Evaluation of diet quality of the elderly and associated factors

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ABSTRACT

Background: Observational studies suggest healthy dietary patterns are associated with risk reduction and better control of various chronic diseases. However, few Brazilian studies have focused on evaluating the quality of the elderly diet and its relationship with diseases. This study aimed to estimate the association between diet quality and socioeconomic factors, health and nutrition of the elderly.

Methods: This is a cross-sectional population-based study whose target population were non-institutionalized elderly residents in the city of Viçosa, Brazil. Anthropometric, socioeconomic, health conditions, lifestyle and food consumption variables were obtained from a semi-structured questionnaire. The quality of the diet was assessed by the revised Healthy Eating Index classified into tertiles, considering the first tertile as "Poor diet quality," the second as 'Intermediate diet quality' and the third as "Better diet quality." To identify factors independently associated with diet quality model, the works used multinomial logistic regression.

Results: In the results of the multivariate analysis, the factors independently associated with "better diet quality" included female gender, higher education, history of one to five medical visits in the past year, history of diabetes mellitus, dyslipidemia and the use of polypharmacy.

Discussion: Our results show that most seniors need to improve the quality of their diet and those of male gender with no or little education, and those who do not seek medical services constitute the group that needs attention concerning the measures to improve the quality of their diet.

1. Introduction

Eating habits play a unique role in health, as the combination of food consumed over time throughout the life cycle can be determinant of the occurrence of various diseases (Hiza, Casavale, Guenther, & Davis, 2013). Results from observational studies suggest that healthy dietary patterns are associated with risk reduction and better control of several chronic diseases such as obesity, dyslipidemia, hypertension and diabetes mellitus (Giuli et al., 2012; Hiza et al., 2013; Kant, 2010; Lopes et al., 2005). Among the elderly, nutrition becomes particularly essential for the good maintenance of acceptable health standards and functional capacity (Silva, Pedraza, & Menezes, 2015).

In order to properly estimate the relationship between diet and morbidities, specific tools have been developed to assess food consumption (Fisberg et al., 2004). Because of the relationship between food, the variety of factors associated with its intake and the prevalence of certain diseases that increase with advancing age, we consider of great importance to conduct the diet evaluation globally since it would

better reflect the complexity of this relationship (Louzada et al., 2012). In this context, the Brazilian Healthy Eating Index–Revised (BHEI-R) (Previdelli et al., 2011) was proposed as dietary assessment tool, wich is based on the food guide recommendations for the Brazilian population (Brasil, 2008) and the Healthy Eating Index of 2005 (Guenther, Reedy, & Krebs-Smith, 2008a).

Few Brazilian studies published in scientific literature have focused on evaluating the diet quality of the elderly. Among the published studies, the authors have observed an association between a poorer diet quality and low education, low income, lack of appetite, difficulty in purchasing and preparing food (Viebig, Pastor-Valero, Scazufca, & Menezes, 2009) in addition to smoking, consumption of sugary drinks and alcohol (Assumpção, Domene, Fisberg, & Barros, 2014). On the other hand, the elderly with nutritional counseling, non-smokers and those who practice physical activity have shown better diet quality (Assumpção et al., 2014; Gadenz & Benvegnú, 2013). However, there are few studies with Brazilian elderly that assessed dietary intake through the BHEI-R and that took chronic diseases that

may be related to food into consideration. In this sense, the present study aimed to estimate the association between diet quality and specific socioeconomic factors, health and nutrition of the elderly.

2. Methodology

2.1. Designing the study

This is a cross-sectional population-based study, which integrates the research project "Health conditions, nutrition and medication use by the elderly in Viçosa (MG): a population-based survey" conducted from June to December 2009. This project was approved by the Ethics Committee on Human Research of the Federal University of Viçosa (Official letter No. 27/2008/CEP/UFV). The evaluation of the elderly was carried out only after all parties signed the Free and Informed Consent Term (FICT).

2.2. Target population and sample

The study's target population consisted of seniors aged over 60 years, who are not institutionalized, residents in rural and urban areas of Viçosa, which corresponded to 7980 elderly in 2008 (study period). Those data were the basis for the calculation of the sample.

