

# HEALTHY EATING INDEX IN SOUTHERN BRAZILIAN OLDER ADULTS AND ITS ASSOCIATION WITH SOCIOECONOMIC, BEHAVIORAL AND HEALTH CHARACTERISTICS

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**Abstract:** *Objective:* The objective of this study was to assess factors associated with the diet quality of Brazilian older adults. *Design:* Cross-sectional study. *Setting:* City of Carlos Barbosa, Brazil. *Participants:* 228 participants aged 60 and older. *Measurements:* A questionnaire with questions on socioeconomic and behavioral variables and health characteristics was used. The body mass index was calculated and the waist circumference was measured to provide information in respect to abdominal fat accumulation. Dietary data were collected via 24-hour recall and the diet quality was assessed using the Healthy Eating Index, an instrument that attributes scores to the diet according to the adequacy of intake of the main food and nutrient groups. Participants were divided into three categories, according to the Healthy Eating Index scores: under 51 - poor diet; between 51 and 80 - diet that needs improvement; over 80 - good diet. The evaluation employed the analysis of variance, t test and non-conditional logistic regression to assess the association between the Healthy Eating Index and the other variables. *Results:* Most participants (80.9%) presented diet that needs improvement and the marital status showed an independent association with the Healthy Eating Index - married individuals showed higher odds of presenting good diet. *Conclusion:* The results of this study suggest that, in general, the diet quality of this group needs improvement and that the marital status is a factor that can be considered for the development of activities to promote health and healthy food intake habits.

**Key words:** Aged, epidemiological studies, food Habits, nutritional assessment, nutrition surveys.

## Introduction

Nutrition, especially to older adults, has shown to be essential for health maintenance, functional capacity and psychological well-being (1). Thus, the development of instruments to assess food intake is important in order to properly estimate the connection between diet and the incidence of non-transmittable chronic diseases and related to morbidity and mortality (2). Many studies have demonstrated the relation between food and the prevalence of certain diseases through the assessment of isolated nutrients, probably because this analysis is easy to perform. However, given the diversity of factors related to food intake, the overall assessment of diet is required, since it provides a better picture of the complexity of food intake (3). For this reason, new methods for these analyses have been tested, including: the Diet Quality Index (4), the 2005 Dietary Guidelines for Americans Adherence Index (5), the Dietary Variety Score (6) and the Healthy Eating Index (7).

The Healthy Eating Index (HEI) is an instrument that attributes scores to the diet of individuals based on the dietary recommendations of The food guide pyramid, which specify the proper quantities of intake of the main food and nutrient groups (8). Hann et al. (2001) (9) and Weinstein et al. (2004) (10) demonstrated associations of the HEI with plasmatic concentrations of folate, alpha-carotene, beta-carotene, vitamin C and lutein, validating it as a useful tool for overall descriptions of diet.

The main functions of the HEI are: population monitoring,

nutritional education, assessment of nutritional interventions and epidemiologic and economic studies (7). In Brazil the population is aging rapidly. Thus, it is important to study the possible factors associated with food intake, to provide a tool for the identification of vulnerable segments of the population.

The aim of this study was to assess whether the socioeconomic and behavioral indicators and the health history were associated with the diet quality according to the Healthy Eating Index in older adults living independently in a city located in southern Brazil.

## Material and Methods

### Design and subjects

This cross-sectional study was based on the data collection of a larger study about nutrition and oral health of independent living older adults in the city of Carlos Barbosa, Rio Grande do Sul, conducted between March and December of 2006. The target population was comprised of individuals living in the mentioned city and aged 60 years old or older, who, according to the last census performed in 2000, represented approximately 2100 older adults out of a total of 20.519 inhabitants (11). A sample of 288 participants was evaluated, providing 95% power of properly identifying a correlation of 0.05, with confidence interval of 0.04-0.06 and alpha of 0.05. The participants were selected from city records of the population over 60 years of age, using a random sampling method. The potential

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participants were contacted via phone or letter, when no phone was available. The refusals were replaced with subsequent individuals in the randomization. Participants were considered eligible if aged 60 years old or older, lived in the community, were not institutionalized and were healthy, which was defined as individuals whose physical, medical and mental conditions allowed them to come to the study place and who could understand the exams performed and the questionnaires used (12).

