH ORAL VARIABLES IN THE ELDERLY: A POPULATION-BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction and objective: To evaluate the association between obesity and independent variables in the elderly of a southern city in Brazil. Material and methods: This is a home-based cross-sectional study conducted in 287 elders, aged 65 to 74 years, from Cruz Alta, Brazil. Clinical examination and a structured questionnaire were used. The diagnosis of obesity was determined by two criteria: according to the World Health Organization (BMI-WHO) and the body mass index for the elderly (BMI-elderly). Poisson regression with robust variance assessed the association between the dependent and independent variables. Two multivariate models were constructed, using the two obesity diagnostic criteria. Results: The prevalence of obesity using the BMI-WHO and BMI-elderly were 24.7% and 49.5%, respectively. In the final multivariate model, non-white and current smokers presented a higher prevalence ratio (PR) of being obese (PR; 95%CI: 1.80; 1.22 – 2.66 and 1.77; 1.09 – 2.88, respectively), according to the BMI-WHO criteria. Meanwhile, according to the BMI-elderly criteria, only skin color presented associated with obesity (PR; 95%CI: 1.28; 1.02 – 1.62). Discussion: Obesity in the elderly may be considered an epidemic public health problem in Brazil. The number of present teeth may not be related to the present of obesity among the elderly. Conclusion: High prevalence of obesity was detected in this sample, which was associated with demographic and behavioral factors. To both criteria, the non-white elders demonstrated higher obesity.

Key words: Body weight. Ethnic Groups. Gerontology. Epidemiology.

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RESUMO

Obesidade não está associada com variáveis odontológicas em idosos: Um estudo transversal de base populacional

Introdução e objetivo: Avaliar a associação entre obesidade e variáveis independentes em idosos de uma cidade do sul do Brasil. Materiais e métodos: Esse é um estudo observacional transversal de base domiciliar realizado em 287 idosos com idade entre 65 e 74 anos da cidade de Cruz Alta, Brasil. Exame clínico e questionário estruturado foram aplicados. O diagnóstico de obesidade foi determinado por dois critérios: de acordo com o adotado pela Organização Mundial da saúde (IMC-OMS) e outro considerando o índice de massa corporal especificamente dos idosos (IMC-idoso). Análises uni- e multivariadas foram realizadas, utilizando-se regressão de Poisson com variância robusta. Dois modelos multivariados foram construídos, utilizando os dois critérios diagnósticos de obesidade. Resultados: a prevalência de obesidade através do IMC-OMS e IMC-idoso foi de 24,7% e de 49,5%, respectivamente. No modelo multivariado final, não brancos e fumantes apresentaram maiores razões de prevalências (RP) de estarem obesos (RP; IC95: 1,80; 1,22 – 2.66 e 1,77; 1,09 – 2,88, respectivamente), de acordo com o critério IMC-OMS. Por outro lado, de acordo com o critério IMC-idosos, somente a cor da pele apresentou-se associado com obesidade (RP; IC95: 1,28; 1,02 – 1,62). Discussão: Obesidade em idosos pode ser considerada um problema epidêmico de saúde pública no Brasil. O número de dentes presentes pode não estar relacionado com a obesidade em idosos. Conclusões: Alta prevalência de obesidade foi detectada em idosos, a qual está associada com fatores demográficos e comportamentais. Independentemente do critério, idosos não-brancos apresentaram maior obesidade.

Palavras-chave: Peso corporal. Grupos étnicos. Geriatria. Epidemiologia.

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INTRODUCTION

The Human ageing phenomenon will be a great challenge for the most countries within the next decades.

This alteration in the population profile is very demanding in terms of public health, as several complex situations might be faced.

One of the main problems encountered in these individuals, which may directly impair their health, is obesity.

Obesity should be defined as the amount of excess fat storage associated with elevated health risk. Therefore, obesity and aging represent an important part of health-care expenses, an increasingly obese elderly population will undoubtedly represent a growing financial problem in health-care systems (Zamboni and collaborators, 2005).

The prevalence of the obesity is growing progressively even in old age groups, in both sexes, all ages, all races, all educational levels, both smokers and nonsmokers (Zamboni and collaborators, 2005).

In the United States, it is estimated that the prevalence of obesity, among the elderly, is approximately 40%, according to the World Health Organization (WHO) criteria (Fakhouri and collaborators, 2012).