The sample size was calculated considering a confidence level of 95%, estimated prevalence of 50% for different outcomes of interest to the larger project, 4% tolerated error and 20% increase to cover losses. From an initial study sample of 670 participants, 50 were excluded because there were losses due to subject refusal to participate (3.6%), unavoidable reasons that interviews could not be conducted such as in situations where randomly selected individuals had died (1.3%), had an address that could not be located in the city (1.2%) or had moved to other locations which were either difficult to find or in other municipalities (1,2%), in addition to missing data from the recall of habitual consumption (0,15%). Those participants excluded were no different from the included ones regarding gender and age range (Nascimento et al., 2012). Thus, excluding losses, the final sample was of 620 elderly, what represents a response rate of 93.0%.

2.3. Data collection

The interviews were previously scheduled, they were performed at each elderly's home and conducted by pairs of trained interviewers. Up to three attempts to visit the interviewee's home were performed before the person was considered a loss. The data collection instrument consisted of a semi-structured questionnaire with sociodemographic variables, health conditions, lifestyle and food consumption. To obtain the food consumption data we have applied a standard recall of habitual consumption using the 'multi-pass' technique (Guenther, DeMaio, Ingwersen, & Berlin, 1995).

The contents of the recall were reviewed prior to data entry. Therefore, we have performed a standardization of preparations and percentage of salt and oil (Araújo & Guerra, 2007; Pinheiro, Lacerda, Benzecry, Gomes, & Costa, 2005; TACO, 2011). Added sugars included all sugars added to foods during processing, preparation or consumption. The amount of added sugar in each food was standardized based on Table for Evaluation of Food Consumption in Household Measurements (Pinheiro et al., 2005), in recipes and on foods labels. Later, the data were entered in Dietpro® version 5i software, and it were performed quality control of the typed data. The study has also measured the interviewee's waist circumference (WHO, 1995).

2.4. Study variables

The Brazilian Healthy Eating Index–Revised (BHEI-R), which evaluates the diet quality and was obtained from the information from the recall of habitual consumption, was used as dependent variable. This index was revised by Previdelli et al. (2011) and validated for Brazilian population by Andrade, Previdelli, Marchioni, and Fisberg (2013).

In relation to the total score, the maximum value of the total BHEI-R is 100 points. Values closer to the maximum score represent better diet quality. Because the index is designed to reflect different aspects of the diet, there is no classification in adequate and inadequate considering the total score (Guenther et al., 2008a; Guenther, Reedy, & Krebs-Smith, 2008b). Therefore, the total BHEI-R was ranked into tertiles, considering the first tertile as "Poor diet quality," the second as "Intermediate diet quality" and the third as "Best diet quality."

The independent variables in this study included:

- Socioeconomic: *gender* (male, female); *age range* (60–74 years, 75 years and older); *education* (never studied; early grades of elementary school; final grades of elementary school or higher); *individual income* (quartiles) and *cohabitation* (living alone, living together).
- Health conditions: *number of medical appointments* (none; 1–5; 6 or more) during the year before the interview and *number of hospitalizations* (none, 1 or more) during the year before the interview. Functional capacity was assessed by questions about ability to perform 14 basic and instrumental activities of daily living, categorized into: no struggle, little struggle, great struggle, unable to do it and does not do it (Nascimento et al., 2012). In the analysis, we have considered the variables *difficulty to feed* and *difficult to prepare food*, as well as functional capacity defined as inadequate, when the elderly reported difficulty performing seven or more activities, or when self-assessed as unable to perform three or more activities; and otherwise as appropriate. We have also evaluated the polypharmacy (yes, no), defined as the use of five or more drugs over the 15 days preceding the interview[2] (Beloosesky et al., 2013). As for morbidities, information about the history of chronic diseases were obtained from the following question: "Have you ever in life had a doctor or other health professional said that you had or have had any of the following diseases?". Diseases of interest to the study included diabetes mellitus; arthrosis, arthritis or rheumatism; heart attack; asthma or bronchitis; depression; hearing problems; high pressure; angina; stroke; vision problems; osteoporosis; dyslipidemia; kidney disease and cancer. For the analysis we used the total number of disorders and history of *diabetes mellitus*, *dyslipidemia* and *high blood pressure*.
- Lifestyle: *alcohol consumption* (yes; no but has drunk before; never drank) and *smoking* (yes; no but has smoked before; never smoked).
- Anthropometric measure: we have measured the *waist circumference* (WC) using flexible and inelastic tape (TBW®, São Paulo, Brazil) 1.80 m long and 0.1 mm accuracy. This variable was measured with the elderly in the standing position, the height of the midpoint between the last rib and the iliac crest, during expiration, according to the protocol of the World Health Organization, 1995 (WHO, 1995) WHO, 1995 World Health Organization, 1995 (WHO, 1995).

