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Factors associated with diet quality of older adults

Fatores associados à qualidade da dieta de idosos

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A B S T R A C T

Objective

Evaluate the factors associated with diet quality of older adults from the city of *São Caetano do Sul, São Paulo*, Brazil.

Methods

A cross-sectional study was carried out on a sample of 295 older adults receiving care in health care units in *São Caetano do Sul*. Diet quality was assessed using the Brazilian Healthy Eating Index. The associations between the diet quality mean score and the socio-demographic, economic, and anthropometric characteristics and lifestyle and health conditions were verified using multiple linear regression.

Results

Lower diet quality mean score were associated with the variables: marital status (widowed or separated) (β=-2.02; p=0.047), retired (β=-4.24; p=0.034), and smoking (β=-8.06; p=0.001); whereas higher diet quality mean score were associated with higher education level (9 years or more) (β=3.49; p=0.013).

Conclusion

Individuals with higher education level had better diet quality, and those who were widowed or separated, retired, and smokers had worse diet quality indicating that socio-demographic, economic, and lifestyle are factors that can influence food choice of older adults.

Keywords: Aging. Elderly nutrition. Food consumption.

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R E S U M O

Objetivo

Avaliar os fatores associados à qualidade da dieta de idosos de São Caetano do Sul, São Paulo.

Métodos

Estudo transversal em uma amostra de 295 idosos usuários das unidades de saúde do município de São Caetano do Sul. A qualidade alimentar foi avaliada pelo Índice de Qualidade da Dieta Revisado. As associações entre as médias do Índice de Qualidade da Dieta Revisado e variáveis sociodemográficas, econômicas, antropométricas, estilo de vida e condições de saúde foram verificadas por meio de regressão linear múltipla.

Resultados

Ao relacionar as variáveis com o Índice de Qualidade da Dieta Revisado, o estado civil viúvo ou separado (β=-2,02; p=0,047), estar aposentado (β=-4,24; p=0,034) e o hábito de fumar (β=-8,06; p=0,001) determinaram índices menores, enquanto que em idosos com maior escolaridade (9 anos ou mais de estudo) as médias observadas foram maiores (β=3,49; p=0,013).

Conclusão

A qualidade da dieta apresentou-se melhor em indivíduos com maior escolaridade e pior em viúvos ou separados, aposentados e fumantes, indicando que fatores sociodemográficos, econômicos e de estilo de vida podem influenciar nas escolhas alimentares de idosos.

Palavras-chave: *Envelhecimento. Nutrição do idoso. Consumo de alimentos.*

I N T R O D U C T I O N

Population aging is progressing rapidly, especially in developing countries. Forecasts indicate that by 2025 Brazil will have the 6th largest elderly population, reaching approximately 35 million in absolute numbers [1]. In 2010, the elderly population in the municipality of *São Caetano do Sul* (SP) was 19.1%, and in the last 10 years, the city has had the highest Municipal Human Development Index in the country [2].

There is a physiological decline in food intake with aging mainly due to loss of appetite, decreased gustatory and olfactory functions, swallowing disorders, and the adoption of a less varied diet [3], which can affect the nutritional value of the foods consumed. The *Inquérito Nacional de Alimentação* (National Dietary Survey) 2008-2009 assessed the dietary habits of older adults in Brazil, and the data showed high prevalence of inadequate intake of vitamins (A, C, D, E, thiamine, and pyridoxine) and minerals (calcium, magnesium, zinc, and copper) [4]. Moreover, 91% of the Brazilian adult population consume inadequate amounts of macronutrients [5], which may increase the risk of chronic diseases.

The qualitative approach to dietary assessment, in terms of food and/or food groups, is used to investigate population dietary habits and the dietary factors associated with reduced risk of chronic diseases. Therefore, Previdelli *et al.* [6] proposed the revised Brazilian Healthy Eating Index (BHEI) for the Brazilian population based on recommendations for healthy eating. Due to the growth in the elderly population and the effects of food consumption on health, evaluating the quality of the diet has become essential for developing nutritional interventions to promote a healthy diet.

Some studies [5,7-13] have identified factors that can influence dietary choices and diet quality, especially socio-demographic, economic, anthropometric factors, as well as lifestyle, and health conditions. Taking into account the current scenario and the importance of determining and monitoring the diet quality of this age group, the objective of the present study was to evaluate the factors associated with diet quality of older adults in the municipality of *São Caetano do Sul* (SP).