The same trend may be observed in Brazil, as one study demonstrated a prevalence of 25% in the elderly, using the same criterion (Silveira, Kac, Barbosa, 2009).

Moreover, it seems that the prevalence of obesity is increasing among the Brazilian elders in the last years (Silva and collaborators, 2018).

Obesity is considered a risk factor and is clearly related to several diseases, like diabetes mellitus, hypertension, dyslipidemia, coronary artery disease and congestive heart failure, which is worrisome in the elderly. Even without body weight changes, the amount of fat significantly increases with age (Zamboni and collaborators, 2005).

The literature shows that the total body fat increases from 20% to 30%, meanwhile the muscle mass decrease with aging. Its pattern of distribution changes, as it is mostly located in the central, abdominal and visceral parts (Kuk and collaborators, 2009), also increases the amount of fat inside and around muscles, while subcutaneous fat in other regions of the body (abdomen and legs) decreases (Zamboni and collaborators, 2005).

In fact, obesity may be considered as a limiting factor for a healthy aging because important medical complication may arise, decreasing quality of life (Gherbon, 2014).

Several aspects may influence the risk for obesity in the elderly. Among those, oral health conditions, general health, socio-demographical and behavioral conditions.

Regarding oral health, several studies demonstrated the poor oral conditions, such as the low number of remaining teeth and the need for dental prosthesis, are associated with obesity (Hilgert and collaborators, 2009; Peruchi and collaborators, 2016).

The literature considered tooth loss as an exposure and obesity as outcome, people with any tooth loss and edentates presented 41% and 60% higher odds of obesity. Moreover, the association between obesity and tooth loss showed that obese people have 1.49 times higher odds of any tooth loss and 1.25 times higher odds of edentulism (Nascimento and collaborators, 2016).

Some behavioral aspects are considered risk factors for obesity in the elderly, such as smoking exposure and lack of physical activity (Silveira and collaborators, 2016). Contrary to the beliefs of many smokers, studies showed that heavy smoking is associated with higher body weight (Oliveira Fontes Gasperin and collaborators, 2014).

The number of cigarettes smoked per day is relevant to the amount of accumulated fat, as overweight and obesity were observed in 84.6% of heavy smokers, compared with 35.6% of light smokers and 33% of moderate smokers (Oliveira Fontes Gasperin and collaborators, 2014).

Two criteria are available to assess obesity in the elderly, both based on the body mass index (BMI). One is based on the WHO criteria for adults and elders (WHO, 1998).
The other one takes into consideration the changes in the body composition that occurs during aging (Lipschitz, 1994).

The literature demonstrates differences in the estimated prevalence of obesity when both criteria is considered (Silveira and collaborators, 2016).

Therefore, the present study aimed to evaluate the prevalence of obesity and its associated factors in the elderly of a Brazilian southern city.

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MATERIAL AND METHODS

Study Design, Location and Ethical Aspects

This is a home-based cross-sectional study that interviewed and examined elders with 65 to 74 years of age (WHO, 1997) in an urban area of Cruz Alta. The city of Cruz Alta is located in the north region of the state of Rio Grande do Sul, Brazil, approximately 350 km from Porto Alegre, the state capital.

According to the last census, 62,821 inhabitants live in Cruz Alta, of which 3,730 are aged 65 to 74 years (Brazil, 2011). Among those individuals, 58% are female and more than 95% of the population lives in the urban area. The city Human Development Index (HDI) in 2010 was 0.75 (Brazil, 2010a) and the Gini index was 0.5419 (Brazil, 2010b).

The present study was approved by the Ethical Committee of the University of Passo Fundo under protocol # 1.531.862. All participants read and signed and informed consent prior to inclusion in the study.

Sample Size Calculation

The sample size calculation was based on the prevalence of obesity in the elderly of 25.3%, as previously demonstrated in the literature (Silveira and collaborators, 2016).

The formula used for sample size calculation was: sample size = standard normal variate^2 x outcome prevalence x (1 - outcome prevalence) / absolute error^2. We assumed a type error of 5% (standard normal variate of 1.96) and an absolute error of 5%.