2.5. Data analysis

For this study, we proceeded the descriptive analysis of variables of interest, based on the frequency distribution and estimates of central tendency and dispersion. The normal distribution of the BHEI-R values between the categories of the variables was assessed using the *Shapiro-Wilk* test.

Multinomial logistic regression analysis was used to obtain estimates for Odds Ratios and 95% confidence intervals of the association between the independent variables of interest in the study and the diet quality. This method of regression is used when the dependent variable has more than two categories, each being compared to a reference category. In this study the reference category was the lowest tertile values of BHEI-R, which was called "Poor diet quality." The variables that were associated with the dependent variable in univariate step with $p < 0.20$ were included in the multivariate multinomial logistic

Table 1
Socioeconomic characteristics of the elderly. Viçosa, Brazil, 2009.

Variable	n	%
Gender		
Female	330	53,2
Male	290	46,8
Age range (years)		
60–74	433	69,8
≥75	187	30,2
Education		
Never studied	94	15,2
Early grades of elementary school	396	64,0
Latest grades of elementary school or higher	129	20,8
Individual income (quartiles)		
Q1 ($ 0–847.87)	72	11,8
Q2 ($ 847.88–952.71)	233	38,2
Q3 ($ 952.72–2691.78)	153	25,0
Q4 (≥$ 2691.79)	153	25,0
Living standards		
Living alone	66	10,6
Living with another	554	89,4

regression model. The variables that were associated with the dependent variable at the level of $p < 0.05$ remained in the final model.

All analyzes were performed using STATA software (Stata Corp. College Station, United States) version 13.0, adopting $\alpha = 0.05$ as statistical significance level for all comparisons.

3. Results

The sample consisted of 620 older adults. According to the socio-economic characteristics, most were female (53.2%), aged between 60 and 74 years (69.8%), studied until the early grades of elementary school (64.0%) and did not live alone (89.4%). About 38.0% of the elderly had individual monthly income between $847.88 and $952.71 (second quartile), whereas the lower limit corresponds to the minimum wage during the period of the study (Table 1).

Regarding to health and food consumption, the sample characterization is shown in Table 2. We have identified that 48.3% of the elderly rated their health as fair, most (72.5%) had a history of one to five doctor appointments and 15.0% had a hospital history during the previous year. Functional capacity was classified as inappropriate in 16.0% of the elderly, and 8.6% reported difficulty to feed and 16.1% reported difficulty to prepare food. Polypharmacy was observed in 36.1% of seniors and 38,0% reported having five or more diseases. About 22.0% had a history of diabetes *mellitus*, 56.0% of dyslipidemia and 76.5% of high pressure. In relation to alcohol consumption, 33.8% admitted to drinking and just over half of the sample reported never having smoked. Approximately 13,0% of the sample reported some reduction in food intake over the three months prior to the survey. Waist circumference and total BHEI-R are shown in tertiles (Table 2).

The results of the univariate analysis showed that the factors positively associated with the tertile "Intermediate diet quality" included female gender, having history of diabetes *mellitus* and having waist circumference between 89,70 and 100,79 cm. For the tertile "Best diet quality," the positive and significant associations were female gender, having studied at least until early grades of elementary school, having made at least one medical visit in the past year, having history of five or more diseases, polypharmacy, history of diabetes *mellitus* and dyslipidemia, and having waist circumference between 59,67 and 70,05 cm (Tables 3 and 4).

The results of multivariate analysis allowed us to observe the factors which remained independently associated to the tertile "Intermediate diet quality" included female gender and having waist circumference between 89,70 and 100,70 cm. On the other hand, the factors independently associated with tertile of "Best diet quality" were female gender, having higher education, having had five medical appointments

Table 2
Characteristics regarding health, use of health services, lifestyle, waist circumference and diet quality of the elderly. Viçosa, Brazil, 2009.