METHODS

A descriptive cross-sectional study was carried out on a non-probability sample of 295 older adults of both genders aged 60 years and older receiving care in health care units in *São Caetano do Sul* (SP) which were geographically distributed in the city's fifteen boroughs. Data were collected between February 2014 and February 2015.

Sample size was determined according to the method proposed by Hair *et al.* [14], which establishes that the minimum number of individuals should be five times the number of food items evaluated. A sample of 288 individuals was estimated to carry out multiple regression analysis with 95% confidence interval, 5% sampling error, and 10% loss of participants.

The data were collected by nutritionists who were previously trained by a professor specialized in dietary intake assessment. Older adults receiving care in Basic Care Units or participating in *Centros de Terceira Idade* (Senior Centers) were invited to take part in the study by the researchers and were informed about the objectives and procedures of the study.

The participants answered a structured questionnaire consisting of socio-demographic and socio-economic questions: gender, age, marital status, household composition, education level (years of study), employment status, and *per capita* income (in minimum wages); anthropometric questions: nutritional status according to body mass index; lifestyle factors: physical activity (yes or no) and smoking habit; and health condition factors: dental health, chewing problems, choking or gagging when swallowing, abdominal pain, use of laxatives, and presence of Chronic Non-Communicable Diseases such as hypertension, dyslipidemia, and diabetes *Mellitus*. Marital status was separated into groups in the multiple regression analysis as follows: married and 'widowed or separated or divorced', which was considered a single variable denominated "widowed or separated".

In order to evaluate the nutritional status, weight and height were measured in an appropriate place using proper equipment and techniques. The measurements were used to calculate Body mass index according to the cut-off points recommended by the Pan American Health Organization [15].

Food consumption was evaluated using the methods recommended by the *Grupo de Pesquisa de Avaliação do Consumo Alimentar* (Food Consumption Evaluation Research Group) of the School of Public Health *Universidade de São Paulo* [16]. An adapted Food Frequency Questionnaire was administered and two 24-Hour Dietary Recall (24HR) interviews were conducted, with an interval of two weeks, to estimate habitual food consumption of a sub-sample of 30% of the participants. The interviews were evenly distributed over the days of the week and months of the year, considering the variability in food consumption patterns during the week and across seasons. The participants were instructed to keep a record of all foods eaten on the day before the interview to reduce the forgetfulness during the 24HR interviews.

Diet quality was evaluated using the revised BHEI developed by Previdelli *et al.* [6] comprising twelve components: nine are related to food groups (total fruit, whole fruit, total vegetables, dark green and orange vegetables, legumes, total grains, whole grains, milk and other dairy products, meat, eggs, and oils), two are related to nutrients (saturated fat and sodium), and one is related to the energetic value from solid fat (saturated and trans fat), alcohol, and added sugar (Chart 1). The components were scored as 0, 5, 10, and 20 points; the method is described in detail in the study by Previdelli *et al.* [6].

After the field research, the data from the 24HR and the food frequency questionnaire were converted; the quantitative estimates of the 24HR data were performed by the conversion of preparations or food intake data recorded in household measures into grams and

Chart 1. Distribution of the components of the Brazilian Healthy Eating Index (BHEI).

Components BHEI	Score (points)				
	0	5	8	10	20
Total fruita	0	----	1.0 portion /1000kcal		
Whole fruitb	0	----	0.5 portion /1000kcal		
Total vegetables	0	----	1.0 portion /1000kcal		
DG/OvegL	0	----	0.5 portion/1000kcal		
Total Cerealc	0	----	2.0 portions /1000kcal		
Whole Cereal	0	----	1.0 portion /1000kcal		
Milk and dairy productsd	0	---		1.5 portions/1000kcal	
Meat, eggs, and legumese	0	---		1.0 portion /1000kcal	
Oilsf	0	---		0.5 portion/1000kcal	
Saturated fat	≥15	--------------------------------	10	----	≤7% of TEV
Sodium	≥2.0	--------------------------------	1.0	----	≤0.75g/ 1000kcal
SoFAAs	≥35	--			≤10% do TEV

Note: [a]All fruit excluding fruit juice; [b]All fruit including fruits and fruit juice; [c]Total grain: cereals, roots, and tubers; [d]Includes milk and other dairy products and soy-based beverages; [e]Includes legumes only after the meat, egg, and legume component reach the maximum score; [f]Includes monounsaturated and polyunsaturated fats, oils from oilseeds, and fat in fish.
DG/OvegL: Dark Green and Orange Vegetables and Legumes; SoFAAs: Energetic value from Solid Fat (saturated and trans fat), Alcohol, and Added Sugar; TEV: Total Energetic Value.

milliliters. Nutrient and energy calculations were performed using the Nutrition Data System for Research software (University of de Minnesota, Minneapolis, Minnesota, United States) [17]. The usual food and nutrient intake was estimated using the Multiple Source Method [18] to eliminate intra-personal variance intake.

