http://dx.doi.org/10.1590/1981-86372023003320220054

| ORIGINAL

Edentulism and number of medications are associated with nutritional status in older adults: a population-based cross-sectional study

Edentuslimo e número de medicações estão associados com estado nutricional em idosos: um estudo transversal de base populacional

Eduarda Willers de **LUCCA**[1] 0000-0003-2835-5199

Francisco Wilker Mustafa Gomes **MUNIZ**[2] 0000-0002-3945-1752

Paulo Roberto Grafitti **COLUSSI**[3] 0000-0002-9351-6959

Luciana Marcon Barbosa **STOFFEL**[4] 0000-0002-2908-6587

Gabriel Schmitt **CRUZ**[5] 0000-0001-8785-5455

Ana Carolina Bertoletti de **MARCHI**[4] 0000-0002-7704-3119

ABSTRACT

Objective: This study evaluated the nutritional status and associated factors among older adults of a southern Brazilian city. **Methods**: A cross-sectional home-based study, with a probabilistic sample per cluster, was carried out with 282 older adults aged ≥60 years in the city of Veranópolis, Brazil. Through a structured questionnaire, socioeconomic, general and behavioral health aspects were assessed. Nutritional status was assessed using the Mini Nutritional Assessment (MAN®) instrument, categorizing the sample into eutrophic or nutritional risk (risk of malnutrition + malnourished). Oral health was assessed by counting teeth and the use of and need for dental prosthesis. Two independent multivariate models were constructed, using number of daily medication and polypharmacy (≥2 daily medications). Logistic regression was used to verify associations. **Results**: The prevalence of nutritional risk was 14.5% (N=41). In the final multivariate analysis, users of ≥6 daily medications demonstrated a greater odds ratio (OR) of being at nutritional risk when compared to those who did not use medication daily (OR: 12.16; 95% confidence interval [95%CI]: 1.47 – 100.82). Non-edentulous older adults had 67.7% (p = 0.006) lower OR for nutritional risk when compared to edentulous. **Conclusions**: The prevalence of nutritional risk was low among this sample, and it was associated with edentulism and number of daily medications.

Indexing terms: Aged. Dental Care for Aged. Nutritional status. Nutrition surveys. Elder nutritional physiological phenomena.

[1] Universidade de Passo Fundo. Passo Fundo, RS, Brasil.
[2] Universidade Federal de Pelotas, Faculdade de Odontologia, Departamento de Periodontia. Rua Gonçalves Chaves, 457, 96015-560, Pelotas, RS, Brasil. Correspondence to: FWMG Muniz, E-mail: E-mail: <wilkermustafa@gmail.com>.
[3] Universidade de Passo Fundo. Faculdade de Odontologia, Departamento de Periodontia. Passo Fundo, RS, Brasil.
[4] Universidade de Passo Fundo. Faculdade, Programa de Pós-Graduação em Envelhecimento Humano. Passo Fundo, RS, Brasil.
[5] Universidade Federal de Pelotas, Faculdade de Odontologia. Pelotas, RS, Brasil.

How to cite this article

Lucca EW, Muniz, FWMG, Colussi PRG, Stoffel LMB, Cruz GS, Marchi ACB. Edentulism and number of medications are associated with nutritional status in older adults: a population-based cross-sectional study. RGO, Rev Gaúch Odontol. 2023;71:e20230033. http://dx.doi.org/10.1590/1981-86372023003320220054

RESUMO

***Objetivo**: Esse estudo avaliou o estado nutricional e fatores associados em idosos de uma cidade do Sul do Brasil. **Métodos**: Um estudo transversal de base populacional, com amostragem probabilística por cluster, foi realizado com 282 idosos com idade ≥60 anos na cidade de Veranópolis, Brasil. Por meio de um questionário estruturado, aspectos socioeconômicos, comportamentais e de saúde geral foram aferidos. Estado nutricional foi verificado usando a Mini Avaliação Nutricional (MAN), categorizando a amostra em eutróficos e risco nutricional (risco de desnutrição + desnutridos). Saúde bucal foi verificada pela contagem dos dentes e uso e necessidade de prótese dentária. Dois modelos multivariados independentes foram construídos, utilizando o número de medicações diárias e polifarmácia (≥2 medicamentos por dia). Regressão logística foi utilizada para verificar as associações. **Resultados**: A prevalência de risco nutricional foi de 14,5% (N=41). Na análise multivariada final, usuários de ≥6 medicamentos por dia demonstraram uma maior razão de chance (RC) de terem risco nutricional quando comparados com aqueles que não utilizaram medicamento diariamente (RC: 12,164; intervalo de confiança de 95% [IC95%]: 1,468 – 100,821). Idosos não edêntulos tiveram 67,7% (p=0,006) menor RC para risco nutricional quando comparados com não edêntulos. **Conclusões**: A prevalência de risco nutricional foi baixa nessa amostral, ela foi associada com edentulismo e número diário de medicações.*

***Termos de indexação**: Idoso. Assistência odontológica para idosos. Estado nutricional. Inquéritos nutricionais. Fenômenos fisiológicos da nutrição do idoso.*

INTRODUCTION

A search for an adequate nutritional status is one of the best strategies for promoting and maintaining a healthy and quality life [1]. Diet and nutrition influence the proper functioning of the immune system, determining the risk and severity of several diseases and infections [2]. The risk of malnutrition increases with advancing age, and studies show that the prevalence of nutritional risk may vary significantly according to the population studied and the instrument used for its assessment [3].