Variables	n	%
Self-perfection of health		
Very good/good	272	45,4
Average	289	48,3
Bad/very bad	38	6,3
Medical appointments (previous year)		
None	45	7,3
1–5	449	72,5
≥6	125	20,2
Number of hospitalizations (previous year)		
None	526	85,0
≥1	93	15,0
Functional capacity		
Adequate	519	84,0
Inadequate	99	16,0
Difficulty to eat	53	8,6
Difficulty to prepare food	66	16,1
Polypharmacy (past 15 days)	224	36,1
Number of disorders		
≤4	385	62,1
≥5	235	37,9
History of diabetes *mellitus*	138	22,3
History of dyslipidemia	352	56,9
History of high blood pressure	474	76,5
Alcohol consumption		
Yes	209	33,8
No but have drunk before	205	33,1
Never drank	205	33,1
Smoking		
Yes	67	10,8
No but have smoked before	206	33,4
Never smoked	345	55,8
Reduction of food intake (past 3 months)	78	12,6

	Average	Min-Max
Waist circumference (cm)		
Tertile 1	82,74	61.30–89,69
Tertile 2	95,18	89.70–100,79
Tertile 3	109,21	100.80–155,80
Total BHEI-R[1] (points)		
Tertile 1	51,72	21,95–59,66
Tertile 2	64,62	59,67–70,05
Tertile 3	76,43	70,10–90,56

[1] BHEI-R: Brazilian Healthy Eating Index–Revised.

in the past year, having history of diabetes *mellitus*, dyslipidemia and having practiced polypharmacy. The variable for number of disorders was not included in this multivariate analysis because the variables history of diabetes *mellitus* and history of dyslipidemia were included in the first (Table 5).

4. Discussion

The results indicate that the diet quality of the elderly requires improvement, considering that two-thirds had scores ranging between about 22 and 70 points. This finding is also reported by other authors (Assumpção et al., 2014; Cannella, Savina, & Donini, 2009; Ervin & Dye, 2008; Louzada et al., 2012; Savoca et al., 2009). In this study, the goal was to investigate the association of socioeconomic variables, health status, use of health services, lifestyle and waist circumference with the older adults' tertiles for BHEI-R. Being female remained positively associated with tertiles "Intermediate diet quality" and "Best diet quality". Among the elderly, 55.6% belonged to the tertile of "Intermediate diet quality" and 60.9% to tertile "Best diet quality". International and national studies show that women generally have better diet quality than men (Hiza et al., 2013; Louzada et al., 2012; Malta, Moura, & Morais Neto, 2011), which has been justified by the fact that

Table 3

Univariate analysis between the socioeconomic variables and those for diet quality[a], Viçosa, Brazil, 2009.

Variable	*BHEI-R* Intermediate diet quality			*BHEI-R* Best diet quality		
	n (%)	OR (IC 95%)	p value	n (%)	OR (IC 95%)	p value
Gender						
Male	92 (44,5)	1,0		81 (39,1)	1,0	
Female	115 (55,6)	**1,6 (1,1–2,4)**	**0,01**	126 (60,9)	**2,0 (1,4–3,0)**	**0,00**
Age range (years)						
60–74	147 (71,0)	1,0		147 (71,0)	1,0	
≥75	60 (29,0)	0,8 (0,6–1,3)	0,44	60 (29,0)	0,8 (0,6–1,3)	0,44
Education						
Never studied	38 (18,4)	1,0		63 (30,4)	1,0	
Early grades of elementary school	135 (65,2)	1,2 (0,7–2,0)	0,49	125 (60,4)	**2,0 (1,1–3,6)**	**0,02**
Latest grades of elementary or higher	34 (16,4)	1,6 (0,8–3,2)	0,15	19 (9,2)	**4,9 (2,4–9,8)**	**0,00**
Individual income (quartiles)						
Q4 (≥ $ 2691.79)	51 (24,8)	1,0		61 (30,2)	1,0	
Q3 ($ 952.72–2691.78)	54 (26,2)	0,9 (0,5–1,7)	0,67	50 (24,8)	0,6 (0,3–1,2)	0,17
Q2 ($ 847.88–952.71)	78 (37,9)	1,1 (0,5–2,2)	0,78	65 (32,2)	0,9 (0,5–1,8)	0,77
Q1 ($ 0–847.87)	23 (11.2)	1,3 (0,7–2,6)	0,55	26 (12,9)	1,3 (0,7–2,6)	0,43

IC95%: 95% confidence interval; OR: odds ratio; PC: waist circumference.

BHEI-R: Brazilian Healthy Eating Index–Revised.

[a] For this analysis, the reference category was the lowest for the tertile with BHEI-R of "Poor diet quality".

they have a greater concern for their health, and with healthier eating habits (Francisco, Segri, Barros, & Malta, 2015).

