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Low diet quality in older adults: a population-based study in southern Brazil

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Abstract *The aim of this study was to identify the factors associated with low diet quality in older adults from the city of Pelotas, Southern Brazil. Information on food consumption was collected using a reduced food frequency questionnaire, and diet quality was assessed by the Elderly Diet Quality Index DQI-E ("Índice de Qualidade da Dieta de Idosos - IQD-I"), devised by the authors. Points were attributed to each food evaluated according to frequency of consumption. Higher consumption frequency of healthy foods received higher scores whilst unhealthy foods received lower scores. Scores were divided into tertiles classified as: low quality, intermediate quality, and good quality. Multinomial logistic regression was used to assess the association between diet quality and the independent variables. The factors associated with low diet quality were: male gender, age < 80 years, low education, problems affording food, underweight, mouth or teeth problems, and having less than four meals a day. Important barriers to the consumption of a good quality diet were observed, highlighting the importance of considering these aspects in the promotion of healthy eating among older adults.*
Key words *Food habits, Feeding behavior, Elderly nutrition, Cross-sectional studies*

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Introduction

Lower fertility and mortality rates, coupled with increased life expectancy, have made the elderly (≥ 60 years) population the fastest growing age group over recent years in most countries[1]. The proportion of older adults worldwide is set to rise from 11.7% in 2013 to 21.2% by 2050, when life expectancy at birth in Brazil will be 82 years[2].

Recent estimates show that almost 60% of Brazilian elderly are overweight[3] and around 80% have at least one non-communicable chronic disease (CNCD)[4]. An unhealthy diet increases the risk of developing CNCDs, an important cause of disability and premature death[5]. Thus, concerted efforts have been made for the adoption of a healthy diet as a means of promoting healthy aging.

In Brazil, the Ministry of Health (MS) released the Dietary Guide (recently revised) for the Brazilian population[6], aimed at fostering the adoption of a healthy diet among adults and elderly[7]. In the first version of the Dietary Guide, the recommendations focused on the ideal intake of a number of food groups based on the Brazilian food pyramid, whereas in the second version, the attitudes favoring healthier dietary behavior are outlined.

Naturally occurring aging is associated with anatomical and functional changes in the organism that impact the health and nutritional status of older adults[8]. Barriers to healthy food consumption in this age group can be attributed to a number of different factors: social environment, functional difficulties purchasing or preparing foods, financial difficulties, changes in cognitive ability, physiological changes in taste sensations, decline in olfactory function and changes in the digestion and absorption of nutrients[9].

Studies assessing diet quality of the elderly remain scarce, particularly in Brazil[10-12]. The few studies on the subject have shown that generally less than 10% of Brazilian elderly have an adequate diet and that most need to modify their diets to meet nutritional needs[10,11]. Given the rapid process of population aging and consequent increase in the burden of chronic diseases, together with the effects of unhealthy diet on the general health status of older adults, identifying the factors associated with low diet quality among this population has become especially important. In addition, assessing diet quality in the elderly is a timely topic that can help inform the devising of policies on nutrition aimed at this population. Therefore, the objective of this study was to identify the factors associated with diet quality of older adults from the city of Pelotas, Rio Grande do Sul state.

Methods

A cross-sectional, population-based study of a sample of the population aged 60 or over in the city of Pelotas was carried out between January and August 2014. Pelotas is a medium-sized city located in the Southern part of Rio Grande do Sul (RS) state with a population of around 330,000[13]. The survey, comprising a research consortium of Masters students in Epidemiology[14], was designed to assess different aspects of the general health status of the elderly residents of the city.

The sample size required to meet the consortium objectives was 1,649 older persons. For the sampling process, census sectors of the urban zone of Pelotas[15] were ranked according to average income. Sectors containing 14 older adults or fewer were pooled together with one or more adjacent groups of similar average income, giving a total of 469 eligible sectors. Of this total, 133 sectors were systematically selected. A total of 31 households per sector were systematically selected for identification of around 12 elderly individuals in each sector (based on 0.4 elderly per household), giving 4,123 interviewees to be visited.

The sample size of the study was estimated based on an outcome prevalence of 50% (corresponding to maximum variability), confidence level of 95%, sampling error of 4% and design effect of 1.5. After the addition of a further 10% for drop-outs and refusals, the estimated minimum number of elderly for inclusion in the study was 990 individuals.

The inclusion criteria for the research consortium were non-institutionalized older adults aged 60 years or older living in the urban zone of Pelotas. The specific exclusion criteria for this study were elderly on enteral or parenteral nutrition.