The literature is vast in reporting poor oral health in individuals with poor nutrition [4, 5]. Moreover, oral health conditions may be characterized as one of the main factors that influence nutritional status [4]. Caries and periodontal disease are the main oral health problems that affect adults and older adults, exhibiting high prevalence and cumulative effects in several population [6]. As a consequence of these conditions, among the older adults, there is a high average of tooth loss and edentulism, which is especially observed in developing countries [7]. Consequently, the poor oral health result in a high percentage of older adults in need for prosthetic oral rehabilitation [8].

More nutritious foods, access to different forms of health treatments, housing, basic sanitation, access to clean water, among others are directly linked to income and instruction, posing a great influence in a good nutritional condition. All issues involving nutritional status are important, especially among the older population, and when considering the current pandemic [9], as it may impair the immune system. In this context, studies on nutritional assessment with representative samples have a significant impact to support future proposals of strategies to risk reduction. Therefore, this study aimed to assess the association of nutritional status with edentulism and number of daily medications in older adults from a southern Brazilian city. Its association with polypharmacy was also tested in the present study. The null hypothesis of the present study was that no statistically significant association with edentulism or number of daily medications would be detected with nutritional status among older adults.

METHODS

Study design and location

The present cross-sectional study of residential households interviewed and examined older adults aged ≥60 year in both urban and rural areas of Veranópolis. The municipality is located in the northeast of the state of Rio Grande do Sul, Brazil, about 160 km from the capital, Porto Alegre. Veranópolis has a population of approximately 22,810 inhabitants [10]. Of these, 3,554 are in the age group of ≥60 years, being 42.91% males and 57.09% females. A total

of 87% of the population lives in an urban area. The Municipal Human Development Index in 2010 was 0.773 [11]. GDP per capita was R$41,184.25 [11], and Gini Index in 2010 was 0.4836 [12]. Life expectancy at birth was 75.24 years, and the illiteracy rate for people aged 15 and over was 2.82%. This study was reviewed and approved by the Ethics Committee of the University of Passo Fundo, protocol #2,990,088. All individuals read and signed the informed consent before participating the study.

Sample calculation and sampling strategy

The inclusion criteria in the present study were individuals aged 60 years or older, living in the randomly selected households. Further details on sampling strategy may be found elsewhere [13]. It was included only healthy individuals, defined as individuals whose physical, medical and mental condition made it possible performed the study, as well as to understand examinations and interviews that were conducted. If during the initial contact, if the researcher observed that the older adult was unable to take part in the research or when the person responsible for older adult reported that he/she was not in a position to participate, the individual was excluded. Further questionnaires to assess the older adults' cognition were not used in the present study. In a household, if more than one resident met the eligibility criteria, all of them were invited to participate.

Both a house or a residential building were counted as one unit of household. Therefore, when a residential building was randomly selected, only one of their apartments could contribute for the sample of the present study. In the case of absence on the day of data collection, a new attempt was made. The household was excluded only after the absence was detected on the second attempt. Excluded from the study were people visiting at home, Long Term Care Institution, commercial establishments and uninhabited households.

Clinical examination and interview

A structured questionnaire was applied that included: sociodemographic, behavioral, medical and history data. This information was obtained by question blocks from the PCATool-Brasil instrument [14]. The instrument used to assess nutritional status was the Mini Nutritional Assessment (MAN®) [15]. Body Mass Index (BMI) was defined by weight (in kg) divided by height (in m^2), which was calculated from the nutritional assessment. Weight was verified using an EKS® electronic scale (Kowloon, Hong Kong), with a maximum weight of 200 kg. Height evaluations were measured in vertical position, using an anthropometric ruler (WISO®, São José, Brazil) fixed to the wall with a movable cursor graduated in centimeters. Oral health was assessed by counting teeth and verifying the use of and need for rehabilitation with dental prostheses, according to the criteria of the World Health Organization (WHO) [16]. Clinical oral examinations were performed with a wooden spatula, without the use of artificial lighting and mouth mirrors.

The individuals were examined and interviewed between December 2018 and January 2019, by teams composed of an interviewer, an oral health examiner, and an anthropometric measurement examiner. The researchers were previously trained and calibrated by the study coordinators in order to ensure uniformity of data. Training consisted of theoretical classes on the subject, discussion of all questions in the questionnaire and explanations about oral health exams and anthropometric measures. Before data collection, application of the questionnaire, oral health examinations and anthropometric measurements were trained with older adults patients undergoing treatment at dental clinics of the University of Passo Fundo. The intra-examiner and inter-examiner reproducibility for clinical oral health examination was verified using 5% of the whole-sample, 14 days after the initial examination. These individuals were randomly selected. Kappa coefficients for intra-examiner and inter-examiner tooth loss were 0.89. The intra-examiner and inter-examiner kappa coefficients for use of dental prosthesis were 1.00 and 0.935, respectively. Kappa coefficients for need for dental prosthesis were 1.00 to both intra-examiner and inter-examiner.

Statistical analysis

The dependent variable of the present study was nutritional status, using MAN® tool. The instrument classifies individuals as normal nutritional status (eutrophic), under risk of malnutrition and malnourished. For data analysis, sample was dichotomized as eutrophic or at nutritional risk (which included those with risk of malnutrition and malnourished). The independent variables were: age (in years), sex, ethnicity/skin color, level of education, living area, retirement, marital status, number of diseases, number of medicines used, smoking exposure (smokers, ex-smokers, and non-smokers), exposure to alcohol (yes or no), access to the dentist in the last 12 months, need for prosthesis, use of prosthesis and edentulism.