Having education was positively associated with "Best diet quality", i.e. the elderly who have a healthier diet had a greater chance of having education compared those in tertile "Poor diet quality". The strength of association was higher the higher the level of education. This association was also found in other studies (Basiotis et al., 2002; Ervin & Dye, 2008; Fisberg et al., 2004). Elderly American participants from the National Health and Nutrition Examination Survey 2003–2004 in which higher levels of education also showed better total score of HEI (Hiza et al., 2013). In a study with elderly in the Brazilian South, it was observed that those with higher education consume less carbohydrates and more foods rich in minerals and vitamins compared to those with less than 8 years of schooling, noting that the level of education is crucial to healthy food habits (Venturini, Engroff, & Sgnaolin, 2015).

When the elderly showed one to five medical appointments during the year before the interview, this was positively associated with a better diet quality, as in a study with elderly in Southern Brazil (Gadenz & Benvegnú, 2013). There was also better diet quality among older people who reported a history of diabetes *mellitus*, dyslipidemia and use of polypharmacy. All these findings can be attributed to what is called reverse causality, as in this case, the diagnosis of a disease may raise a need for change in lifestyle in the individual, and may thus result in the adoption of healthier eating habits.

The positive association between history of diabetes *mellitus* and "Best diet quality" probably results from the change in behavior, since diet is one of the key factors for glycemic control (Exebio et al., 2011; Jenkins et al., 2008). In a population-based study for elderly people in São Paulo, we found similar results with better diet quality among those diagnosed with diabetes *mellitus* (Assumpção et al., 2014). In addition to diabetes *mellitus*, dyslipidemia and obesity are also common in this age group[33], and the appropriate control and prevention of complications from these diseases are associated with healthy eating habits (Giuli et al., 2012; Kant, 2010). Our results, although consistent with the literature, have the limitation of not assessing whether the elderly with better diet quality had adequate control of the disease because no information was available for this evaluation. This aspect can be explored in future studies, especially those of longitudinal design to allow more evidence about the influence of the diet quality over the control of chronic non-communicable diseases in the elderly.

Polypharmacy appears as a frequent practice among the elderly and its prevalence in the sample (36.1%) was higher than that observed in other Brazilian studies (5–27%) (Duarte et al., 2012; Flores & Benvegnú, 2008; Flores & Mengue, 2005; Gontijo et al., 2012; Loyola Filho et al., 2005) On the one hand, polypharmacy can be seen as an indicator of increased morbidity among the elderly, compared to its strong association with other diseases. In this study, its association with the "Best diet quality" may indicate that seniors using five or more medications are more concerned with healthy eating. Notwithstanding, there is an important concern about the influence of using multiple drugs in the elderly nutritional status. Certain studies have evaluated its association with nutritional factors and it is known that the use of multiple drugs, inappropriate prescribing and use of two or more drugs with the same pharmacological activity, among other factors, promote increased side effects and interactions that interfere with digestion, absorption and metabolism of nutrients (Faria, Franceschini, & Ribeiro, 2010). Additional studies are needed to verify the actual interference of polypharmacy in the bioavailability of nutrients as well as longitudinal studies can help to elucidate the influence of polypharmacy in the nutritional status of the elderly.

As the high concentration of serum lipids, abdominal obesity is a major risk factor for cardiovascular diseases (Rocha et al., 2013). As waist circumference (WC) is an indicator of central adiposity, it has been associated with the risk of morbidity and mortality in the elderly (Romaguera et al., 2011). In the present study, only the second tertile for WC values remained associated with "Intermediate quality diet", which also suggests a change in behavior. The fact that the WC tertile with the highest values is not associated with the "Best diet quality" can mean low sample power, given that the study was not specifically designed to evaluate this relationship.

Some limitations should be considered when interpreting the findings of the present study. First, its cross-sectional design limits the interpretation of some associations found as a result of cause and effect relationship. However, the results are consistent with the literature. Second, some variables analized in this study were self-reported, however, studies in adults and the elderly attest the reliability of this information (Martin, Leff, Calonge, Garrett, & Nelson, 2000; Lima-Costa, Peixoto, & Firmo, 2004; Selem, Castro, César, Marchioni, & Fisberg, 2013). Third, the variable physical activity was not considered as a control, due to the lack of information about kind of activity, intensity and frequency. At this point of view, the relationship between physical activity practice and diet quality improvement should be addressed in future studies. Fourth, there are the limitations inherent to dietary surveys such as errors in the estimate of food portions and memory bias (Scagliusi & Lancha Júnior, 2003). One reservation should be made to the fact that we have used the recall of habitual

Table 4

Univariate analysis of the association between the variables health, use of health services, lifestyle, waist circumference and diet quality[a], Viçosa, Brazil, 2009.