### **Data collection**

Data collection was performed in weekly meetings at places assigned by the city administration, where the dietary recalls, questionnaire and anthropometry were performed. The questionnaire with 25 questions on socioeconomic and behavioral variables and health characteristics was used. It included information regarding age, gender, ethnic group, income, schooling, marital status and smoking habit. The presence of diabetes mellitus, systemic arterial hypertension and history of cancer were self-reported.

Weight and height were measured and the body mass index (BMI) was calculated. The BMI was obtained by dividing the weight in kilograms by the square of height in meters (12). Height was measured with the individual standing straight, without shoes, feet together, arms at the sides, stretched legs, relaxed shoulders and head at the Frankfurt horizontal line with the ankles, scapula and the back part of the head touching the wall. The measurements were recorded in centimeters using a portable stadiometer (SECA; Hamburg, Germany). Weight was measured with the individuals barefoot and wearing light clothes, using a digital scale of 0.1 kg graduation (TBF-612, Tokyo, Japan). The BMI classification was based on the guidelines of the World Health Organization (13): BMI under 18.5 kg/m<sup>2</sup> was considered underweight, between 18.5 and 24.9 kg/m<sup>2</sup> as normal range, between 25 and 29.9 kg/m<sup>2</sup> as pre-obese and 30 kg/m<sup>2</sup> or over as obese. The cases of extreme underweight and obesity were not analyzed separately. The waist circumference was measured using a flexible tape measure at the horizontal plane one centimeter above the iliac crest, with the individual standing straight (14). The individuals were divided into two groups, according to the guidelines of the National Cholesterol Education Program Adult Treatment Panel III (15): men and women presenting waist circumference values under 102cm and 88cm, respectively, were considered as having normal measurements and men and women with waist circumference values of 102cm and 88cm or over, respectively, were considered as having abdominal obesity.

Dietary data were collected using the 24-hour recall of a typical day - between Monday and Friday - on which all food and liquid intake from the previous day was recorded with respective quantities. The assessment of calorie, micronutrient and macronutrient intake was based on a specific software developed for analyzing dietary intake data from population groups (Nutwin version 1.5) of the University of São Paulo,

authorized by the Federal University of Health Science of Porto Alegre. The tables of nutritional composition of the foods used in the program are from the United States Department of Agriculture. The program database was adapted with the addition of the Brazilian table of food composition (16), which has specific data about the composition of food consumed in Brazil.

The assessment of diet quality used the Healthy Eating Index version 2005 (7), an instrument based on The food guide pyramid (8), which attributes scores to the diet according to the adequacy of intake of food and nutrient groups, based on the 24-hour recall previously applied.

The HEI components are: five food groups – total fruit, total vegetables, total grains, milk and meat and beans; and seven additional groups – whole fruit, dark green and orange vegetables and legumes, whole grains, oils, saturated fat, sodium and calories from solid fat, alcohol and added sugar (SoFAAS). Each component was assessed and scored zero to five for total fruit, whole fruit, total vegetables, dark green and orange vegetables and legumes, total grains and whole grains, from zero to ten for milk, meat and beans, oils, saturated fat and sodium and from zero to twenty for calories from SoFAAS. The intermediate values were calculated proportionally. The maximum score that can be obtained with the sum of components is 100. The components related to food groups were based on the foods and preparations described in The food guide pyramid (8). The individuals were divided into three categories defined according to the score obtained: under 51 - poor diet; between 51 and 80 - diet that needs improvement; and over 80 - good diet.