Food intake for the past week was assessed using the reduced 11-item Food Frequency Questionnaire (FFQ) devised for the study based on recommendations from the first edition of the Dietary Guide for the Brazilian population[6], the prevailing version at the time of study planning. Given that the use of a more comprehensive food frequency questionnaire was not possible, the main recommendations for food consumption contained in the guide were followed. Consump-

tion of the following foods and/or combination of foods in the past week was investigated: beans and rice; whole foods; fruit; legumes and vegetables; meats (red meat, chicken and fish) or eggs; milk and milk-based products; fried foods; sweet food products, soft-drinks or processed juices; foods in preservatives, processed meats or canned products; frozen foods and ready meals; and fast food.

The combination "rice and beans" was included in the FFQ because it represents a traditional Brazilian dish of good nutritional value ranked highly in the above-mentioned Dietary Guide. Although the same Guide contains recommendations on water consumption, it was decided to include only foods contributing to the calorific value of the diet, given that the aim of the study was to estimate the quality of this diet. The questionnaire was previously tested in a pre-pilot study to identify problems and assess understanding of the instrument.

The dietary quality of the elderly participants was assessed using an index devised by the authors *a posteriori* to data collection called the Elderly Diet Quality Index (DQI-E). First, the weekly frequencies of consumption of each food group from the FFQ were grouped into four categories: not eaten in the past week, eaten on 1-3 days during the week, eaten 4-6 days, and eaten every day of the week. Scores ranging from zero to three were attributed to each category (Chart 1). Given that no recommendations on ideal frequency of food consumption currently exist, higher scores were given for greater frequency of consumption of foods deemed healthy, based on the premise that greater frequencies probably reflect greater consumption of these foods. Thus, foods such as rice and beans, whole foods, fruit, legumes and vegetables, meats and milk and milk-based products were given increasing scores (not consumed = zero points, consumed every day = three points). By contrast, foods deemed unhealthy or of low nutritional value were given decreasing scores (not consumed = three points, consumed every day = zero points), drawing on recommendations that consumption of these foods should be reduced.

Total score on the DQI-E ranged from 0 to 33 points, where high scores are suggestive of higher frequency of consumption of healthy foods and lower frequency of unhealthy foods. Total score on the DQI-E was divided into tertiles classified as: 1st tertile (low score) – low quality; 2nd tertile – intermediate quality; 3rd tertile (high score) – good quality.

The independent variables analyzed in this study were:

. demographic and socioeconomic: sex (male, female), age (collected as discrete numeric variable and later categorized into age brackets 60-69 years, 70-79 years or ≥ 80 years), skin color (as observed by interviewer and classified as white or non-white), marital status (with or without partner), education (collected as cate-

Chart 1. Description of scoring used for calculating the Elderly Diet Quality Index.

Recommendation[a]	Food or group of foods	Category	Criterion score
"Eat foods such as whole grains, beans, fruit, legumes and vegetables, milk and milk-based products, and lean meats, poultry or fish, on a daily basis."	Healthy Rice with beans Whole foods Legumes and vegetables Fruit Meat, poultry, fish or eggs Milk and milk-based products	Not eaten in past week Eaten 1-3 days/week Eaten 4-6 days/week Eaten every day	0 1 2 1
"Reduce consumption of fried foods and those containing a high amount of sugar, fat or salt."	Unhealthy Fried foods Sweet products, soft drinks or processed juices Pickles, processed meats, canned foods Frozen foods Fast food	Not eaten in past week Eaten 1-3 days/week Eaten 4-6 days/week Eaten every day	3 2 1 0

[a] Dietary Guide for the Brazilian population (2008).

gorical variable and classified as 0-3, 4-7, 8-11 or ≥ 12 years of study) and presence of self-reported difficulty affording food (categorized into yes or no);

. food-related behaviors; number of meals consumed per day (< 4 or ≥ 4) and company during meals (alone/accompanied);

. health-related variables: presence of oral problems that affect eating (self-reported) and nutritional status, as assessed by Body Mass Index (BMI) and classified according to Ministry of Health recommendations (underweight, normal weight, overweight[16]). Body weight was measured using digital scales (Tanita®) with capacity of 150 Kg and accurate to the nearest 100 grams. Standing height was estimated based on knee height (measured using a pediatric stadiometer with a 100 cm scale by Indaiá®) employing the equation recommended by Chumlea and Guo[17].

Interviews were conducted at participants´ homes by interviewers educated at least to high school level and previously trained on collecting data and taking anthropometric measurements. Measurement training was based on Habicht´s[18] method of good anthropometric measure collection technique to increase the precision and accuracy of measurements. Interviews were carried out with the aid of notebooks and data collection was checked weekly to identify potential inconsistencies. Quality control of interviews was performed by the supervisors of the field work in 10% of the sample by applying a reduced questionnaire. Given that the FFQ questions referred to the week leading up to the interview, and thus subject to variability, the variable chosen for calculating agreement was education, yielding a weighted Kappa coefficient of 0.83.