Variable	*BHEI-R* Intermediate diet quality			*BHEI-R* Best diet quality		
	n (%)	OR (IC 95%)	p value	n (%)	OR (IC 95%)	p value
Functional capability						
Adequate	174 (84,1)	1,0		169 (82,4)	1,0	
Inadequate	33 (16,0)	1,1 (0,6–1,9)	0,69	36 (17,6)	1,2 (0,7–2,1)	0,41
Difficulty to eat						
No	189 (91,3)	1,0		191 (92,3)	1,0	
Yes	18 (8,7)	0,9 (0,5–1,8)	0,85	16 (7,7)	0,8 (0,4–1,7)	0,59
Difficulty to prepare food						
No	126 (86,3)	1,0		112 (81,8)	1,0	
Yes	20 (13,7)	0,8 (0,4–1,6)	0,53	25 (18,2)	1,1 (0,6–2,2)	0,69
Medical appointments (past year)						
None	17 (8,2)	1,0		5 (2,4)	1,0	
1 to 5	148 (71,5)	1,4 (0,7–2,7)	0,34	156 (75,7)	**4,9 (1,8–13,4)**	**0,00**
≥ 6	42 (20,3)	1,5 (0,7–3,2)	0,30	45 (21,8)	**5,4 (1,9–15,7)**	**0,00**
Number of disorders						
≤ 4	138 (66,7)	1.0		104 (50,2)	1,0	
≥ 5	69 (33,4)	1,1 (0,8–1,7)	0,55	103 (49,8)	**2,2 (1,5–3,4)**	**0,00**
History of diabetes *mellitus*						
No	169 (81,6)	1,0		131 (63,3)	1,0	
Yes	38 (18,4)	**1,7 (1,0–3,0)**	**0,06**	76 (36,7)	**4,4 (2,6–7,3)**	**0,00**
History of dyslipidemia						
No	96 (46,4)	1,0		62 (29,9)	1,0	
Yes	110 (53,4)	1,3 (0,9–1,9)	0,20	145 (70,0)	**2,6 (1,8–3,9)**	**0,00**
History of high blood pressure						
No	54 (26,1)	1,0		39 (18,8)	1,0	
Yes	153 (73,9)	1,0 (0,6–1,5)	0,93	168 (81,2)	1,5 (0,9–2,4)	0,09
Polypharmacy						
No	140 (67,6)	1,0		104 (50,2)	1,0	
Yes	67 (32,4)	1,3 (0,9–2,1)	0,17	103 (49,8)	**2,8 (1,8–4,2)**	**0,00**
Alcohol consumption						
Never drank	73 (35,3)	1,0		69 (33,5)	1,0	
No but has drunk before	65 (31,4)	0,8 (0,5–1,4)	0,51	70 (34,0)	1,0 (0,6–1,6)	0,90
Yes	69 (33,4)	0,9 (0,6–1,5)	0,72	67 (32,5)	0,9 (0,6–1,5)	0,80
Smoking						
Never smoked	115 (55,8)	1,0		122 (59,2)	1,0	
No but has smoked before	73 (35,4)	1,0 (0,6–1,5)	0,87	62 (30,1)	0,8 (0,5–1,2)	0,24
Yes	18 (8,7)	0,6 (0,3–1,2)	0,16	22 (10,7)	0,7 (0,4–1,3)	0,30
Reduction of food intake						
No	184 (88,9)	1,0		182 (87,9)	1,0	
Yes	23 (11,1)	0,7 (0,4–1,3)	0,29	25 (12,1)	0,8 (0,5–1,4)	0,46
PC (tertiles)						
Lower than the first tertile	54 (26,7)	1,0		65 (32,2)	1,0	
Between the first and second tertiles	80 (40,8)	**2,4 (1,5–3,9)**	**0,00**	65 (33,2)	**1,6 (1,0–2,7)**	**0,05**
Higher our equal to second tertile	66 (33,3)	1,6 (0,9–2,5)	0,07	67 (33,8)	1,3 (0,8–2,1)	0,25

IC95%: 95% confidence interval; OR: odds ratio; PC: waist circumference.