### **Statistical Analysis**

Data analyses were performed in Statistical Package for Social Sciences (SPSS) version 16.0. The frequency analysis was made for categorical variables and mean and standard error for continuous variables. The mean values of the HEI were compared using the t test or analysis of variance, with the application of Bonferroni test for multiple comparisons. A model of non-conditional logistic regression with stepwise procedure was used, considering the HEI as dependent variable (data were recategorized in good diet and others) and the other variables (socioeconomic, demographic, anthropometric and health characteristics) as independent. The critical alpha of 0.05 was considered in all comparisons.

### **Ethical Procedures**

The study was approved by the Research Ethics Committee of the Federal University of Rio Grande do Sul and all participants signed the informed consent term.

## **Results**

The sample of this study comprised 288 older adults, who corresponded to a representative sample of the population of

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around 2.100 older adults living in the city of Carlos Barbosa.. The age ranged from 60 to 90 years, mean of 69.14 ( $\pm$  6.77) years. Table 1 shows the distribution of individuals according to socioeconomic, behavioral and anthropometric variables and health characteristics.

**Table 1**

Distribution of individuals, mean value and standard error of the Healthy Eating Index scores and p value according to socioeconomic, behavioral and anthropometric variables and health characteristics (n=288)

		Frequency	HEI score	p
		N (%)	Mean $\pm$ standard error	
Gender	Male	92 (31.9)	62.65 $\pm$ 12.35	0.08†
	Female	196 (68.1)	68.49 $\pm$ 9.75	
Ethnic Group	White	284 (98.6)	66.60 $\pm$ 11.00	0.51†
	Nonwhite	4 (1.4)	70.20 $\pm$ 6.90	
Age	60-69 years	161 (55.9)	67.41 $\pm$ 10.67	0.30‡
	70-79 years	100 (34.7)	66.00 $\pm$ 11.30	
	80 years and over	27 (9.4)	64.25 $\pm$ 11.47	
Schooling	Less than 4 years	110 (38.2)	65.02 $\pm$ 11.80	0.22‡
	4 years	152 (52.8)	66.90 $\pm$ 11.40	
Annual Income	8 years and over	26 (9.0)	63.40 $\pm$ 10.00	0.24‡
	Up to 4200 reais (US\$1953)	141 (49.0)	66.30 $\pm$ 11.34	
	4200 – 8400 reais (US\$1953 - US\$3906)	92 (31.9)	68.04 $\pm$ 10.20	
Marital Status	8400 reais (US\$3906) or more	55 (19.1)	65.02 $\pm$ 11.17	0.06‡
	Married	232 (80.5)	65.27 $\pm$ 11.17	
Diabetes	Divorced/widowed /single	56 (19.5)	68.39 $\pm$ 12.50	0.30†
	Yes	31 (10.8)	68.54 $\pm$ 9.43	
Hypertension	No	257 (89.2)	66.39 $\pm$ 11.13	0.03†
	Yes	169 (58.7)	67.79 $\pm$ 10.26*	
History of cancer	No	119 (41.3)	64.97 $\pm$ 11.75**	0.56†
	Yes	12 (4.2)	64.83 $\pm$ 12.22	
Smoking	No	276 (95.8)	66.70 $\pm$ 10.93	0.11†
	Yes	9 (3.1)	60.91 $\pm$ 10.02	
BMI	No	278 (96.9)	66.78 $\pm$ 10.97	0.005‡
	Underweight	4 (1.4)	69.43 $\pm$ 5.30*	
	Normal range	72 (25.0)	63.40 $\pm$ 12.55**	
	Pre-obese	124 (43.0)	66.37 $\pm$ 10.75*	
Waist circumference	Obese	88 (30.6)	69.50 $\pm$ 9.32*	0.07†
	Normal range	72 (25.0)	64.63 $\pm$ 13.15	
	Abdominal obesity	216 (75.0)	67.29 $\pm$ 10.08	

† subject misses Smoking; HEI: Health Eating Index; BMI: body mass index; † t test; ‡ Analysis of variance (ANOVA); Mean values in different symbols are significantly different, one from another

The HEI mean score was 66.63 ( $\pm$ 10.97), ranging from 35.13 to 91.69. When participants were categorized, we observed that 9.4% of them presented poor diet, 80.9% diet that needs improvement and 9.7% good diet.