Data analysis was conducted using the Stata statistics program, version 12.1 (College Station, United States). After checking for inconsistencies, descriptive analysis was performed to characterize the sample. Multinomial logistic regression was used to obtain the adjusted odds ratio for the DQI-E categories, where the good quality diet category was the reference category. The adjusted analysis was performed at two levels. In the first level, demographic and socioeconomic variables with values < 0.20 on the raw analysis were included in the model. In the second level, the other variables were included. Variables with a p-value of 5-20-% were retained in the model to control for confounders. Variables with p < 0.05 were considered factors associated with the outcome. The sampling design effect was considered in all analyses.

The study was approved by the Research Ethics Committee of the School of Medicine of the Federal University of Pelotas.

Results

Of the total households selected for the sample, 3,799 were identified. For the remaining households, the Masters students were unable to contact dwellers after three attempts on different days and times. A total of 1,844 elderly were located, of which 1,839 were eligible for the study. In total, 1,426 older adults answered the full dietary questionnaire and constituted the final sample of this study. Dropouts and refusals amounted to 10.8% (n=199) and 11.6% (n=214), respectively, comprising predominantly women (60.0%) and individuals aged 60-69 years (59.0%).

A description of the sample studied is given in Table 1. The sample comprised predominantly women (62.8%), individuals aged 60-69 years (52.6%), with white skin color (83,6%), with partner (52.9%), < 8 years´ education (68.2%), and no problems affording food (81.0%). Less than 12% of elderly reported having oral and/or teeth problems affecting eating, while over half were overweight (56.2%). With regard to behavioral variables, the majority of the elderly had ≥ 4 meals daily (77.2%) and ate meals in the company of others (70.4%). Median income per capita was R$ 864.00 (data not shown in table).

The DQI-E had a mean score of 24.2 (SD = 3.8), median 24.0 and amplitude of 11-33 points. The low quality diet tertile ranged from 11-22 points; intermediate 23-16; and good quality 27-33 points (data not shown in table).

Mean scores for each food group or combination of foods by DQI-E category are given in Table 2. Each component is scored on a scale of 0-3 points. Lower means (indicating lower consumption) for healthy foods and unhealthy foods (indicating higher consumption) were found in the low quality diet category. Marked differences in the consumption of whole foods were evident, with a mean of 0.2 points in the low quality category, 0.7 in intermediate, and 1.7 in the good quality category. Mean score for meat consumption was relatively high (≥ 2.5 points) in the low quality category, but significantly lower than for the other categories. Mean score for fast and frozen food consumption was similar across diet quality categories at around 2.9, indicating a low frequency of consumption of these foods, even in the elderly classified as having low and intermediate quality diet.

Table 1. Description of sample according to demographic, socioeconomic, health and behavioral variables. Pelotas, Rio Grande do Sul (n = 1,426).

Variable	N	%
Sex		
Male	530	37.2
Female	896	62.8
Age (years)		
60-69	748	52.6
70-79	450	31.6
≥ 80	225	15.8
Skin color		
White	1.190	83.6
Non-white	234	16.4
Marital status		
Without partner	671	47.1
With partner	753	52.9
Education (full years)		
0-3	526	37.2
4-7	439	31.0
8-11	141	10.0
≥ 12	309	21.8
Cannot afford foods needed		
No	1.120	81.0
Yes	263	19.0
Mouth/teeth problems		
No	1.224	88.5
Yes	159	11.5
Nutritional status[a]		
Underweight	126	9.3
Normal weight	471	34.5
Overweight	767	56.2
Nº of meals/day		
< 4	325	22.8
≥ 4	1.101	77.2
Have meals alone		
No	974	70.4
Yes	409	29.6

[a] Highest number missing: 75.

Raw odds ratios of the independent variables according to DQI-E categories are shown in Table 3. Only the variables skin color and marital status were unassociated with diet quality. On the adjusted analysis (Table 4), the same associations seen in the raw model remained. Men had a 2-fold greater chance of having a low quality diet than women. With regard to age, individuals in the 60-69 age group had 1.3 and 1.8 times greater chance, respectively, of having a low and intermediate quality diet than older age groups. The chance of a low quality diet rose with number of years of education, with the greatest effect observed in elderly with ≤ 3 years of education

(OR = 2.02). Elderly reporting problems affording food had a 2.5 times greater chance of having low quality diet compared to those not reporting this problem. Elderly suffering from mouth or teeth problems had 3.6 and 2.9 times the chance of having low and intermediate quality diets, respectively, than individuals without mouth or teeth problems. Low-weight individuals had a 2.4 times greater chance of having a low quality diet compared to those of normal weight. Elderly that consumed < 4 meals per day had a 2.9 and 1.8 times greater chance of having a low and intermediate quality diet, respectively, compared to those who ate more frequently. Lastly, elderly that ate meals alone had a 1.4 times chance of having an intermediate quality diet compared to individuals that had meals with others.