Regarding sex, only male and female sex options were available. Ethnicity/skin color was categorized as white or non-white. The non-white group included those who referred to be black, yellow, brown or indigenous. The level of education was categorized as low, which includes older adults with up to complete elementary school, including illiterates, and medium/high, for those with at least incomplete high school. Living area included older adults from urban or rural areas, and this information was based on data available in maps of Veranópolis. Retirement was categorized into three groups: one with non-retired, another with retired that do not have any labor activity, and a third group with retired individuals that continue with some work activity. The marital status was categorized into two groups: married and not-married. Not-married were those older adults that reported to be widow, single or divorced.

The number of self-reported illnesses was assessed by the question: "Do you have any health problems that have lasted or are likely to last for more than a year, such as a physical, mental or emotional problem?" The self-reported answers were then categorized by the referred quantity. Number of daily medications was measured by the question: "Are you taking any daily medication?" Affirmative responses were checked by the physical presence of the medication and its medicine package insert. Then, the answer was categorized into: none, one, two, between 3 and 5 and ≥6. Polypharmacy was considered when the individual reported using ≥2 daily medications as previously reported in the literature [17].

The use of dental prosthesis was categorized as yes and no. Dental prosthesis users were considered when at least one fixed prosthesis, one removable partial dentures or complete denture were present during oral examination. The need for dental prosthesis was also categorized as yes and no. Older adults that needed partial or total prosthesis, in at least one arch, were considered to need a prosthesis. Edentulism was dichotomized was yes (no teeth present during oral examination) and no (older adults presenting at least one tooth present).

Data analysis was performed using the SPSS 21 statistical package (SPSSInc., Chicago, United States). Associations between dependent and independent variables were assessed using the chi-square or Mann-Whitney tests and presented by frequency distribution. The level of significance adopted was 5%. Uni- and multivariate analyses were performed, using Logistic Regression with backwards technique to verify the association between the dependent variable and the independent variables. Two independent multivariate models were constructed, one using number of daily medication and another using polypharmacy (≥2 daily medications). To both models, only those variables that presented $p<0.20$ in the univariate analysis were included in the multivariate model. The maintenance of independent variables in the final model was determined by a combination of $p<0.05$ and analysis of effect changes. Multicollinearity analyses between independent variables were performed, but none was observed.

RESULTS

Overall, 282 older adults were interviewed and examined, 244 (86.5%) in the urban area and 38 (13.5%) in the rural area, as described in figure 1. None of the variables demonstrated any missing data. When considering the whole-sample, mean age was 71.42 (SD ±7.89). Eighty-one (28.7%) and 201 (71.3%) males and females, respectively, were included. Regarding ethnicity/skin color, 252 (89.4%) declared themselves as whites. Lower level of education was reported by 225 (79.8%) individuals, of which 17 (6%) were illiterate. Approximately, 53% were married. The

prevalence of nutritional risk was 14.5% (n=41), of which only one older adult was considered malnourished. It showed a statistically significant association with nutritional status the following variables: marital status, number of self-reported diseases, number of daily medications, smoking exposure, alcohol exposure, access to the dentist and edentulism (table 1). Polypharmacy was detected in 73.0% (n=206) of the older adults at nutritional risk. This variable was also significantly associated with nutrition status.