Taken into consideration the population of 3,730 elderlies, aged 65 to 74, an alpha error of 5%, a level of confidence of 95%, a total of 270 individuals was considered necessary. A probabilistic per conglomerate sample was conducted to visit 300 households, regardless the number of elders in each household.

Sampling Strategy

The sampling strategy is described in detail elsewhere (Stoffel and collaborators, 2018). The city of Cruz Alta has 68 neighborhoods and districts (Brazil, 2010).

A list of every neighborhood and district was obtained and numbered from 0 to 67 in a crescent order of the population above 65 years.

After that, the city was divided into five areas, according to the number of elder inhabitants in each neighborhood or district.

A total of 17 neighborhoods or districts were randomly chosen, using the website www.random.org, obeying the proportionality of the elderly in each area. Moreover, the corners were randomly chosen using the same website.

The researchers visited every household until the sufficient number of individuals were included in the present study.

After the first interview, the visits followed the clockwise direction until concluding the work set. Whenever necessary, new blocks were chosen to complete the number of households stimulated to be visited in each neighborhood or district.

Inclusion and Exclusion Criteria

Only the elderly, aged 65 to 74 years, living the selected neighborhood or district were included in the present study.

Only those with physical, medical and mental conditions, that allowed the execution of data collected, were included. No other restriction about their medical condition was imposed. In every household, if more than one resident fitted the eligibility criteria, all of them were included.

Two attempts were made before the household was considered excluded. Visiting individuals in the household, homes for the aged, and commercial buildings were not eligible.

Clinical Axamination and Interview

A structured questionnaire was applied, which included socio-demographical and behavioral factors, obtained by a block of questions, the PCATool-SB Brasil (Brazil, 2010c).

Obesity was defined by the BMI (weight in Kg divided by the height in m^2). Weight was verified by an electronic scale, with a maximum weight of 200 Kg and 100g sensitivity.

The height measurements were performed by an anthropometric ruler graduated in centimeters, which was fixed vertically in the wall, with a mobile cursor.

Oral health variables were collected by the counting of present teeth, verification of use and need of dental prosthesis. These examinations were performed after the

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interview, with the use of wooden spatula under natural illumination. For teeth counting, all teeth were considered, except third molars. Teeth the somehow could be rehabilitated were counted as present.

The interview and clinical examinations were performed between July and August 2016 by two research teams, composed by an interviewer, an oral examiner, and an anthropometric examiner. All researchers were previously trained by the study coordinator in order to ensure standardized data collection. The training consisted of theoretical lectures, discussion of all questions in the questionnaire, and explanations about the oral health and anthropometric examinations.

The inter-examiner reproducibility for both oral and anthropometric examination was verified by examining twice approximately 5% of the total sample. The kappa index demonstrated that the need for dental prosthesis and the teeth counting were 1 and 0.85, respectively. The weighted kappa index for weight (variation ±100 g) and height (variation ±0.01 m) were 1 and 0.70, respectively.

Statistical Analysis

Obesity was considered the dependent variable in the present study, and two criteria were used to assess obesity. Both of them, used the BMI to classify the individuals. The BMI-elderly considers the modifications during the aging, and comprises the following cut-off points (Lipschitz, 1994):

Low weight: <22 kg/m^2
Eutrophic: ≥22 kg/m^2 and ≤27 kg/m^2
Obese: >27 kg/m^2

The BMI-WHO considers the following cut-off points (WHO, 1998):
Low weight: <18.5 kg/m^2
Eutrophic: ≥18.5 kg/m^2 and <25 kg/m^2
Overweight: ≥25 kg/m^2 and <30 kg/m^2
Obese: ≥ 30 kg/m^2

To both criteria, the individuals were dichotomized into obese and non-obese. The independent variables were age, sex, ethnicity/skin color, level of education, marital status, retirement, use of medications, smoking exposure, mean tooth loss, need of dental prosthesis, and use of dental prosthesis in edentulous individuals.

Ethnicity/skin color were categorized into white and non-white. The non-white group is composed by those that reported themselves as black, yellow, brown or indigenous. The level of education was divided into low, which included the elderly with up to complete elementary school and illiterates; medium, which included those with incomplete or complete high school; and high level of education, for those with incomplete or complete higher education. The marital status was dichotomized into married and non-married. The non-married group was composed by the singles, divorced or widow individuals.