Discussion

This study identified several factors associated with greater vulnerability to consumption of a low quality diet by older adults. The risk groups consisted of men, younger old individuals, with low educational level, reporting problems affording foods, with low weight and oral problems that affected eating. The study results revealed that consuming meals less frequently was associated with the consumption of a low quality diet.

Greater susceptibility to low quality diet among elderly men was shown in a recent systematic review of the national and international studies[19]. In general, women are more concerned from a young age about weight control and also have the social role of caregivers, which may in turn lead to them taking more care over food choices[20] and explain their better quality diet compared to that of men.

With regard to age, the study of Assumpção[12] conducted in Southeast Brazil found similar results. The authors reported a higher quality diet among elderly age 80 years or older. Another study carried out in the United States in 2012 showed that elderly aged 75 years or older had a better quality diet than younger individuals[21]. The presence of chronic diseases and comorbidities and the desire for better quality of life may encourage elderly (and/or family members) to adopt a healthier diet as a means of managing these conditions and might explain this association, given that these diseases are more prevalent in older individuals.

The skin color variable was not associated with diet quality, corroborating findings of

Table 2. Mean and standard deviation of each component and DQI-E category. Pelotas. Rio Grande do Sul (n = 1,426).

Combination or group of foods[*]	Amplitude score	Diet Quality			p-value
		Low Mean (SD)	Intermediate Mean (SD)	Good Mean (SD)	
Healthy[a]					
Rice with beans	0-3	1.71 (1.1)	2.07 (0.9)	2.40 (0.8)	< 0.001
Whole foods	0-3	0.19 (0.6)	0.70 (1.1)	1.73 (1.3)	< 0.001
Legumes and vegetables	0-3	1.15 (0.9)	1.90 (0.9)	2.48 (0.8)	< 0.001
Fruit	0-3	1.53 (1.0)	2.20 (0.9)	2.74 (0.6)	< 0.001
Meat	0-3	2.61 (0.8)	2.85 (0.4)	2.92 (0.4)	< 0.001
Milk and milk-based products	0-3	1.36 (1.2)	2.18 (1.1)	2.71 (0.7)	< 0.001
Unhealthy[b]					
Sweet products	0-3	1.02 (1.1)	1.65 (1.2)	2.24 (1.0)	< 0.001
Fried foods	0-3	2.27 (0.7)	2.54 (0.6)	2.77 (0.5)	< 0.001
Processed Meats	0-3	2.30 (0.9)	2.50 (0.8)	2.80 (0.5)	< 0.001
Frozen foods	0-3	2.89 (0.3)	2.92 (0.3)	2.97 (0.2)	0.139
Fast-food	0-3	2.91 (0.3)	2.94 (0.2)	2.99 (0.1)	0.126
Total	**0-33**	**19.9 (1.8)**	**24.5 (1.1)**	**28.7 (1.6)**	

[a] Higher means indicate greater frequency of consumption. [b] Higher means indicate lower frequency of consumption.

a previous study[12] showing that this individual characteristic exerts no effect on eating habits, which appear to be very similar among whites and non-whites. Further studies on this issue are warranted.

Other Brazilian studies in older adults failed to find an association between education and dietary quality[10,12], in contrast with some studies conducted in middle-to-high income countries[21-23]. Lower educated individuals generally have lower income and consequently less access to healthy foods[24]. Problems affording foods was associated with greater chance of a low quality diet. Income, along with other variables not assessed such as values connected with foods, appears to exert a major influence at the time of food choice. Studies have shown that a healthy diet is more expensive than typical Western style diets, predominantly consisting of fat and sugar-rich foods[25,26]. In the present study, the lowest DQI-E scores in the low quality category were found for more expensive healthy foods such as whole grains, vegetables, fruit and dairy products.

The relationship between low weight and diet quality observed in the present study was not found in a recently published study with a similar cut-off point for classifying nutritional status[12]. In the present study, elderly with low quality diet had lower intake of foods essential for the daily diet, energy sources, fiber, vitamins and minerals. This type of diet tends to result in calorie intake that is insufficient to meet the nutritional needs of elderly[27] and can lead to weight loss. It is important to point out that, owing to the cross-sectional design of the study, this association is subject to reverse causality bias, although the study objective was to identify associated factors and not to establish a causal relationship.