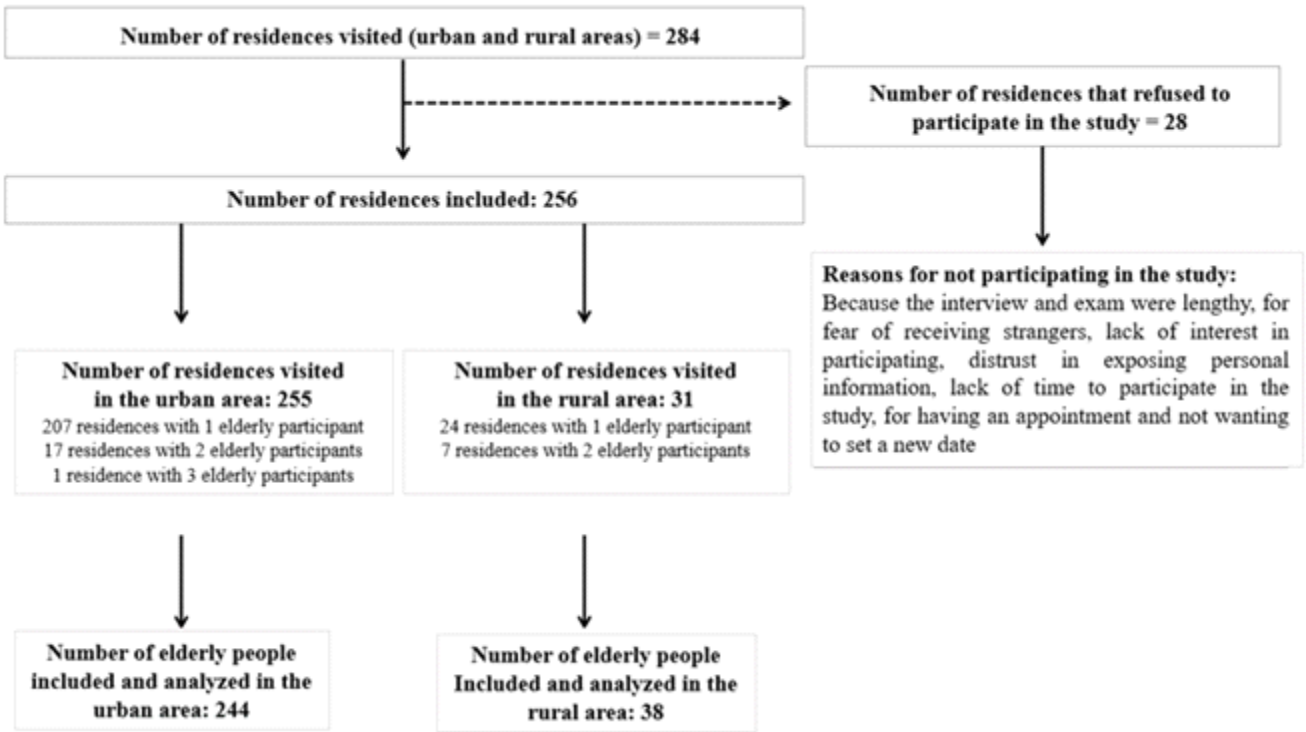

Figure 1. Flowchart of the number of residences visited.

Table 1. Association between the nutrition status and sociodemographic, behavioral, and medical and dental history among older adults, Veranópolis, 2019.

1 of 2

Variables		Eutrophics N=241 (85.5%)	Nutritional Risk N=41 (14.5%)	P-value
BMI	Mean ± SD	28.64±4.89	28.19±6.68	0.209#
Age (in years)	Mean ± SD	71.00±7.44	73.88±9.94	0.115#
Sex	Male – n (%) Female – n (%)	73 (30.3) 168 (69.7)	8 (19.5) 33 (80.5)	0.159*
Ethnicity/skin color	White – n (%) Non-white – n (%)	218 (90.5) 23 (9.5)	34 (82.9) 7 (17.1)	0.148*
Level of education	Low – n (%) Medium/High – n (%)	189 (78.4) 52 (21.6)	36 (87.8) 5 (12.2)	0.167*
Living area	Urban – n (%) Rural – n (%)	207 (85.9) 34 (14.1)	37 (90.2) 4 (9.8)	0.451*
Retirement	Not retired – n (%) Retired – n (%) Retired and working – n (%)	26 (10.8) 153 (63.5) 62 (25.7)	7 (17.1) 30 (73.2) 4 (9.8)	0.064*
Marital status	Married – n (%) Not-Married – n (%)	137 (56.8) 104 (43.2)	13 (31.7) 28 (68.3)	0.003*

Table 1. Association between the nutrition status and sociodemographic, behavioral, and medical and dental history among older adults, Veranópolis, 2019.

Variables		Eutrophics N=241 (85.5%)	Nutritional Risk N=41 (14.5%)	P-value
Number of self-reported diseases	0 – n (%)	33 (13.7)	1 (2.4)	0.023*
	1 – n (%)	74 (30.7)	10 (24.4)	
	2 – n (%)	61 (25.3)	8 (19.5)	
	3 – n (%)	47 (19.5)	12 (29.3)	
	≥4 – n (%)	26 (10.8)	10 (24.4)	
Number of daily medications	0 – n (%)	34 (14.1)	1 (2.4)	<0.001*
	1 – n (%)	39 (16.2)	2 (4.9)	
	2 – n (%)	43 (17.8)	3 (7.3)	
	3 to 5 – n (%)	80 (33.2)	16 (39.0)	
	≥6 – n (%)	45 (18.7)	19 (46.3)	
Polypharmacy	No (<2/day) – n (%)	73 (30.3)	3 (7.3)	0.002*
	Yes (≥2/day) – n (%)	168 (69.7)	38 (92.7)	
Smoking exposure	Smokers – n (%)	16 (6.6)	4 (9.8)	0.307*
	Former smokers – n (%)	55 (22.8)	13 (31.7)	
	Never smokers – n (%)	170 (70.5)	24 (58.5)	
Alcohol exposure	Yes – n (%)	141 (58.5)	15 (36.6)	0.009*
	No – n (%)	100 (41.5)	26 (63.4)	
Access to the dentist	Yes – n (%)	118 (49.0)	13 (31.7)	0.041*
	No – n (%)	123 (51.0)	28 (68.3)	
Need for dental prosthesis	Yes – n (%)	66 (27.4)	10 (24.4)	0.689*
	No – n (%)	175 (72.6)	31 (75.6)	
Use of dental prosthesis	Yes – n (%)	207 (85.9)	39 (95.1)	0.102*
	No – n (%)	34 (14.1)	2 (4.9)	
Edentulism	Yes – n (%)	106 (44.0)	31 (75.6)	<0.001*
	No – n (%)	135 (56.0)	10 (24.4)	

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

Table 2 shows the univariate analysis for the association between nutritional status and exploratory variables. Age was associated with nutritional status. For every one-year-old increase, there is a 0.5% increase in Odds Ratio (OR) of the older adult be at nutritional risk. Retired individuals with some work activity had 76% lower OR for nutritional risk in comparison to non-retired (OR: 0.24; 95% confidence interval [95% CI]: 0.07 – 0.89). Not-married individuals had 183% higher OR for nutritional risk when compared to married ones. Older adults that reported 3 or ≥4 diseases had, respectively, 8.43 (95% CI: 1.04 – 67.98) and 12.69 (95% CI: 1.53 – 105.63) higher OR for nutritional risk when compared to those without any self-reported disease. Older adults that use ≥6 daily medications had 14.36 (95% CI: 1.83 – 112.59) higher chances for nutritional risk when compared with those that did not use any medication. Those not exposed to alcohol had a 144% (p=0.011) higher OR for nutritional risk when compared to users of alcohol. Older adults without access to the dentist in the last 12 months had 107% (p=0.044) higher OR for nutritional risk when compared to older adults with access to the dentist. In addition, non-edentulous individuals had 75% (p<0.001) lower OR for nutritional risk when compared to edentulous.