Table 2 shows the mean values and the mean values relative to maximum scores for each component of the HEI (n=288).The components with the highest percentages of individuals meeting the dietary recommendations were: total grains (88.89%) and whole fruit (86.46%) (Figure 1). Consistent with these results, the highest relative mean scores were obtained with the same components (97.4 and 88.6, respectively) (Table 2). The analysis demonstrated 76% and 66% of the individuals meeting the dietary recommendations

for total fruit and meat and beans, respectively, and between 20% and 35% presenting the ideal intake of vegetables, milk, saturated fat and GSAAA. Only 9.03% presented the recommended intake of oils, 11.46% presented the recommended intake of sodium and 14.93% of whole grains (Figure 1).

**Table 2**

Mean value, mean value relative to maximum score and standard error of scores for each component of the Healthy Eating Index (n=288)

Component	Score	Mean	M/S <sub>max</sub> (%)	Standard error
Total fruit	0 to 5	4.33	86.6	1.54
Whole fruit	0 to 5	4.43	88.6	2.55
Total vegetables	0 to 5	2.63	52.6	1.72
Dark Green and Orange s	0 to 5	1.76	35.2	2.13
Vegetables and Legume				
Total grains	0 to 5	4.87	97.4	0.5
Whole grains	0 to 5	1.12	22.4	1.92
Milk	0 to 10	6.19	61.9	3.10
Meat and Beans	0 to 10	8.78	87.8	2.31
Oils	0 to 10	4.40	44	2.83
Saturated fat	0 to 10	8.05	80.5	2.73
Sodium	0 to 10	4.83	48.3	3.88
Calories from SoFAAS	0 to 20	15.18	75.9	5.71

M/S<sub>max</sub>= relation between mean and maximum score; SoFAAS= Solid Fat, Alcohol and Added Sugar

**Table 3**

Relation between good diet according to the Healthy Eating Index and independent variables, assessed through logistic regression

Independent variables†	OR (CI 95%)	p	
Annual Income	Up to 4200 reais (US\$1953)	1	
	4200 – 8400 reais (US\$1953 - US\$3906)	0.70 (0.29- 1.71)	0.44
	8400 reais (US\$3906) or more	0.22 (0.04-1.06)	0.06
Marital Status	Married	1	
	Divorced/widowed/single	0.29 (0.11-0.72)	0.008
Waist circumference	Normal range	1	
	Abdominal obesity	0.43 (0.18-1.03)	0.06

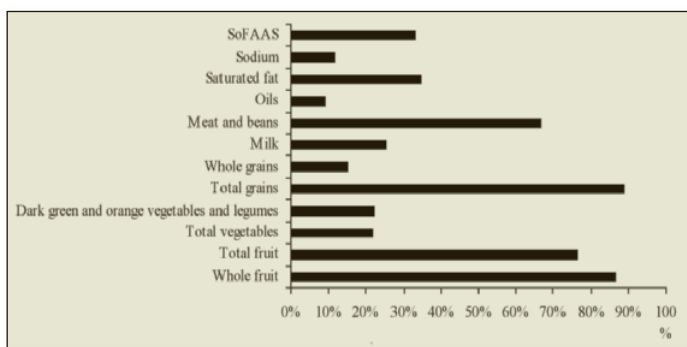
† The other independent variables were excluded from the final model through stepwise exclusion because they did not contribute significantly to explain the final regression model; OR= odds ratio; CI= confidence interval

According to bivariate analysis, there were differences between the mean HEI scores relating to marital status, BMI and to hypertension. The lowest scores were obtained by non-married, non-hypertensive and with normal weight individuals (Table 1). The multivariate analysis showed that only one variable - marital status - showed an independent effect on the HEI, as the married individuals presented higher odds of having good diet (Table 3).