Problems related to oral health such as tooth loss, poorly fitting prostheses and sensation of dry mouth often seen in elderly, hamper chewing and are associated with lower consumption of foods like meat, fruit and raw vegetables. These foods are considered important for health and therefore oral problems can lead to inadequate levels of intake of protein, fiber, vitamins and minerals[28] resulting in low quality diet[22,23], as evidenced in the present study.

The consumption of fewer meals and having meals alone were associated with a low and/or intermediate quality diet. The new Dietary Guide released in 2014[7] emphasizes the importance of healthy behaviors that favor the adoption of a good quality diet, including having meals in the company of family members and/or friends. The greater frequency of consumption of meals, provided these comprise healthy foods, should be encouraged.

The elderly studied had a low intake of unhealthy foods such as fried foods, pickled products, processed meats, canned foods and particularly frozen and fast foods, whose average scores

Table 3. Bivariate analysis between diet quality and demographic, economic, health and behavioral variables. Pelotas. Rio Grande do Sul (n = 1,426).

Variable	Diet quality[a]			
	Low OR (raw)	p-value	Intermediate OR (raw)	p–value
Sex		< 0.001		0.196
Male	1.89 (1.46; 2.44)		1.20 (0.92; 1.56)	
Female	1.00		1.00	
Age (years)		0.014[t]		0.001t
60-69	1.55 (1.10; 2.22)		1.85 (1.28; 2.68)	
70-79	1.34 (0.87; 2.07)		1.39 (0.93; 2.07)	
≥ 80	1.00		1.00	
Skin color		0.420		0.127
White	1.00		1.00	
Non-white	1.15 (0.78; 1.70)		0.76 (0.52; 1.11)	
Marital status		0.386		
Without partner	0.89 (0.66; 1.19)		0.95 (0.71; 1.29)	0.724
With partner	1.00		1.00	
Education		< 0.001t		
0-3	2.47 (1.58; 3.85)		1.37 (0.93; 2.02)	0.104t
4-7	2.13 (1.46; 3.10)		1.32 (0.94; 1.85)	
8-11	2.10 (1.22; 3.60)		1.27 (0.79; 2.05)	
≥ 12	1.00		1.00	
Cannot afford to foods needed		< 0.001		
No	1.00		1.00	0.007
Yes	2.93 (1.89; 4.55)		1.70 (1.10; 2.60)	
Mouth/teeth problems		< 0.001		
No	1.00		1.00	< 0.001
Yes	3.20 (1.91; 5.35)		2.56 (1.56; 4.20)	
Nutritional Status[b]		0.034		
Underweight	2.67 (1.60; 4.46)		1.67 (0.95; 2.95)	0.034
Normal weight	1.00		1.00	
Overweight	1.33 (0.97; 1.81)		1.30 (0.95; 1.78)	
Nº of meals/day		< 0.001		
< 4	3.39 (2.33;4.93)		2.00 (1.37; 2.93)	< 0.001
≥ 4	1.00		1.00	
Have meals alone		0.144		
No	1.00		1.00	0.027
Yes	1.25 (0.90; 1.74)		1.39 (1.03; 1.88)	

[a] Reference category: good diet quality. [b] Highest number missing: 75. [t] Linear Trend.

were similar across all categories of the DQI-E. This finding represents a positive characteristic of this population because these foods are typically ultraprocessed, contain a high level of calories and fat, and are poor in nutrients. The low intake of these foods could be related to the traditional eating habits of this group established at a time when the availability and consumption of ultraprocessed foods was far lower[29]. In addition, this pattern might be linked to the popular belief that these foods are less digestible and inappropriate beyond a certain age. With greater longevity, the guidance provided by health professionals may also have addressed these aspects and positively influenced the eating habits of these individuals.

Several limitations inherent to this study should be taken into account. The first involves the FFQ employed in the study. The pooling of several foods into a single category may have led to under- or over-estimation of the intake of certain foods. Nevertheless, this form of the instrument has advantages over longer versions for its ease of application and greater adherence of interviewees[30]. The FFQ used in the study en-

Table 4. Final model for factors associated with diet quality of elderly. Pelotas. Rio Grande do Sul (n = 1,426).

