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Diversity of eating patterns in older adults: A new scenario?

Diversidade de padrões alimentares em idosos: um novo cenário?

Patrícia Moraes FERREIRA[1]
Silvia Justina PAPINI[2]
José Eduardo CORRENTE[3]

ABSTRACT

Objective

To identify eating patterns and their distribution in a representative sample of older adults from the municipality of *Botucatu, São Paulo*, Brazil.

Methods

This cross-sectional study used food frequency and sociodemographic questionnaires to collect the respective data from 355 older users, selected by stratified sampling, of *Botucatu*'s primary health care units from March to June 2011. Principal component analysis extracted six eating patterns. Individual food intake scores were divided into tertiles, classifying individual adherence to each eating pattern as low, moderate, or high, to measure the relationship between adherence tertiles and sociodemographic variables.

Results

Six eating patterns were identified and named as follows: healthy foods; snacks and weekend meals; fruits; light and whole foods; soft diet; and traditional diet. Individuals with elementary school adhered highly to the patterns 'healthy foods' and 'fruits'. On the other hand, men and individuals with the highest education levels adhered highly to the pattern 'snacks and weekend meal'. Females adhered more often to the patterns 'light and whole foods' and 'soft diet'. The pattern 'soft diet' was also preferred by the oldest subgroup.

Conclusion

The study population presented a diversity of eating patterns influenced by sociodemographic characteristics.

Indexing terms: Aged. Feeding beharvior. Population studies in public health. Principal component analysis.

[1] Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Medicina de Botucatu, Programa de Pós-Graduação em Saúde Coletiva. Distrito Rubião Júnior, s/n., 18618-970, Botucatu, SP, Brasil. *Correspondência para*/Correspondence to: PM FERREIRA. *E-mail*: <patriciaferreira.nut@gmail.com>.
[2] Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Medicina de Botucatu, Departamento de Enfermagem. Botucatu, SP, Brasil.
[3] Universidade Estadual Paulista Júlio de Mesquita Filho, Instituto de Biociências, Departamento de Bioestatística. Botucatu, SP, Brasil.

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RESUMO

Objetivo

Identificar padrões alimentares e a distribuição dos mesmos, em uma amostra representativa de idosos do município de Botucatu, São Paulo.

Métodos

Estudo transversal, ocorrido entre março e junho de 2011, com 355 idosos cadastrados na rede básica de saúde do município, selecionados por amostragem estratificada entre as unidades de saúde. Aplicou-se um questionário de frequência alimentar e questionário sociodemográfico. Padrões alimentares foram identificados utilizando-se análise de componentes principais. Escores de consumo individual foram divididos em tercis, caracterizando a adesão baixa, moderada e alta dos indivíduos para cada padrão alimentar. Realizaram-se análises entre os tercis dos padrões alimentares e as variáveis sociodemográficas.

Resultados

Identificaram-se seis padrões alimentares: saudável; lanches e refeição de final de semana; frutas; light *e integral; dieta branda; e tradicional. A alta adesão aos padrões "saudável" e "frutas" é atingida por indivíduos que cursaram até o primário; e a alta adesão ao padrão "lanches e refeição de final de semana" é mais prevalente no sexo masculino e em indivíduos com nível máximo de escolaridade. A alta adesão aos padrões "*light *e integral" e "dieta branda" é mais prevalente no sexo feminino, sendo este último padrão também característico de idosos em idade mais avançada.*

Conclusão

Identificou-se uma diversidade de padrões alimentares nessa população de idosos e o comportamento alimentar variou de acordo com as condições sociodemográficas inseridas no grupo.

Termos de indexação: *Idoso. Comportamento alimentar. Estudos populacionais em saúde pública. Análise de componente principal.*

INTRODUCTION

In the context of ageing, eating behavior is frequently associated with nutritional problems[1] and dietary monotony[2,3] because many physiological, economic, and psychosocial factors limit food intake[3-5]. Thus, older adults are not only vulnerable, but also a heterogeneous group with respect to many aspects, including diet[5]. The higher food diversity resultant from food processing and trade may encourage new dietary patterns in a population group.

In nutritional epidemiology, eating patterns may be identified by statistical methods for reduction and/or aggregation components. Methods of identifying eating patterns, known as a posteriori methods, are based on empirical food data, which are aggregated by statistical analysis followed by assessment[6]. Principal component analysis is one of the most common statistical methods used for deriving eating patterns empirically[6]. Eating patterns derived a posteriori do not necessarily represent ideal patterns[7,8]. However, the specificity of these methods has the advantage of reflecting the real behavior of a population group, providing useful information for the creation of nutritional guidelines[9]. Eating patterns may be the result of cultural heritage, ethnic and multiple environmental factors[8].