The need of dental prosthesis was categorized into yes, for those with any need of dental prosthesis, and no, for those without dental prosthesis need. The use of dental prosthesis in edentulous individuals used the following categorization: elders with at least one tooth, regardless the use of partial prosthesis; edentulous wearing both dentures; and edentulous wearing only one denture or no denture. The use of medication was categorized into two groups, one with the elderly the reported the use of at least one medication and another without the use of medications. The number of lost teeth was dichotomized into ≤18 and ≥19 lost tooth, as the median of lost tooth in the whole-sample was 18.

The statistical analyses were performed with the SPPS 21 (SPSS, version 21.0, IBM Corp., Armonk, NY, USA). The association between the dependent and independent variables were evaluated by the chi-square or Mann-Whitney tests. Uni- and multivariate analyses are conducted, applying the Poisson regression with robust variance. Two multivariate models were constructed, considering the different criteria to assess obesity as a different dependent variable. In the multivariate analyses, for both models, variables that presented $p< 0.25$ in the univariate analysis were included. The level of significance adopted was 5%.

RESULTS

A total of 292 households was visited with elderlies aged 65 to 74 years, of which 260 households were included in the present study.

The remaining 32 households were excluded, and the main reasons are expressed in Figure 1. Two hundred and eighty-seven elders were interviewed and examined, of which 102 (35.5%) and 185 (64.5%) were male

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and female, respectively. The mean age was 69.3 (SD±3.52).

Regarding ethnicity/skin color, 196 (68.3%) reported to be white, and 190 (62.6%) presented low level of education, including 17 (5.9%) illiterates. Approximately 60% were married, and 76.9% were retired.

The prevalence of obesity in the elderly was 24.7%, according to the BMI-WHO criterion (BMI ≥30 Kg/m^2). Only ethnicity/skin color was significantly associated with obesity (p=0.008).

According to the BMI-elderly criterion (BMI >27 Kg/m^2), the prevalence of obesity was 49.5%, and no statistically significant association was observed using this criterion (Table 1).

Regardless the criterion to assess obesity, no significant association was detected with sex, level of education and oral health conditions.

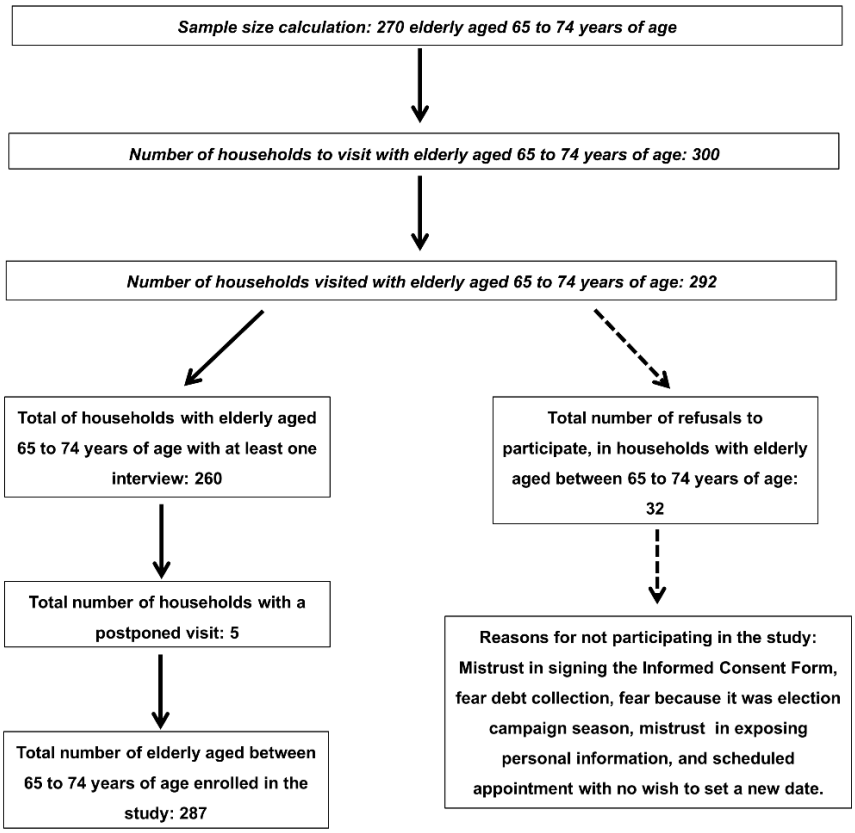

Figure 1 - Flowchart of the present study.