Variable	Diet Quality[a]			
	Low OR (adjusted)	p-value	Intermediate OR (adjusted)	p-value
Sex		< 0.001		0.130
Male	1.98 (1.51; 2.59)		1,23 (0.94; 1.60)	
Female	1.00		1.00	
Age (years)		0.029		0.029
60-69	1.37 (0.92; 2.05)		1.82 (1.24; 2.67)	
70-79	1.09 (0.70; 1.71)		1.29 (0.86; 1.93)	
≥ 80	1.00		1.00	
Education		0.004t		0.108t
0-3	2.02 (1.26; 3.25)		1.38 (0.92; 2.08)	
4-7	1.82 (1.24; 2.69)		1.29 (0.90, 1.84)	
8-11	1.83 (1.06; 3.16)		1.19 (0.73; 1.93)	
≥ 12	1.00		1.00	
Cannot afford to foods needed		< 0.001		0.060
No	1.00		1.00	
Yes	2.55 (1.67; 3.89)		1.50 (0.98; 2.29)	
Mouth/teeth problems		< 0.001		< 0.001
No	1.00		1.00	
Yes	3.57 (2.02; 6.33)		2.87 (1.71; 4.80)	
Nutritional Status[b]		0.024		0.024
Underweight	2.38 (1.39; 4.07)		1.43 (0.79; 2.59)	
Normal weight	1.00		1.00	
Overweight	1.30 (0.92; 1.83)		1.22 (0.88; 1.70)	
Nº of meals/day		< 0.001		0.003
< 4	2.86 (1.91; 4.28)		1.78 (1.22; 2.62)	
≥ 4	1.00		1.00	
Have meals alone		0.113		0.029
No	1.00		1.00	
Yes	1.31 (0.94; 1.82)		1.40 (1.04; 1.90)	

[a] Reference category: good diet quality. [b] Highest number missing: 75. [t] Linear Trend.

compassed the food intake of a single week and may not reflect actual eating habits. This recall period, however, was adopted to reduce the effect of memory bias. Because the instrument has not been validated, measurement bias cannot be ruled out, where the dietary intake of the elderly may have included other foods not covered by the instrument. The FFQ applied did not collect information on fat levels of dairy products or meat. However, consumption of these high-fat foods is known to decrease with age[3], possibly as a result of guidance from health professionals and/or family members.

The second limitation of the study concerns the DQI-E. The study did not employ a dietary quality index available in the literature, hampering comparison of findings with the results of other studies. Nevertheless, it should be reit-

erated that the index was devised specifically to estimate the diet quality of the elderly, an area little explored in the literature. Assessment of diet using different scores is an approach also used by other authors[31,32].

The identification of problems affording food and related to oral health affecting eating, as perceived by interviewees, are subjective measure and thus susceptible to information bias. It is likely that individuals in a more severe situation report these problems more frequently, and therefore the possibility of overestimation for these cases exists. Besides these issues, the cross-sectional design precludes inferences of a temporal nature on the associations found, calling for caution interpreting the results as mentioned above. The profile of drop-outs is noteworthy, particularly concerning the greater loss

of women from the sample. Perhaps, owing to this greater loss, the effect of the association between low diet quality and male gender may have been overestimated. However, as outlined in this discussion, the result is in line with observations made in other epidemiological studies.

Strengths of the study include the representativeness of the sample of the elderly population of Pelotas city, assuring its internal validity. The methodological quality of the study also warrants mention given that the training of the interviewers and quality control of the interviews lend the data collected greater credibility. Pelotas is a medium-sized city with similar features to many other Brazilian cities. Consequently, the results of this study can be extrapolated to other low-to-middle sized cities, representing the majority of Brazilian cities.

The results of this study highlight the need for public and educational policies that promote the consumption of a healthy diet by older adults with an emphasis on high risk groups, and that consider the different barriers to the adoption of healthy eating habits. Individualized actions for enhanced effectiveness are also required, underscoring the importance of a multidisciplinary approach to healthcare for the elderly.

Collaborations

AP Gomes was involved in all stages of the study, including planning, literature review, data analysis and writing the article. ALG Soares was involved in study planning, data analysis, as well as in writing and reviewing the article. H Gonçalves participated in study planning, data analysis and in reviewing the article.

References

1. Bongaarts J. Human population growth and the demographic transition. *Philos Trans R Soc Lond B Biol Sci.* 2009; 364(1532):2985-2990.
2. United Nations (UN). Department of Economic and Social Affairs, Population Division. *World Population Prospects: The 2012 Revision, Key Findings and Advance Tables.* New York: UN; 2013. Working Paper No. ES-A/P/WP.227
3. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. *Vigitel Brasil 2012: Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico.* Brasilia: MS; 2013.
4. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional por Amostra de Domicílios (PNAD). Um panorama da saúde no Brasil. Acesso e Utilização dos serviços, condições de saúde e fatores de risco e proteção à saúde.* Rio de Janeiro: IBGE; 2010.

5. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, Amann M, Anderson HR, Andrews KG, Aryee M, Atkinson C, Bacchus LJ, Bahalim AN, Balakrishnan K, Balmes J, Barker-Collo S, Baxter A, Bell ML, Blore JD, Blyth F, Bonner C, Borges G, Bourne R, Boussinesq M, Brauer M, Brooks P, Bruce NG, Brunekreef B, Bryan-Hancock C, Bucello C, Buchbinder R, Bull F, Burnett RT, Byers TE, Calabria B, Carapetis J, Carnahan E, Chafe Z, Charlson F, Chen H, Chen JS, Cheng AT, Child JC, Cohen A, Colson KE, Cowie BC, Darby S, Darling S, Davis A, Degenhardt L, Dentener F, Des Jarlais DC, Devries K, Dherani M, Ding EL, Dorsey ER, Driscoll T, Edmond K, Ali SE, Engell RE, Erwin PJ, Fahimi S, Falder G, Farzadfar F, Ferrari A, Finucane MM, Flaxman S, Fowkes FG, Freedman G, Freeman MK, Gakidou E, Ghosh S, Giovannucci E, Gmel G, Graham K, Grainger R, Grant B, Gunnell D, Gutierrez HR, Hall W, Hoek HW, Hogan A, Hosgood HD 3rd, Hoy D, Hu H, Hubbell BJ, Hutchings SJ, Ibeanusi SE, Jacklyn GL, Jasrasaria R, Jonas JB, Kan H, Kanis JA, Kassebaum N, Kawakami N, Khang YH, Khatibzadeh S, Khoo JP, Kok C, Laden F, Lalloo R, Lan Q, Lathlean T, Leasher JL, Leigh J, Li Y, Lin JK, Lipshultz SE, London S, Lozano R, Lu Y, Mak J, Malekzadeh R, Mallinger L, Marcenes W, March L, Marks R, Martin R, McGale P, McGrath J, Mehta S, Mensah GA, Merriman TR, Micha R, Michaud C, Mishra V, Mohd Hanafiah K, Mokdad AA, Morawska L, Mozaffarian D, Murphy T, Naghavi M, Neal B, Nelson PK, Nolla JM, Norman R, Olives C, Omer SB, Orchard J, Osborne R, Ostro B, Page A, Pandey KD, Parry CD, Passmore E, Patra J, Pearce N, Pelizzari PM, Petzold M, Phillips MR, Pope D, Pope CA 3rd, Powles J, Rao M, Razavi H, Rehfuess EA, Rehm JT, Ritz B, Rivara FP, Roberts T, Robinson C, Rodriguez-Portales JA, Romieu I, Room R, Rosenfeld LC, Roy A, Rushton L, Salomon JA, Sampson U, Sanchez-Riera L, Sanman E, Sapkota A, Seedat S, Shi P, Shield K, Shivakoti R, Singh GM, Sleet DA, Smith E, Smith KR, Stapelberg NJ, Steenland K, Stöckl H, Stovner LJ, Straif K, Straney L, Thurston GD, Tran JH, Van Dingenen R, van Donkelaar A, Veerman JL, Vijayakumar L, Weintraub R, Weissman MM, White RA, Whiteford H, Wiersma ST, Wilkinson JD, Williams HC, Williams W, Wilson N, Woolf AD, Yip P, Zielinski JM, Lopez AD, Murray CJ, Ezzati M, AlMazroa MA, Memish ZA. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; 380(9859):2224-2260.

6. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Coordenação Geral da Política de Alimentação e Nutrição. *Guia alimentar para a população brasileira: promovendo a alimentação saudável*. Brasília: MS; 2008.

7. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Coordenação Geral da Política de Alimentação e Nutrição. *Guia alimentar para a população brasileira*. 2ª ed. Brasília: MS; 2014.

8. Campos MTFS, Monteiro JBR, Ornelas APRC. Fatores que afetam o consumo alimentar e a nutrição do idoso. *Rev Nutr* 2000; 13(3):157-165.

9. Bernstein M, Munoz N. Position of the Academy of Nutrition and Dietetics: food and nutrition for older adults: promoting health and wellness. *J Acad Nutr Diet* 2012; 112(8):1255-1277.

10. Da Costa Louzada ML, Chagas Durgante P, De Marchi RJ, Neves Hugo F, Balbinot Hilgert J, Pereira Padilha DM, Terezinha Antunes M. Healthy eating index in southern Brazilian older adults and its association with socioeconomic, behavioral and health characteristics. *J Nutr Health Aging* 2012; 16(1):3-7.

11. Malta MB, Papini SJ, Corrente JE. Avaliação da alimentação de idosos de município paulista: aplicação do Índice de Alimentação Saudável. *Cien Saude Colet* 2013; 18(2):377-384.