The present study was conducted in *Botucatu, São Paulo*, a city that stands out for developing an increasing number of aging researches and having high prevalence of older adults (13.35%)[9], exceeding the national (10.8%) and state (11.6%) prevalences[10].

Until now, only a few studies have used statistical methods for empirically identifying the eating patterns of older adult subgroups[11-13]. In Brazil, such statistical analysis were not published only with a sample of older adults.

Knowledge of the eating behavior of older adults is essential once this group is more

vulnerable to nutritional problems and their consequences, which are much more severe in old age than in other life stages[5].

Based on the hypothesis that the eating environment in old age is diversifying, the objective of this study was to identify the eating patterns and their distributions in a representative sample of older urban users of the municipal primary health care network of *Botucatu* (SP).

METHODS

This is a cross-sectional epidemiological study of a representative sample of urban adults aged 60 years or more, users of the Basic Health units and family health strategy units of *Botucatu* (SP).

The participants answered a Food Frequency Questionnaire (FFQ) validated for this population containing 71 food items[14]. The sample size was given by multiplying the number of food items in the FFQ (K) by five because the FFQ contained more than fifteen food items, as follows: if K>15, then n=5xK[15]. Hence, a sample of 355 older adults was randomly selected from the 16 health care units of *Botucatu* (SP) by stratified sampling. These units included the Basic Health units and family health strategy units.

The older adults who agreed to participate in the study were interviewed after being informed of the study objectives and proving capable of answering the questionnaires. The interviews were conducted at the participants' homes or the health care units they frequented, depending on their preference. Participants with hearing loss and those who could not understand the questions well were included in the study since they were accompanied by a caregiver who had previously agreed to answer the questions for them. New participants were randomly selected to replace those who refused to participate. All participants signed an Informed Consent Form.

The participants answered the FFQ validated for this population and a sociodemographic and lifestyle-related questions during interviews conducted at their homes or the primary health care units they frequented between March and June 2011.

Sociodemographic variables were gender (male, female); age in years (60-69; 70-79; 80-89; 90 or more); education level (never attended school, incomplete elementary school, elementary school, high school, higher education); family income per member (continuous variable); and skin color (white, black, and brown).

Exploratory factor analysis, namely Principal Component Analysis (PCA), was used to extract and interpret dietary patterns from the dietary information collected by the FFQ.

We used a Food Frequency Questionnaire (FFQ) with 71 food items, referring to previous year, with response options in consumption frequencies ranging from "never" to "10 times" for units of time "day", "week", "month" and "year", and a field to mark the usual individual portion relative to a middle portion indicated for each food. But to simplify data collection and analysis, only the intake frequency was collected, not the amount consumed. All intake frequencies (per day, week, month, and year) were converted to daily intake frequency (frequency numerator divided by the number of days in the frequency denominator), and this value was used in factor analysis.

Then were withdrawn from the FFQ food items whose frequency of consumption did not apply to this type of qualitative analysis, since these were foods with more quantitative importance in the diet of individuals. The excluded items were: common oils, salad dressings, table salt added to salads, seasoning, and table sugar/honey/fruit preserves. Therefore, PCA included only 66 of the 71 FFQ food items.

The following stages of principal component analysis were performed as suggested by Olinto[6]: using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett test of sphericity for assessing the appropriateness of using PCA; preparing the correlation matrix; extracting a set

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of factors from the correlation matrix; determining the number of factors; rotating the factors to ease their interpretation; naming the eating patterns.

Individual food intakes were scored to improve the understanding of the distribution of these eating patterns in the study population, resulting in factor scores, which are estimated composite measures for each individual in each factor (eating pattern) extracted by factor analysis[15]. These scores were divided into tertiles: the first tertile included individuals with low adherence to an eating pattern; the second tertile included individuals with moderate adherence to an eating pattern; and the third tertile included individuals with high adherence to an eating pattern.

Bivariate analyses (Chi-square test) checked how the adherence tertiles related to the sociodemographic variables (gender, age group, skin color, and education level). Multiple logistic regression analysis adjusted for gender and education level, both identified as confounding variables, measured the association between family income per member and adherence tertiles. The Odds Ratios (OR) were calculated with a Confidence Interval of 95% (95%CI) and a significance level of 5% ($p<0.05$) for the statistical tests.