Table 1 - Demographical, medical and dental characteristics of the participants, classified according to the different criteria of obesity.

Variable	n - (%) or mean±SD	Non-obese BMI <30 Kg/m² (n=216; 75.3%)	Obese BMI ≥30 Kg/m² (n=71; 24.7%)	p-value	Non-obese BMI ≤27 Kg/m² (n=145; 50.5%)	Obese IMC >27 Kg/m² (n=142; 49.5%)	p-value
Age	(in years)	69.5 ± 3.6	68.7 ± 3.4	0.10#	69.4 ± 3.5	69.2 ± 3.5	0.57#
Sex	Male	77 (35.6)	25 (35.2)	1.00*	54 (37.2)	48 (33.8)	0.62*
	Female	139 (64.4)	46 (64.8)		91 (62.8)	94 (66.2)	
Skin color	White	157 (72.7)	39 (54.9)	<0.01*	107 (73.8)	89 (62.7)	0.06*
	Non-white	59 (27.3)	32 (45.1)		38 (26.2)	53 (37.3)	
Level of education	Low	143 (66.2)	47 (66.2)	0.87*	97 (66.9)	93 (65.5)	0.85*
	Medium	38 (17.6)	14 (19.7)		27 (18.6)	25 (17.6)	
	High	35 (16.2)	10 (14.1)		21 (14.5)	24 (16.9)	
Marital status	Married	93 (43.1)	29 (40.8)	0.78*	65 (44.8)	57 (40.1)	0.47*
	Non-married	123 (56.9)	42 (59.2)		80 (55.2)	85 (59.9)	
Retirement	Yes	166 (76.9)	53 (74.6)	0.75*	115 (79.3)	104 (73.2)	0.27*
	No	50 (23.1)	18 (25.4)		30 (20.7)	38 (26.8)	

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Use of medication	Yes No	174 (80.6) 42 (19.4)	63 (88.7) 8 (11.3)	0.15*	115 (79.3) 30 (20.7)	122 (85.9) 20 (14.1)	0.16*
Smoking exposure	Smokers Former smokers Never smokers	22 (10.2) 65 (30.1) 129 (59.7)	13 (18.3) 21 (29.6) 37 (52.1)	0.18*	20 (13.8) 45 (31.0) 80 (55.2)	15 (10.6) 41 (28.9) 86 (60.6)	0.58*
Tooth loss	≤18 tooth ≥19 tooth	73 (49.0) 76 (51.0)	31 (59.6) 21 (40.4)	0.20*	51 (51.5) 48 (48.5)	53 (52.0) 49 (48.0)	1.00*
Need of dental prosthesis	Yes No	89 (41.2) 127 (58.8)	33 (46.5) 38 (53.5)	0.49*	57 (39.3) 88 (60.7)	65 (45.8) 77 (54.2)	0.28*
Use of dental prosthesis in edentulous individuals	Dentate Edentulous individuals wearing 2 dentures Edentulous individuals wearing none or only one denture	149 (69.3) 56 (26.0) 10 (4.7)	52 (73.2) 17 (23.9) 2 (2.8)	0.73*	99 (68.8) 38 (26.4) 7 (4.9)	102 (71.8) 35 (24.6) 5 (3.5)	0.78*

Legend: # Mann-Whitney; * Chi-square.

Table 2 - Univariate analysis for the association between obesity and independent variables.