12. Assumpção D, Domene SMA, Fisberg RM, Barros MBA. Qualidade da dieta e fatores associados entre idosos: estudo de base populacional em Campinas, São Paulo, Brasil. *Cad Saude Publica* 2014; 30(8):1680-1694.

13. Instituto Brasileiro de Geografia e Estatística (IBGE). Dados referentes ao município de Pelotas. Rio de Janeiro: IBGE; 2014.

14. Barros AJD, Menezes AMB, Santos IS, Assunção MCF, Gigante D, Fassa AG, Marques M, Araújo C, Hallal PC, Facchini LA. O Mestrado do Programa de Pós-graduação em Epidemiologia da UFPel baseado em consórcio de pesquisa: uma experiência inovadora. *Rev Bras Epidemiol* 2008; 11(Supl. 1):133-144.

15. Instituto Brasileiro de Geografia e Estatística (IBGE). *Censo 2010*. Rio de Janeiro: IBGE; 2010.

16. Brasil. Ministério da Saúde (MS). *SISVAN-Vigilância alimentar e nutricional. Orientações básicas para coleta, processamento e análise de dados e informação em serviços de saúde*. Brasília: MS; 2004.

17. Chumlea WC, Guo S. Equations for predicting stature in white and black elderly individuals. *J Gerontol* 1992; 47(6):197-203.

18. Habicht J. Estandarización de metodos epidemiológicos cuantitativos sobre el terreno. *Boletín de la Oficina Sanitaria Panamericana* (OSP). 1974; 76(5):375-384.

19. Freisling H, Knaze V, Slimani N. A Systematic Review of Peer-Reviewed Studies on Diet Quality Indexes Applied to Old Age: A Multitude of Predictors of Diet Quality. In: Preedy VR, Hunter L-A, Patel VB, editors. *Diet Quality. Nutrition and Health*. New York: Springer; 2013. p. 365-381.

20. Kiefer I, Rathmanner T, Kunze M. Eating and dieting differences in men and women. *J Mens Health Gend* 2005; 2(2):194-201.

21. Hiza HA, Casavale KO, Guenther PM, Davis CA. Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. *J Acad Nutr Diet* 2013; 113(2):297-306.

22. Ervin RB. Healthy Eating Index scores among adults, 60 years of age and over, by sociodemographic and health characteristics: United States, 1999-2002. *Adv Data* 2008; (395):1-16.

23. Shatenstein B, Gauvin L, Keller H, Richard L, Gaudreau P, Giroux F, Gray-Donald K, Jabbour M, Morais JA, Payette H. Baseline determinants of global diet quality in older men and women from the NuAge cohort. *J Nutr Health Aging* 2013; 17(5):419-425.

24. Riediger ND, Moghadasian MH. Patterns of fruit and vegetable consumption and the influence of sex, age and socio-demographic factors among Canadian elderly. *J Am Coll Nutr* 2008; 27(2):306-313.

25. Claro RM, Monteiro CA. Renda familiar, preço de alimentos e aquisição domiciliar de frutas e hortaliças no Brasil. *Rev Saude Publica* 2010; 44(6):1014-1020.

26. Rao M, Afshin A, Singh G, Mozaffarian D. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open* 2013; 3(12):e004277.

27. Fisberg RM, Marchioni DML, Castro MA, Verly Junior E, Araújo MC, Bezerra IN, Pereira RA, Sichieri R. Ingestão inadequada de nutrientes na população de idosos do Brasil: Inquérito Nacional de Alimentação 2008-2009. *Rev Saude Publica* 2013; 47(Supl. 1):222s-230s.

28. Emami E, de Souza RF, Kabawat M, Feine JS. The impact of edentulism on oral and general health. *Int J Dent* 2013; 2013:498305.

29. Jaime PC, Figueiredo ICR, Moura EC, Malta DC. Fatores associados ao consumo de frutas e hortaliças no Brasil, 2006. *Rev Saude Publica* 2009; 43(Supl. 2):57-64.

30. Chiara VL, Barros M-E, Costa LP, Martins PD. Redução de lista de alimentos para questionário de freqüência alimentar: questões metodológicas na construção. *Rev Bras Epidemiol* 2007; 10(3):410-420.

31. Molina MCB, Lopéz PM, Faria CP, Cade NV, Zandonade E. Preditores socioeconômicos da qualidade da alimentação de crianças. *Rev Saude Publica* 2010; 44(5):785-732.

32. Kourlaba G, Polychronopoulos E, Zampelas A, Lionis C, Panagiotakos DB. Development of a diet index for older adults and its relation to cardiovascular disease risk factors: the Elderly Dietary Index. *J Am Diet Assoc* 2009; 109(6):1022-1030.

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