The software Statistical Analysis System (SAS) version 9.2 for Windows performed the statistical treatments.

This study was approved by the Research Ethics Committee of School of Medicine of *Botucatu, Universidade Estadual Paulista Júlio de Mesquita Filho* (Unesp), under Protocol number 3560/2010.

RESULTS

Characteristics of the study population

The study sample consisted of 355 individuals aged 60 years or more. Of these, 163 (45.9%) were males and 192 (54.1%) were females, percentages close to those reported by the Brazilian Census of 2010[16] (42.7% males and 57.3% females), indicating that this sample is representative of the municipal population.

The participants' ages varied from 60 to 92 years. The mean age and Standard Deviation were 69.5±7.73 years. This population had a mean family income per member of 1.76 minimum salaries.

Identification of the eating patterns

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.636) and Bartlett test of sphericity ($p<0.000$) indicated the appropriateness of factor analysis for analyzing the data.

Analysis of the 66 study food items resulted in 28 factors with eigenvalues greater than one, which explained 67.44% of the variability of the 66 original items. However, this elevated number of factors hindered data interpretation and characterization because many food items in many factors were loaded, and some factors had less than three food items.

The scree plot showed that the six factors above the "elbow" in the plot were appropriate for factor analysis because they explained 25.89% of the variability of the 66 original food items. Based on this datum, the factors were re-extracted, resulting in six factors that improved interpretation coherence.

Only the items with a factor loading greater than 0.3 were maintained in the matrix, as suggested by Hair *et al.*[15].

Varimax rotation was used to extract the six factors.

Table 1 shows the food items, their factor loadings, their communalities, and the percentage of explained variance by each factor after Varimax rotation. Factor loadings greater than 0.3 are highlighted. Only the food items with a factor loading above 0.3 in at least one factor were included in the table.

The food items with factor loading above 0.3 in more than one factor were maintained according to their original factor loadings, except for those with negative values. The food items

Table 1. Factor loading matrix, solutions of six factors for older adults from *Botucatu* (SP), Brazil, 2011.