In addition to the variables presented, sex, skin color, educational level and use of prostheses were included in the initial multivariate model. Table 3 shows the final multivariate analysis for the association between nutritional status and exploratory variables. It remained significantly associated with nutritional status, number of daily medications and edentulism. Those that use ≥6 daily medications had (OR: 12.16; 95% CI: 1.47 – 100.82) significantly higher OR for nutritional risk when compared to those that do not use medication. In contrast, non-edentulous individuals had 68% (p = 0.006) lower OR for nutritional risk when compared with edentulous.

Table 2. Univariate analysis of the association between nutritional status and independent variables, Veranópolis, 2019.

Variables		Odds Ratio (95% CI)	P-value
Age		1.05 (1.01 – 1.09)	0.033
Sex	Male	Ref.	0.163
	Female	1.79 (0.79 – 4.07)	
Ethnicity/skin color	White	Ref.	0.154
	Non-white	1.95 (0.78 – 4.90)	
Level of education	Low	Ref.	0.174
	Medium/High	0.51 (0.19 – 1.35)	
Living area	Urban	Ref.	0.453
	Rural	0.66 (0.22 – 1.96)	
Retirement	Not retired	Ref.	
	Retired	0.73 (0.29 – 1.83)	0.500
	Retired and working	0.24 (0.07 – 0.89)	0.033
Marital status	Married	Ref.	0.004
	Not-married	2.83 (1.40 – 5.75)	
Number of self-reported diseases	0	Ref.	
	1	4.46 (0.56 – 36.28)	0.162
	2	4.33 (0.52 – 36.11)	0.176
	3	8.43 (1.04 – 67.98)	0.045
	≥4	12.69 (1.53 – 105.63)	0.019
Polypharmacy	No (<2/day)	Ref.	0.006
	Yes (≥2/day)	5.50 (1.65 – 18.40)	
Number of daily medications	0	Ref.	
	1	1.74 (0.15 – 20.09)	0.656
	2	2.37 (0.24 – 23.84)	0.463
	3 to 5	6.80 (0.87 – 53.34)	0.068
	≥6	14.36 (1.83 – 112.59)	0.011
Smoking exposure	Smokers	Ref.	
	Former smokers	0.95 (0.27 – 3.30)	0.930
	Never smokers	0.57 (0.17 – 1.83)	0.341
Alcohol exposure	Yes	Ref.	0.011
	No	2.44 (1.23 – 4.85)	
Access to the dentist	Yes	Ref.	0.044
	No	2.07 (1.02 – 4.18)	
Need for dental prosthesis	Yes	Ref.	0.690
	No	1.17 (0.54 – 2.52)	
Use of dental prosthesis	Yes	Ref.	0.120
	No	0.31 (0.07 – 1.35)	
Edentulism	Yes	Ref.	<0.001
	No	0.25 (0.12 – 0.54)	

Table 3. Multivariate analysis of the association between nutritional status, including number of daily medications as an independent variable, Veranópolis, 2019.

1 of 2

Variables		Odds Ratio (95%IC)	P-value
Ethnicity/skin color	White	Ref.	0.440
	Non-White	1.51 (0.53 – 4.31)	
Retirement	Not retired	Ref.	
	Retired	0.61 (0.21 – 1.76)	0.363
	Retired and working	0.45 (0.10 – 1.98)	0.293

Table 3. Multivariate analysis of the association between nutritional status, including number of daily medications as an independent variable, Veranópolis, 2019.

Variables		Odds Ratio (95%IC)	P-value
Marital status	Married	Ref.	0.204
	Not-married	1.66 (0.76 – 3.62)	
Number of daily medications	0	Ref.	
	1	2.32 (0.19 – 28.29)	0.509
	2	2.66 (0.25 – 28.30)	0.416
	3 to 5	7.21 (0.86 – 60.41)	0.069
	≥6	12.16 (1.47 – 100.82)	0.021
Exposure to alcohol	Yes	Ref.	0.180
	No	1.69 (0.79 – 3.63)	
Edentulism	Yes	Ref.	0.006
	No	0.32 (0.14 – 0.73)	

When the other multivariate analysis was performed, considering polypharmacy as an independent variable, the same trend of results was observed. Edentulism remaining associated with the nutritional risk (table 4), and polypharmacy showed a statistically significant association with nutritional risk (OR: 4.65; 95% CI: 1.33 – 16.23).

Table 4. Multivariate analysis of the association between nutritional status, including polypharmacy as an independent variable, Veranópolis, 2019.