Variables		Prevalence ratio (95% CI) BMI-WHO	p-value	Prevalence ratio (95% CI) BMI-elderly	p-value
Age (in years)		0.95 (0.90 – 1.01)	0.08	0.99 (0.96 – 1.02)	0.54
Sex	Female	1.01 (0.67 – 1.55)	0.95	1.08 (0.84 – 1.39)	0.55
Ethnicity/skin color	Non-white	1.77 (1.19 – 2.63)	<0.01	1.28 (1.02 – 1.62)	0.04
Level of education	Medium	1.09 (0.65 – 1.82)	0.75	0.98 (0.72 – 1.35)	0.91
	High	0.90 (0.49 – 1.64)	0.73	1.09 (0.80 – 1.49)	0.59
Marital status	Non-married	0.93 (0.62 – 1.41)	0.74	0.91 (0.71 – 1.15)	0.46
Retirement	No	1.09 (0.69 – 1.73)	0.71	1.18 (0.91 – 1.52)	0.21
Use of medication	No	0.60 (0.31 – 1.18)	0.14	0.78 (0.54 – 1.12)	0.17
Smoking exposure	Former smokers	1.10 (0.69 – 1.75)	0.70	0.92 (0.71 – 1.20)	0.54
	Never smokers	1.67 (0.99 – 2.79)	0.05	0.83 (0.55 – 1.25)	0.36
Tooth loss	≥19 tooth	0.73 (0.45 – 1.17)	0.19	0.99 (0.76 – 1.30)	0.95
Need of dental prosthesis	No	0.85 (0.57 – 1.27)	0.44	0.88 (0.69 – 1.11)	0.27
Use of dental prosthesis in edentulous individuals	Edentulous individuals wearing 2 dentures	0.90 (0.56 – 1.45)	0.67	0.95 (0.72 – 1.24)	0.69
	Edentulous individuals wearing none or only one denture	0.64 (0.18 – 2.33)	0.50	0.82 (0.42 – 1.63)	0.57

Table 2 shows the univariate analyses of the association between obesity and the independent variables.

Only ethnicity/skin color was associated with obesity in both criteria analyzed. When obesity was defined by BMI-WHO, non-whites presented a significantly higher prevalence ratio (PR) of 1.77 (95%CI: 1.19 – 2.63), whereas, when the BMI-elderly criterion was used, the PR for non-whites was 1.28 (95%CI: 1.02 – 1.62). No other significant association was detected.

Table 3 shows that multivariate analyses for the association between obesity and the independent variables. In the initial multivariate model that used BMI-WHO to assess obesity, the following variables were included: ethnicity/skin color, smoking exposure, tooth loss, use of medications, and age.

However, in the final multivariate analysis, only ethnicity/skin color and smoking exposure remained significantly associated with obesity. Non-white elders presented a significantly higher PR of being obese in comparison to white (PR; 95%CI: 1.80; 1.22 – 2.66).

Meanwhile, current smokers presented 77% higher prevalence ratio of being obese when compared to never smokers (PR; 95%CI: 1.77; 1.09 – 2.88).

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Table 3 - Multivariate analysis for the association between obesity and the independent variables.

Variables		Prevalence ratio (95% CI) BMI-WHO	p-value	Prevalence ratio (95% CI) BMI-elderly	p-value
Age (in years)		0.95 (0.89 – 1.00)	0.05	-	-
Ethnicity/skin color	Non-white	1.80 (1.22 – 2.66)	<0.01	1.28 (1.02 – 1.62)	0.04
Smoking exposure	Former smokers	1.12 (0.71 – 1.78)	0.62	0.92 (0.70 – 1.19)	0.51
	Never smokers	1.77 (1.09 – 2.88)	0.02	0.83 (0.56 – 1.24)	0.36

The other multivariate model, that used the BMI-elderly criterion, included initially the following variables: ethnicity/skin color, smoking exposure, use of medication, and retirement.

In the final multivariate model, only ethnicity/skin color presented significantly associated with obesity, as non-white presented 28% higher prevalence ratio of being obese in comparison to white elders (PR; 95%CI: 1.28; 1.02 – 1.62) (Table 3). No association with the oral variables was detected in this analysis.

DISCUSSION

The present study evaluated the prevalence of obesity and its associated factors in a sample of elders in a city in South Brazil.

This evaluation is especially important, as the number of aged individuals is increasing significantly in the last decades and establishing risk indicators for obesity helps in prevention and treatment of several related diseases.

Moreover, these results may support the planning for public health policies in this life cycle, that is characterized by increased morbidity from different diseases, as well as increased health-related costs. The prevalence of obesity by the BMI-WHO and BMI-elderly was 24.7% and 49.5%, respectively. Regardless of the criterion, only ethnicity/skin color was associated with obesity.

The results found herein are like another study conducted in the literature. In one of those studies, the prevalence of obesity, when assessed by the same criteria, was 25.3% and 48.7% to BMI-WHO and BMI-elderly (Silveira and collaborators, 2016).