Variables	Factors						
	1	2	3	4	5	6	Commonality
Soup	0.18886	-0.01929	0.00995	0.10890	**0.58335**	-0.19785	0.42743598
Deep-fried savory snack	-0.09431	**0.38677**	0.07355	-0.17669	-0.05896	-0.10341	0.20928645
Baked savory snack	-0.00492	**0.41349**	0.01932	0.05400	0.03444	-0.06528	0.17973793
Pasta with meat	-0.04553	**0.35786**	0.02374	0.06349	0.09663	0.14525	0.16516339
Pizza/pancake	0.08745	**0.47204**	-0.07935	0.08443	-0.15561	-0.14376	0.28877716
Polenta	0.07114	0.01600	-0.06945	-0.16111	**0.30953**	-0.02068	0.13233529
Pork	0.18624	0.14658	-0.04074	**-0.40018**	-0.19753	-0.04525	0.25904567
Bacon/jerky	0.01870	**0.39987**	-0.05000	0.14124	-0.10720	-0.02335	0.19473225
Sausages	-0.09966	0.24777	0.02116	**-0.36038**	0.01080	0.24854	0.26353317
Other processed meats	-0.00460	**0.60340**	0.02853	-0.05810	-0.05810	-0.25292	0.43774218
Patties/nuggets/meatballs.	0.13372	**0.38924**	-0.02059	-0.11578	0.04145	0.06769	0.18951889
Seafood	**0.38755**	0.01162	0.14022	-0.10567	-0.10836	-0.08559	0.20022526
Whole milk	-0.10789	-0.06409	0.01195	-0.24047	**0.34172**	0.05863	0.19392623
Milk, semi/skimmed	0.08115	-0.01817	0.07173	**0.58645**	-0.12542	-0.05171	0.37438581
Yellow cheeses	0.10085	**0.50186**	0.09554	-0.07658	-0.24799	-0.21173	0.38335648
Beans	-0.03858	-0.16888	-0.09772	-0.18950	0.00077	**0.57362**	0.40451007
White rice	0.00298	0.03289	-0.08930	-0.28656	-0.01832	**0.61393**	0.46843146
French or cassava fries	-0.09373	**0.33141**	-0.06265	-0.19838	0.02430	-0.00156	0.16248962
Cooked potato/cassava	0.16580	-0.00961	0.11770	0.08603	**0.65393**	-0.16336	0.50314769
Potato salad w/mayonnaise	0.09463	**0.35493**	0.02470	0.03715	0.08421	0.29638	0.23185233
Lettuce	**0.43882**	-0.00835	-0.00910	0.19890	-0.05116	**0.32017**	0.33740423
Tomato	**0.47015**	0.08009	0.04118	0.21302	0.00975	**0.30598**	0.36825020
Carrot	**0.54347**	0.05159	0.03115	0.18109	**0.33932**	-0.10287	0.45751082
Other non-starchy vegetables	**0.64190**	0.00928	0.05913	-0.10230	0.25369	-0.05602	0.49357503
Other raw leaf vegetables	**0.66238**	0.01562	0.21746	-0.09040	-0.01996	-0.01934	0.49522289
Other cooked leaf vegetables	**0.55270**	-0.00664	0.10540	-0.03644	0.04018	0.11113	0.33192789
Broccoli/cabbage/cauliflower	**0.62533**	-0.12436	0.09394	0.08992	0.12417	0.04772	0.44110494
Orange	0.04776	-0.00395	**0.42152**	0.11189	0.02761	0.01049	0.19337064
Banana	-0.01758	0.01653	**0.38011**	0.19003	0.22355	0.10814	0.24284694
Apple	0.12455	-0.01164	**0.54907**	0.23143	-0.19282	-0.06871	0.41258776
Melon	0.28500	-0.00633	**0.44710**	-0.01969	0.01855	-0.01894	0.28225539
Papaya	0.27553	-0.02270	**0.58547**	0.14700	-0.14838	-0.21073	0.50724502
Guava	0.11717	-0.03453	**0.68944**	-0.00900	-0.06454	-0.10794	0.50614241
Avocado	0.16233	-0.10929	**0.71030**	-0.19347	-0.13020	0.00486	0.59723062
Fruit juice w/added sugar	0.13810	0.00082	-0.01736	-0.17100	0.28098	**-0.42054**	0.30441870
Coffee w/o added sugar	0.08060	0.00494	0.26805	0.16984	**-0.36358**	0.08755	0.24707542
Coffee w/added sugar	-0.19107	0.00124	-0.13042	**-0.37337**	0.27129	-0.06656	0.27095361
Conventional soda	-0.18317	**0.37142**	-0.05635	-0.03979	0.01607	0.06702	0.18101517
Bread roll	-0.25351	**0.35843**	0.13324	-0.02916	**0.39359**	0.29032	0.45053886
Conventional butter	-0.11190	**0.38085**	0.26102	0.26975	0.29752	0.26254	0.45590910
Desserts	0.03405	**0.33373**	0.07418	0.03276	0.11768	0.08999	0.14105578
Oatmeal	**0.32436**	0.00925	0.18084	**0.32941**	-0.00916	-0.17134	0.27594809
Extra-virgin olive oil	**0.50458**	0.15005	0.11387	**0.31180**	-0.16229	-0.12678	0.42971110
Fruit juice w/o added sugar	0.09911	-0.04062	-0.04208	**0.38553**	0.02591	-0.09723	0.17200329
Whole bread	0.18013	0.02284	0.08350	**0.45993**	**-0.30313**	-0.07047	0.34833032
Number of items	10	14	7	8	8	5	
% explained variance	7.65%	4.74%	4.17%	3.43%	3.10%	2.80%	

Note: Factor loadings greater than 0.3 are highlighted.

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with negative factor loadings were excluded to maintain the foods that are actually consumed in the eating patterns.

The name of each factor (eating pattern) was based on two criteria: first, the nutritional and functional characteristics of the foods; and second, characteristics of the food items with the greatest factor loadings.

The six eating patterns are:

1. Healthy: other raw leaf vegetables; other non-starchy vegetables; broccoli/cauliflower/cabbage; other cooked leaf vegetables; carrot; extra-virgin olive oil; tomato; lettuce; seafood; oatmeal.

2. Snacks and weekend meal: sausages; yellow cheeses; pizza/pancake; baked savory snacks; bacon/jerky; meat patties/chicken nuggets/meatballs; deep-fried savory snacks; conventional butter; conventional soda; bread roll; pasta with meat; potato salad with mayonnaise; desserts/sweets; French fries/cassava fries.