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**Figure 1**

Percentage of individuals meeting the dietary recommendations for the Healthy Eating Index components (n=288)



### Discussion

The results suggest that, in general, the diet quality of this Brazilian elderly needs improvement and that married individuals show higher chance of presenting good diet. This finding corroborates with the results reported by other authors, demonstrating that food intake and nutrient intake are determined not only by food availability, but also by sociocultural and behavioral factors (17, 18). This is one of the first studies that make an overall assessment of the diet quality of Brazilian older adults and analyze its associated factors. This specific dietary index was selected for being based on recent recommendations, applicable to cross-sectional investigations and generated via 24-hour recall, resources employed in this study.

The HEI mean score was 66.63 in this study, with most individuals (80.9%) presenting the score of diet that “needs improvement”. These results corroborates with previous studies, that described mean scores between 60.4 e 66.6 and around 75% of the individuals classified with a diet that “needs improvement” (2, 17, 19, 20).

The fact that married individuals show higher chance of presenting good diet can be related to differences in lifestyle, as the self-care level can be lower for those without a spouse (21). Besides, the benefit of marriage to health is linked with the support and social control provided by one spouse regarding his/her partner’s health (22). Kroshus (2008) (23) described that marriage was positively associated with healthy food intake habits in men and women and Hann et al. (2001) (9) studied a sample of American women and reported that married women presented higher scores of HEI when compared to divorced and separated women. Older adults who are married tend to have better mental health and lower levels of depressive symptoms than those who are not married and it may influence food consumption too (24, 25). However, such analyses could not be performed in this study, as these data measurements were not provided.

Several authors (2, 17, 19) found a positive association

between the diet quality and schooling and income, which was not found in this investigation. These studies analyzed groups with more heterogeneous characteristics, enabling more comparisons between subgroups. One of the main characteristics of this sample is the homogeneity regarding socioeconomic and cultural aspects, with many of them presenting similar financial, schooling and family characteristics.

A literature review that analyzed several studies published until 2001 about dietary indexes found out that the relations of such indexes with the BMI were inconsistent and varied according to the method and protocol employed (3). In agreement with this study, an investigation with North American older adults living in the rural area did not find differences between the HEI of individuals in different nutritional states classified according to the BMI (26). On the other hand, Ervin (2008) (17) found a significant association between the BMI and the HEI score only in older women, those with the BMI under 25 kg/m<sup>2</sup> and higher total score than those with the BMI of 30 kg/m<sup>2</sup> or over.

It should be noted that a limitation of this study was the assessment of food intake of just one day, as each individual is known to present a considerable daily variation in the dietary intake, and this single measurement may not represent the habitual intake (27). Despite that, previous studies indicated that the analysis of 24-hour food intake is reliable to estimate usual values of intake in representative samples of population groups (28), and this method was used in the Third National Health and Nutrition Examination Survey (NHANES III), a study with the American population that used the 24-hour recall as food intake record and the HEI to assess the diet quality (19). The Healthy Eating Index was created based on the Dietary Guidelines for Americans, which imposes certain limitations on the application to populations with different socioeconomic characteristics and food intake habits, like this one.

An adequate and balanced nutrition of elderly people is important for providing a healthy life. The results of this study suggest that, in general, the diet quality of this group needs improvement and that the marital status is a factor that can be considered for the development of activities to promote health and healthy food intake habits. The diet components that demand greater emphasis on nutritional interventions include whole grains, oils, sodium and milk. Further studies are required to explain how the marital status interferes in the dietary intake of these older adults and to correlate the family and social isolation with the diet quality.

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