Variables		Odds Ratio (95%IC)	P-value
Skin color	White	Ref.	0.475
	Non-white	1.45 (0.52 – 4.07)	
Retirement	Not retired	Ref.	
	Retired	0.60 (0.22 – 1.67)	0.332
	Retired and working	0.39 (0.09 – 1.61)	0.192
Marital status	Married	Ref.	0.120
	Not-married	1.83 (0.85 – 3.93)	
Polypharmacy	No (<2/day)	Ref.	0.016
	Yes (≥2/day)	4.65 (1.33 – 16.23)	
Alcohol exposure	Yes	Ref.	0.112
	No	1.84 (0.87 – 3.89)	
Edentulism	Yes	Ref.	0.007
	No	0.34 (0.15 – 0.75)	

DISCUSSION

The present study demonstrated that the prevalence of risk of nutritional malnutrition was low and significantly associated with higher number of daily medications, polypharmacy and edentulism among older adults. The knowledge of physiological, physical and mental changes of these individuals are upmost importance, as they are directly correlated with overall health and quality of life [18]. In this sense, nutritional status is one of the main factors that can interfere in healthier process, including a better quality of life.

Veranópolis may be considered a small city, but it was chosen because it is one of the first cities on human aging in Brazil [13]. The present study demonstrated a lower prevalence of poor nutritional status (14.5%), which is slightly

lower than observed in most studies with similar methodology. In general, the prevalence in home-based studies range between 26.4% [19] to 48.4% [5]. However, a nutritional risk of 48.8% was also observed in a population-based study conducted in another city in Brazil [5]. In general, the prevalence of nutritional risk 50% or higher is observed in studies conducted in homes for the aged, such as nursing homes, geriatric homes or hospitals [20]. The low prevalence of nutritional risk observed in the present study may be explained by the socioeconomic characteristics of Veranópolis. The city has a high Human Development Index, with high longevity and level of income in comparison to other cities of Brazil [10]. The city is also known, since 1990, as the land of longevity. Moreover, WHO granted the title of Age-friendly City. This distinction is explained by several projects and research developed in the city, which includes health care and leisure. This also includes continuous monitoring of physical and mental conditions of older adults participants.

Oral health conditions are among the main factors that can influence the improvement of nutritional status, and this is particularly important among older adults [21]. In the present study, edentulism (loss of all teeth) was associated with nutritional risk. Both tooth loss and edentulism are consequences of poor oral health conditions, being the final result of cumulative effect of the most prevalent oral diseases [22]. This is particularly important in countries with great socioeconomic inequalities, such as Brazil, where the differences in terms of income and educational level are among the largest in the world [10]. In the present study, 48.58% of the older adults edentulous. Unfortunately, this high prevalence is observed in several Brazil's regions. In fact, more than 50% of Brazilians older adults were considered edentulous or had a severe mean tooth loss [7]. This reality implies the need for oral rehabilitation for approximately 70% of older adults from Brazil [8]. These two aspects, partial or total tooth loss and need for oral rehabilitation, are generally interconnected and might affect nutritional status of older adults [4,5].

In this sense, maintaining the largest number of teeth during life would be important, as literature shows that lower number of teeth present is observed in older adults at nutritional risk or malnourished [4]. The literature also demonstrates that lack of partial or complete rehabilitation in edentulous people was associated with higher prevalence ratio of nutritional risk [5]. In fact, masticatory efficiency can be compensated, in part, by an adequate oral rehabilitation [5]. In addition, reduction in masticatory function occurs during aging process and can cause a reduction in the individuals' physical and motor capacity [23]. In addition to this naturally occurring process, lower number of remaining natural teeth and lack of oral rehabilitation can also inhibit the desire to eat, decreasing the ingestion of more nutritious foods [24].

Nutritional risk was significantly associated with higher number of daily medications (≥6) and polypharmacy (≥2 drugs/day). These two analyses were performed, as there is no unanimity about the minimum number of drugs to consider a polymedicated individual, ranging from two to five [25]. The association with poor nutritional status and higher number of medications is well-established in the literature [26]. Partially, these findings may be explained by the higher rates of overweight and obesity among older adults with higher numbers of daily medications [27]. Moreover, limited physical activities, detected in those with higher number of medications might explain this association [28]. However, it is important to emphasize that appetite is not significantly associated with number of daily medications [29].

The strong exposure between drugs used by older adults and the nutrients must be taken into consideration when interpreting these results. These events are commonly detected among older adults and may lead to exponential incidences of adverse drug reactions, interactions between medications and between drugs and food [30]. One characteristic of adverse drug reactions is the impairment of nutrient absorption process, which may explain the results detected in the present study [31].

The association between sociodemographic and behavioral factors with nutritional status was not observed in the adjusted analyses of the present study. Although this association has not been observed, it must always be considered in the analysis of nutritional risk. In the univariate analyses, it was demonstrated a better nutritional status among those who are retired and working. Literature shows that work life activities, among older adults, are significantly associated with cognitive [32], depression, and other health-related outcomes [33]. In contrast, higher PR for nutritional risk was demonstrated among those who reported being non-users of alcohol. Despite of these findings, readers must understand that after appropriate adjustment for confounders both retirement and alcohol exposure were not significantly associated with nutritional status, which emphasize the need for adjusted analyses when assessing the nutritional status. Moreover,

literature shows that alcohol exposure is not significantly associated with nutrition status, which emphasizes the findings of the present study [1].

Issues involving oral health are directly linked to income and educational level. The literature associated lower level of education with higher prevalence of edentulism [7, 34]. Moreover, lower income, in most cases, may prevents the choice of more expensive treatments, which includes oral rehabilitation [7].