The study variables were categorized to obtain descriptive and inferential statistics at 5% level of significance, and the measures of central tendency and dispersion were calculated. Regression analysis was carried out to evaluate the effect of the independent variables (socio-demographic, economic, and anthropometric characteristics, lifestyle, and health conditions) on the dependent variable Brazilian Healthy Eating Index. In the simple linear regression analysis (univariate regression), the independent variables with $p<0.20$ were selected for multiple regression analysis performing stepwise and forward selection. Statistically significant variables ($p<0.05$) were maintained in the final model. Residual analysis of the final model showed homoscedasticity (constant variance), indicating that the data meet one of the assumptions which justify the use of linear regression. Data were statistically processed using Stata (Stata Corporation, College Station, Texas, United States) software version 12.

The present study was approved by the Research Ethics Committee of the *Universidade São Judas Tadeu* (CAAE n° 24855113.6.0 000.0089).

RESULTS

The older adult population studied consisted mainly of female (85.1%), married (44.7%), and non-smoking (95.6%) individuals with up to four years of schooling (41.7%). The relationships between the BHEI score and the socio-demographic, economic, and lifestyle characteristics showed statistically significant differences between marital status, education level, and smoking habit. Widowed and smoking older adults had lower BHEI score than married and non-smoking older adults; older adults who had 9-12 or more years of schooling had higher BHEI score (Table 1).

Table 1. Brazilian Healthy Eating Index according to the socio-demographic and lifestyle characteristics of older adults living in the municipality of *São Caetano do Sul* (SP), Brazil (2014).

Variables	Brazilian Healthy Eating Index							
	n	%	Mean	±	SD	Minimum	Maximum	*p*
Gender								
Female	251	85.1	77.24	±	9.04	31.88	95.56	
Male	44	14.9	78.85	±	8.16	58.11	91.04	0.269
Age (years)								
60 to 69	137	46.5	77.45	±	8.71	44.08	91.41	
70 to 79	124	42.0	78.33	±	9.39	31.88	95.56	0.420
80 or older	34	11.5	74.43	±	7.39	55.65	87.47	0.077
Marital status								
Married	132	44.7	79.01	±	8.57	31.88	95.56	
Widowed	107	36.3	75.85	±	9.43	43.22	91.41	0.006
Separated/divorced	56	19.0	76.94	±	8.21	58.50	90.42	0.144
Lives alone								
Yes	75	25.4	78.13	±	8.43	55.65	91.41	
No	220	74.6	77.25	±	9.08	31.88	95.56	0.461
Education level (years of schooling)								
0-4 years	123	41.7	75.90	±	8.49	43.22	91.75	
5-8 years	62	21.0	75.86	±	10.75	31.88	91.41	0.972
9-12 years	53	18.0	79.95	±	8.60	44.07	91.04	0.005
12 years or more	57	19.3	80.31	±	6.58	58.11	95.56	0.002
Employment status								
Still works (including those that are retired)	21	7.1	74.77	±	9.57	58.11	90.32	
Retired	184	62.4	78.16	±	9.57	31.88	95.56	0.100
Homemaker	86	29.2	76.73	±	9.20	43.22	90.39	0.220
*Income (MW)**								
No income	29	9.8	79.19	±	7.18	66.85	90.39	
Up to 1	62	21.0	75.06	±	10.57	31.88	91.75	0.039
>1 to ≤3	130	44.0	77.19	±	9.10	43.22	91.41	0.274
>3	68	23.1	79.36	±	7.19	60.12	95.56	0.930
Physical activity								
Yes	256	86.8	77.36	±	9.10	31.88	91.75	
No	39	13.2	78.19	±	7.69	58.11	95.56	0.588
Smoking habit								
Yes	13	4.4	70.49	±	11.65	44.07	87.54	
No	282	95.6	77.79	±	8.66	31.88	95.56	0.004

Note: *Minimum Wage in 2014=R$724,00.
SD: Standard Deviation.

As for chronic non-communicable disease, there were no statistically significant differences ($p < 0.05$) between the BHEI score and the presence of hypertension (53.6%), dyslipidemia, (42.0%), and diabetes *Mellitus* (21.7%) (Table 2).