BHEI-R: Brazilian Healthy Eating Index–Revised.

[a] For this analysis, the reference category was the lowest for the tertile with BHEI-R of "Poor diet quality".

consumption as consumer assessment tool, which despite not being validated, allowed us to observe that the elderly tend to have monotonous diets as the difficulties to prepare food and even to eat increase (Venturini et al., 2015) and even due to income issues, which minimizes the potential bias in this case and justifies the use of this recall. Moreover, this recall provides a better estimate of food intake when compared to the Food Frequency Questionnaire, which has a limited number of food items.

This study's results show most seniors need to improve their diet quality and there is evidence of the association between female gender, having higher education, having history of diabetes *mellitus*, dyslipidemia, using polypharmacy and having the "Best quality diet". Considering some methodological differences between the studies, these results are similar to those observed in the elderly in developed countries and larger cities in Brazil. Elderly men, with any or little education and those who do not seek health services are the groups that needs more attention regarding to the measures to improve their diet quality.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Authors' contributions

Fernandes DPS worked in study design, analysis and interpretation of data, article writing and critical review of relevant intellectual content and final approval of the version to be published. Ribeiro AQ guided the design, collection and analysis and interpretation of data, and critical review of relevant intellectual content and final approval of the version to be published. Duarte MSL and Pessoa MC collaborated in the analysis and interpretation of data, article writing and critical review of relevant intellectual content; Franceschini SCC collaborated in the relevant critical review of the intellectual content.

Ethical

The study was conducted according to the directives established in

Table 5

Results of the multivariate analysis of the association between sociodemographic conditions, health status, use of health services, lifestyle, waist circumference and diet quality[a], Viçosa, Brazil, 2009.

Variable	BHEI-R Intermediate diet quality OR (IC 95%)	p value	BHEI-R Best diet quality OR (IC 95%)	p value
Gender				
Male	1,0		1,0	
Female	**1,8 (1,1–2,9)**	**0,02**	**1,7 (1,0–2,9)**	**0,04**
Education				
Never studied	1,0		1,0	
Early grades of elementary school	1,4 (0,8–2,4)	0,26	**3,1 (1,5–6,1)**	**0,00**
Latest grades of elementary or higher	2,0 (0,9–4,1)	0,07	**10,5 (4,5–24,5)**	**0,00**
Medical appointments (past year)				
None	1,0		1,0	
1 to 5	1,2 (0,6–2,6)	0,57	**3,7 (1,0–13,1)**	**0,04**
≥6	1,2 (0,5–2,9)	0,62	3,2 (0,8–12,5)	0,10
History of diabetes *mellitus*				
No	1,0		1,0	
Yes	1,4 (0,8–2,6)	0,27	**4,1 (2,3–7,5)**	**0,00**
History of dyslipidemia				
No	1,0		1,0	
Yes	1,1 (0,7–1,7)	0,74	**1,6 (1,0–2,6)**	**0,05**
History of high blood pressure				
No	1,0		1,0	
Yes	0,8 (0,5–1,3)	0,44	1,1 (0,7–2,0)	0,65
Polypharmacy				
No	1,0		1,0	
Yes	1,1 (0,7–1,8)	0,67	**1,8 (1,1–3,0)**	**0,02**
Smoking				
Never smoked	1,0		1,0	
No but has smoked before	1,3 (0,8–2,0)	0,35	0,8 (0,5–1,4)	0,44
Yes	0,9 (0,4–1,9)	0,88	1,4 (0,7–2,9)	0,40
PC (tertiles)				
Lower than the first tertile	1,0		1,0	
Between the first and second tertiles	**2,5 (1,5–4,2)**	**0,00**	1,6 (0,9–2,7)	0,09
Higher our equal to second tertile	1,5 (0,9–2,4)	0,14	0,9 (0,5–1,5)	0,60

IC95%: 95% confidence interval; OR: odds ratio; PC: waist circumference.

BHEI-R: Brazilian Healthy Eating Index–Revised.

[a] For this analysis, the reference category was the lowest for the tertile with BHEI-R of "Poor diet quality".

the Declaration of Helsinki, and all procedures involving human being were approved by the Research Ethics Committee of the Federal University of Viçosa, Brazil. All persons gave their informed consent prior to their inclusion in the study.

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