This study is representative of the socioeconomic strata of older adults from Veranópolis, Brazil. For this reason, a study with a probabilistic sample per cluster was performed. In this sense, there was proportionality among older adults living in urban and rural areas. Level of education of the included individuals was similar to that observed in the last national census for this city [10]. In addition, examiners were trained and calibrated to data collect, which increases the internal validity. On the other hand, this study has some limitations. The cross-sectional design, which did not allow temporality of the associations between nutritional assessment and exploratory variables. Additionally, there was no question about the reasons for tooth loss or a clinical examination for to assess caries and periodontal disease. The quality of prosthetic rehabilitation and masticatory capacity were also not evaluated. In addition, the mental status of the older was assessed according to the researchers' discretion, as no formal questionnaire was used for it. Despite the limitations, the study design allows data generalization for comparisons with other home-based studies with a representative sample.

CONCLUSION

It was concluded that the prevalence of nutritional risk was low in among older adults and it was associated with edentulism and higher number of daily medications.

Acknowledgements

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001. All other funding was self-supported by the authors. The authors report no conflict of interest related to this study.

Collaborators

EW Lucca, analyzed the data, validated the results, reviewed the literature, wrote the manuscript, and approved the final version of the manuscript. FWMG Muniz, designed the study, analyzed the data, supervised the study, wrote the manuscript, and approved the final version of the manuscript. PRG Colussi And ACB Marchi, designed the study, collected the data, and approved the final version of the manuscript. LMB Stoffel, collected the data, and approved the final version of the manuscript. GS Cruz, validated the results, reviewed the literature, wrote the manuscript, and approved the final version of the manuscript.

REFERENCES

1. O'Keeffe M, Kelly M, O'Herlihy E, O'Toole PW, Kearney PM, Timmons S, et al. Potentially modifiable determinants of malnutrition in older adults: A systematic review. Clin Nutr. 2019;38(6):2477-98. http://dx.doi.org/10.1016/j.clnu.2018.12.007
2. Gasmi A, Noor S, Tippairote T, Dadar M, Menzel A, Bjørklund G. Individual risk management strategy and potential therapeutic options for the COVID-19 pandemic. Clin Immunol. 2020:108409. http://dx.doi.org/10.1016/j.clim.2020.108409
3. Wu LL, Cheung KY, Lam PYP, Gao XL. Oral health indicators for risk of malnutrition in elders. J Nutr Health Aging. 2018;22(2):254-61. http://dx.doi.org/10.1007/s12603-017-0887-2
4. Toniazzo MP, Amorim PS, Muniz FWMG, Weidlich P. Relationship of nutritional status and oral health in elderly: Systematic review with meta-analysis. Clin Nutr. 2018;37(3):824-30. http://dx.doi.org/10.1016/j.clnu.2017.03.014
5. Stoffel LMB, Muniz FWMG, Colussi PRG, Rösing CK, Colussi EL. Nutritional assessment and associated factors in the elderly: apopulation-based cross-sectional study. Nutrition. 2018;55-56:104-10. http://dx.doi.org/10.1016/j.nut.2018.03.053
6. Chen MX, Zhong YJ, Dong QQ, Wong HM, Wen YF. Global, regional, and national burden of severe periodontitis, 1990-2019: an analysis of the Global Burden of Disease Study