With regard to health conditions, the older adults who had with their own natural teeth (42.1%) and those who did not report having chewing problems (89.2%) had higher the BHEI score. The association between nutritional status and BHEI score showed that obese older

adults (30.8%) had lower BHEI score (Table 2). However, the variables were not maintained in the multiple regression analysis (Table 3).

Investigating the relationship between the variables and the Brazilian Healthy Eating Index, it was observed that the widowed older adults and those who were separated or divorced, retired, and smokers had lower BHEI score, whereas those who had more years of schooling had higher mean scores (Table 3).

DISCUSSION

The present study analyzed the factors associated with diet quality of older adults living in the city of *São Caetano do Sul*, Brazil. The main findings showed that those with higher education level (9 to 12 or more years of schooling) had higher diet quality, and those who were widowed or separated, retired, and smokers.

There was no significant difference between diet quality and gender, corroborating

Table 2. Brazilian Healthy Eating Index mean scores according to the health conditions of older adults living in the municipality of *São Caetano do Sul* (SP), Brazil (2014).

Variables	Brazilian Healthy Eating Index							
	n	%	Mean	±	SD	Minimum	Maximum	*p*
Have own natural teeth								
Yes	124	42.1	79.03	±	8.12	43.22	95.56	
No	171	57.9	76.34	±	9.31	31.88	91.75	0.001
Chewing problems								
Yes	32	10.8	74.52	±	9.98	51.90	90.00	
No	263	89.2	77.83	±	8.73	31.88	95.56	0.047
Choking or gagging when swallowing								
Yes	7	2.4	76.25	±	7.30	63.66	86.25	0.714
No	288	97.6	77.50	±	8.96	31.88	95.56	
Abdominal pain								
Yes	16	5.4	74.01	±	8.94	55.22	85.20	0.111
No	279	94.6	77.67	±	8.89	31.88	95.56	
Use of laxatives								
Yes	11	3.7	74.79	±	10.24	57.39	88.74	0.310
No	284	96.3	77.58	±	8.86	31.88	95.56	
Hypertension								
Yes	164	55.6	77.75	±	7.90	51.90	91.75	0.545
No	131	44.4	77.12	±	10.06	31.88	95.56	
Dyslipidemia								
Yes	124	42.0	77.41	±	8.86	43.22	95.56	0.914
No	171	58.0	77.52	±	8.98	31.88	91.75	
Diabetes Mellitus								
Yes	64	21.7	77.41	±	8.86	43.22	95.56	0.914
No	231	78.3	77.52	±	8.98	31.88	91.75	
Nutritional status								
Eutrophic	125	42.4	78.44	±	7.65	57.39	95.56	
Undernourished	41	13.9	76.83	±	9.41	43.22	91.34	0.316
Overweight	38	12.9	78.56	±	7.45	58.98	90.86	0.942
Obese	91	30.8	75.98	±	10.61	31.88	91.75	0.046

Note: SD: Standard Deviation.

the findings of another study on older adults in different cities and states in Brazil [7,8]. However, some studies with adults and older adults have reported higher BHEI score for women [9,10]. Assumpção *et al.* [10] found that women consumed more vegetables, fruits, and milk and less sodium, meat, saturated fat, alcohol, and added sugar, when compared to men. The diet quality similarity found between female and male individuals living in *São Caetano do Sul* can be explained by the fact that most of the older adults studied were married and retired,

Table 3. Association between Brazilian Healthy Eating Index scores and characteristics of older adults living in the municipality of *São Caetano do Sul* (SP), Brazil (2014).

Characteristics	Univariate regression		Multivariate regression	
	β	p	β	p
Gender				
Female	1.00			
Male	1.62	0.269	-	
Age (years)				
60 to 69	1.00			
70 to 79	0.89	0.420	-	
80 or older	-3.01	0.077		
Marital status				
Married	1.00			
Widowed or separated	-2.79	0.007	-2.02	0.047
Lives alone				
Yes	1.00			
No	-0.88	0.461	-	
Education level (years of schooling)				
0-4 years	1.00			
5-8 years	-0.05	0.972	-0.58	0.965
9-12 years	4.04	0.005	3.49	0.013
12 years or more	4.41	0.002	3.92	0.005
Employment status				
Still works	1.00			
Retired	-3.39	0.100	-4.24	0.034
Homemaker	-1.43	0.220	-0.14	0.903
Income (MW)				
No income	1.00			
Up to 1	-4.13	0.039	-	
>1 to ≤3	-2.00	0.274		
>3	0.17	0.930		
Smoking habit				
Yes	-7.31	0.004	-8.06	0.001
No	1.00			
Nutritional status				
Eutrophic	1.00			
Undernourished	-1.61	0.316	-	
Overweight	0.12	0.942		
Obese	-2.45	0.046		