However, other studies, using the cuf-off point of ≥30 Kg/m^2, report higher prevalence of approximately 40% (Fakhouri and collaborators, 2012; Oliveira and collaborators, 2018).

Generally, these results show that obesity in the elderly may be considered an epidemic public health problem in Brazil.

The results of the present study highlight the need for standardization in the BMI cut-off points for the assessment of obesity. The lack of uniformity also difficult the health policies planning in this life cycle. In order to provide a better an appropriate prevalence estimate, we used two BMI criteria to assess obesity, including the WHO criterion that is the most used one (Silva and collaborators, 2018).

Ethnicity/skin color was associated with obesity, regardless the BMI criterion used. These results are similar to other studies that found that some ethnic groups may be associated with obesity. Black individuals present a higher prevalence of obesity and a higher burden of chronic diseases related to obesity than other ethnic groups (Lincoln, Abdou, and Lloyd, 2014).

The ethnic characteristics are determinants in the health profile, especially in developing countries like Brazil.

In Brazil, it is well-established that white individuals show higher income and level of education than non-white (Brazil, 2011).

Therefore, the findings of the present study should consider that ethnicity is a proxy of socio-economic status, especially considering the inter-racial pattern found in Brazil. These differences are directly associated with access to health care, healthier nutrition options, leisure and physical activity, among other attitudes, that are linked to healthier behaviors.

In the present study, when the BMI-WHO criterion was considered, smoking exposure was associated with obesity. Current smokers present 77% higher prevalence ratio of being obese when compared to never smokers. Other study reported this association in the elderly with overweight and obesity (Andrade and collaborators, 2012).

However, in adults, the opposite association is detected, as the amount of

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cigarettes smoked per day is inversely associated with BMI. Despite of that, the number of cigarettes is not significantly associated with central obesity in adults (Xu, Yin, and Wang, 2007).

In fact, the literature shows that heavier smokers present higher body weight and important metabolic alterations (Oliveira Fontes Gasperin and collaborators, 2014).

Longer periods of smoking exposure are detected in the elderly, higher number of cigarettes smoked per day, and increased difficulty to quit smoking (Jordan and collaborators, 2017).

Additionally, current smokers report more frequent cravings for unhealthier food consumption, such as high-fat foods and fast-food fats (Chao and collaborators, 2017), and elevated rates of depression, anxiety, and poor eating habits (Smith, Pedneault, and Schmitz, 2016).

All those characteristics must be taken into consideration when analyzing the higher prevalence of obesity in current smokers.

No association was detected with obesity and sex. In contrast, the literature demonstrates that female individuals present higher rates of obesity (Silveira and collaborators, 2016; Oliveira and collaborators, 2018).

Generally, these studies also report an association with obesity and worst socio-economic condition, especially lower income and level of education (Bhurosy and Jeewon, 2014).

Other study also reported the association of obesity with poor oral health conditions, such as the lack of oral rehabilitation (Hilgert and collaborators, 2009).

The association of poor nutritional status and oral health conditions is also reported in the literature (Toniazzo and collaborators, 2018).

In fact, when we analyzed the nutritional status of the sample included in the present study, it was demonstrated that the lack of oral rehabilitation is significantly associated risk of malnutrition (Stoffel and collaborators, 2018).

It must be stressed that the assessment of obesity only by BMI may be insufficient to properly demonstrate the elevated risk of related diseases.

This is a representative study of the elderly individuals of Cruz Alta that used a probabilistic per conglomerate sampling. The present study included similar proportions of male/female and white/non-white to what is found in the city according to the last census.

Moreover, the examiners were trained and calibrated previously to data collection in order to enhance the data reliability. Conversely, some limitations may arise, such as the cross-sectional design, which does not include temporality in the associations detected.

The absence of a specific test for masticatory efficiency and the level of physical activity are other important limitations.

Despite of that, the study design allows data generalization and it can be compared with other representative home-based studies.

The higher rates of overweight and obesity are detected worldwide and represent an important challenge for the prevention of non-communicable diseases along the different life cycles (Hruby and Hu, 2015).

CONCLUSION

In conclusion, the present study demonstrated a high prevalence of obesity in the elderly, which was associated with skin color and smoking exposure. Further strategies must be conducted to reduce obesity, especially among smokers and non-white individuals.

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