2019. J Clin Periodontol. 2021;48(9):1165-88. http://dx.doi.org/10.1111/jcpe.13506

7. Dias JJ, Muniz FWMG, Colaço J, Marostega MG, Peron D, Rösing CK, et al. Tooth loss and associated factors in the elderly in Cruz Alta, Brazil: a crosssectional study. Acta Odontol Latinoam. 2019;32(3):172-80.
8. Azevedo JS, Azevedo MS, Oliveira LJC, Correa MB, Demarco FF. [Needs for dental prostheses and their use in elderly Brazilians according to the National Oral Health Survey (SBBrazil 2010): prevalence rates and associated factors]. Cad Saude Publica. 2017;33(8):e00054016. http://dx.doi.org/10.1590/0102-311X00054016
9. Bong CL, Brasher C, Chikumba E, McDougall R, Mellin-Olsen J, Enright A. The COVID-19 Pandemic: Effects on Low and Middle-Income Countries. Anesth Analg. 2020;131(1):86-92. http://dx.doi.org/10.1213/ANE.0000000000004846
10. Brasil. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010: resultados. Rio de Janeiro, 2011. [cited 2022 December 4]. Available from: <https://censo2010.ibge.gov.br/resultados.html>.
11. Brasil. Instituto Brasileiro de Geografia e Estatística. Cidades e estados. Índice de Desenvolvimento Humano, 2010. Brasília, 2010. [cited 2022 December 4]. Available from: <https://www.ibge.gov.br/cidades-e-estados/rs/veranopolis.html>.
12. Brazil. Ministério da Saúde. Índice de Gini da Renda Domiciliar per capita – Rio Grande do Sul. Brasília, 2010. [cited 2022 December 4]. Available from: http://tabnet.datasus.gov.br/cgi/ibge/censo/cnv/ginirs.def.
13. Rosalen NP, Muniz FWMG, Scalco NR, Dezingrini KDS, Colussi EL, Pires ALC, et al. What variables are associated with use of and need for dental prosthesis? A cross-sectional study. Gerodontology. 2022;39(2):177-86. http://dx.doi.org/10.1111/ger.12552
14. Brasil. Ministério da Saúde. Manual do instrumento de avaliação da atenção primária à saúde. Brasília, 2010. [cited 2022 December 4]. Available from: <https://bvsms.saude.gov.br/bvs/publicacoes/manual_avaliacao_pcatool_brasil.pdf>.
15. Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. The Mini Nutritional Assessment. Clin Geriatr Med. 2002;18(4):737-57. http://dx.doi.org/10.1016/s0749-0690(02)00059-9
16. World Health Organization. Oral health surveys: basic methods. 4a ed. Geneva: World Health Organization; 1997 [cited 2022 December 4]. Available from: <https://apps.who.int/iris/handle/10665/41905>.
17. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. BMC Geriatr. 2017;17(1):230.
18. Govindaraju T, Sahle BW, McCaffrey TA, McNeil JJ, Owen AJ. Dietary patterns and quality of life in older adults: a systematic review. Nutrients. 2018;10(8):971. http://dx.doi.org/10.3390/nu10080971
19. Khoury C, Samot J, Helmer C, Rosa RW, Georget A, Dartigues JF, et al. The association between oral health and nutritional status in older adults: a cross-sectional study. BMC Geriatr. 2022;22(1):499. http://dx.doi.org/10.1186/s12877-022-03133-0
20. Grammatikopoulou MG, Gkiouras K, Theodoridis X, Tsisimiri M, Markaki AG, Chourdakis M, et al. Food insecurity increases the risk of malnutrition among community-dwelling older adults. Maturitas. 2019;119:8-13. http://dx.doi.org/10.1016/j.maturitas.2018.10.009
21. Shiga Y, Nezu T, Hosomi N, Aoki S, Nishi H, Naito H, et al. Effect of tooth loss and nutritional status on outcomes after ischemic stroke. Nutrition. 2020;71:110606. http://dx.doi.org/10.1016/j.nut.2019.110606
22. Roberto LL, Crespo TS, Monteiro-Junior RS, Martins AMEB, De Paula AMB, Ferreira EF, et al. Sociodemographic determinants of edentulism in the elderly population: A systematic review and meta-analysis. Gerodontology. 2019;36(4):325-37. http://dx.doi.org/10.1111/ger.12430
23. Fan Y, Shu X, Leung KCM, Lo ECM. Associations of general health conditions with masticatory performance and maximum bite force in older adults: A systematic review of cross-sectional studies. J Dent. 2022;123: 104186. http://dx.doi.org/10.1016/j.jdent.2022.104186
24. Shokry AAE, Adel MR, Rashad AE-sA. Educational program to improve quality of life among elderly regarding oral health. Future Dental J. 2018;4(2):211-5. https://doi.org/10.1016/j.fdj.2018.07.002
25. García-Caballero TM, Lojo J, Menéndez C, Fernández-Álvarez R, Mateos R, Garcia-Caballero A. Polimedication: applicability of a computer tool to reduce polypharmacy in nursing homes. Int Psychogeriatr. 2018;30(7):1001-8.
26. Kok WE, Haverkort EB, Algra YA, Mollema J, Hollaar VRY, Naumann E, et al. The association between polypharmacy and malnutrition (risk) in older people: a systematic review. Clin Nutr ESPEN. 2022;49:163-71. https://doi.org/10.1016/j.clnesp.2022.03.007
27. Ye L, Yang-Huang J, Franse CB, Rukavina T, Vasiljev V, Mattace-Raso F, et al. Factors associated with polypharmacy and the high risk of medication-related problems among older community-dwelling adults in European countries: a longitudinal study. BMC Geriatr. 2022;22(1):841. https://doi.org/10.1186/s12877-022-03536-z
28. Hsu HF, Chen KM, Belcastro F, Chen YF. Polypharmacy and pattern of medication use in community-dwelling older adults: a systematic review. Journal of clinical nursing. 2021;30(7-8):918-28. https://doi.org/10.1111/jocn.15595
29. Chareh N, Kiesswetter E, Kob R, Hannink A, Brandl B, Skurk T, et al. Association between inflammation and appetite in healthy community-dwelling older adults – an enable study. Front Aging. 2022;3:826816. https://doi.org/10.3389/fragi.2022.826816
30. Martin-Cantero A, Reijnierse EM, Gill BMT, Maier AB. Factors influencing the efficacy of nutritional interventions on muscle mass in older adults: a systematic review and meta-analysis. Nutr Rev. 2021;79(3):315-30.
31. Galmés S, Reynés B, Palou M, Palou-March A, Palou A. Absorption, distribution, metabolism, and excretion of the main olive tree phenols and polyphenols: a literature review.

J Agric Food Chem. 2021;69(18):5281-96. https://doi.org/10.1021/acs.jafc.1c00737

32. Calatayud E, Lozano-Berges G, Peralta-Marrupe P, Latorre E, Gomez-Soria I. Job demands may determine cognitive and physical aging after retirement. J Appl Gerontol. 2022;41(12):2435-46. https://doi.org/10.1177/07334648221120080

33. Andrea SB, Eisenberg-Guyot J, Oddo VM, Peckham T, Jacoby D, Hajat A. Beyond hours worked and dollars earned: multidimensional eq, retirement trajectories and health in later life. Work Aging Retire. 2022;8(1):51-73.

34. Margozzini P, Berrios R, García-Huidobro R, Véliz C, Valle CD, Vargas JP, et al. Number of Remaining Teeth and Its Association with Educational Level in Chilean Adults: Data from the National Health Survey 2016-2017. Int J Dent. 2020;2020:8848190. https://doi.org/10.1155/2020/8848190

Received on: 5/7/2022
Final version resubmitted on: 12/12/2022
Approved on: 20/12/2022

Assistant editor: Luciana Butini Oliveira