Note: MV: Minimum Wage.

and thus they probably had meals together with their spouses. Moreover, widowed older adults had lower BHEI score than married individuals; there are no studies available addressing the association between diet quality and marital status. However, Borim et al. [19] found that older adults who lived alone had higher diet quality.

The relationship between BHEI score and education level showed higher scores among the older adults with 9 or more years of schooling. A similar result was found by Morimoto et al. [11], who justified that individuals with higher education level may have higher income and better knowledge about food. Assumpção et al. [10] observed that individuals with higher education level had higher BHEI score for the components whole grains, fruits, vegetables, and milk and other dairy products.

The practice of leisure time physical activity provides health benefits to older adults. Studying older adults, Xu et al. [12] found an association between diet quality and faster gait speed. Assumpção et al. [8] reported that older adults participating in physical activities had higher BHEI score. However, no difference was observed between the practice of physical activity and BHEI score in the present study.

Smoking individuals had lower BHEI score, similar to the findings reported in other studies [7,12,20,21]. Although not very frequent in the studied population, this habit significantly affected diet quality, and several studies [12, 21] have reported an association between lower intake of foods such as fruits, vegetables, and dairy products among smokers.

In the present study, it was also found that older adults with dental prosthesis who reported chewing problems had lower BHEI score. Corroborating findings of the present study, other studies found lower BHEI score [22] in edentulous older adults [13] and in those with oral cavity problems [22] and reported that oral health is a major factor affecting diet quality [23] of older adults.

Among the main morbidities among older adults reported in the literature, hypertension was the most frequent, but it was not associated with diet quality. Unlike the present study, Assumpção et al. [8] and Chen et al. [24] found that older adults with diabetes had higher BHEI score, and these authors stated that patients with chronic diseases can make healthier food choices since they are frequently given nutritional guidance and recommendations, hoping that after being diagnosed, patients are encouraged to adopt a healthier lifestyle [25].

Despite the high number of eutrophic older adults, approximately 1/3 of the studied population was classified as obese. These results confirm the current situation since according to the Family Budget Survey 2008/2009 data, there is high prevalence of overweight older adults in Brazil [26]. In the present study, it was found that eutrophic older adults had higher BHEI score than obese older adults, similar to the results found by Oliveira et al. [27].

The present study showed some limitations such as the use of a non-probability sample since it hinders comparison between national and international population studies. However, to reduce this bias, the participants were selected among the fifteen neighborhoods geographically distributed in the city, which have different social, demographic, and economic characteristics. Another possible limitation is the participants` age because age-related changes such as trouble concentrating and memory problems can increase the length of the interviews requiring more attention by the interviewers. Accordingly, the training of the nutritionists involved in the research and the space available for data collection were fundamental to ensure the reliability of the information collected, analysis, and results obtained.

Finally, it is worth mentioning that the instrument used to evaluate diet quality considers both the consumption and the probability of consumption of several food items, data obtained using a food frequency questionnaire and two 24HR interviews, allowing the evaluation of the

usual diet. The BHEI is a tool that can be used in future interventions among older adults and to compare results obtained in studies using similar instruments.

CONCLUSION

The findings of this study provide information on the diet quality of older adults identifying differences according to socio-demographic, economic, and anthropometric characteristics and lifestyle and health conditions. Diet quality was better in individuals with higher education level and worse lower in those who were widowed or separated, retired, and smokers, indicating that these factors can influence food choices. These results show the need for improvements in the diet quality and quality of life of this population, mainly through the provision of better nutritional care and more comprehensive health care services, as well as the adoption of strategies for promoting their health. Further studies on diet quality are recommended in order to develop public policies focused on diet and nutrition of older adults.

CONTRIBUTORS

TI FREITAS raised the data, reviewed the literature, analyzed and interpreted the results and wrote the article. AN PREVIDELLI performed the statistical analysis and interpreted the results. MPN FERREIRA and KM MARQUES raised the field data and interpreted the results. RMM GOULART collaborated in the study and interpreted the results. RC AQUINO designed and coordinated the study and conducted the final critical revision of the manuscript.

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