3. Fruits: avocado; guava; papaya; apple/pear; melon/watermelon; orange/mandarin orange/pineapple; banana.

4. Light and whole foods: skimmed/semi-skimmed milk; whole bread; fruit juice without added sugar; oatmeal; extra-virgin olive oil.

5. Soft diet: cooked potatoes/cassava; soup; bread roll; whole milk; carrot; *polenta* (cornmeal boiled into a paste and eaten as is or baked, fried, or grilled).

6. Traditional: white rice; beans; lettuce; tomato.

Distribution of eating pattern adherence

Table 2 shows the logistic regression results for the association between family income per member and eating patterns, and Tables 3, 4, and 5, the distribution of the eating pattern adherences according to the demographic characteristics.

Table 2 shows that income prevents adherence to the patterns 1. Healthy (p=0.0083; OR=0.825; 95%CI=0.715-0.952); 3. Fruits (p=0.0377; OR=0.864; 95%CI=0.752-0.992); and 4. Light and whole foods (p<0.0001; OR=0.704; 95%CI=0.598 -0.829); and that income promotes adherence to the patterns 2. Snacks and weekend meals (p<0.0001; OR=1.674; 95%CI=1.393-2.011); and 5. Soft diet (p=0.0059; OR=1.223; 95%CI=1.060-1.411).

Table 3 shows that high adherence to the eating pattern 1. Healthy prevailed in individuals with incomplete or complete elementary school, and low adherence prevailed in individuals with a high education level (p=0.0017); high adherence to the pattern 2. Snacks and weekend meal prevailed in males (p=0.0095) and individuals with higher education (p<0.0001).

Table 4 shows that high adherence to the pattern 3. Fruits prevailed in whites (p=0.0004)

Table 2. Multiple logistic regression analysis* for the association between family income per member and the dietary patterns of older adults from *Botucatu* (SP), Brazil, regarding the highest adherence tertile, 2011.

Dietary patterns	Family income per member			
	Estimate	Standard error	*p*-value*	OR (95%CI)
1. Healthy	-0.1924	0.0729	0.0083	0.825 (0.715-0.952)
2. Snacks and weekend meal	0.5150	0.0937	<0.0001	1.674 (1.393-2.011)
3. Fruits	-0.1467	0.0706	0.0377	0.864 (0.752-0.992)
4. Light and whole foods	-0.3507	0.0831	<0.0001	0.704 (0.598-0.829)
5. Soft diet	0.2010	0.0730	0.0059	1.223 (1.060-1.411)
6. Traditional	-0.0429	0.0680	0.5286	0.958 (0.838-1.095)

Note: *Logistic model adjusted for gender and education level obtained by full model maintaining all the variables of interest.
OR: *Adjusted Odds Ratio*; 95%CI: Confidence Interval of 95%.

Table 3. Distribution of adherence to the eating patterns 1-Healthy and 2-Snacks and weekend meal according to sociodemographic characteristics of older adults from *Botucatu* (SP), Brazil. 2011.

Variables	Pattern 1. Healthy							
	Low		Adherence Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								0.1527
Male	61	37.42	54	33.13	48	29.45	163	
Female	57	29.69	61	31.77	74	38.54	192	
Age group								0.2987
60-69	56	28.57	66	33.67	74	37.76	196	
70-79	42	36.84	39	34.21	33	28.95	114	
80-89	18	46.15	8	20.51	13	33.33	39	
90 or more	2	33.33	2	33.33	2	33.33	6	
Skin color								0.4062
White	97	32.33	100	33.33	103	34.33	300	
Black	7	36.84	3	15.79	9	47.37	19	
Brown	12	37.50	12	37.50	8	25.00	32	
Education level								0.0017
Never attended school	10	27.03	13	35.14	14	37.84	37	
Complete elementary school	8	20.00	5	12.50	27	67.50	40	
Middle school	20	32.79	21	34.43	20	32.79	61	
High school	64	36.99	59	34.10	50	28.90	173	
Higher education	16	36.36	17	38.64	11	25.00	44	
Variables	Pattern 2. Snacks and weekend meal							
	Low		Adherence Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								
Male	40	24.54	58	35.58	65	39.88	163	0.0095
Female	75	39.06	62	32.29	55	28.65	192	
Age group								
60-69	66	33.67	64	32.65	66	33.67	196	0.5614
70-79	30	26.32	42	36.84	42	36.84	114	
80-89	16	41.03	13	33.33	10	25.64	39	
90 or more	3	50.0	1	16.67	2	33.33	6	
Skin color								
White	105	35.0	99	33.00	96	32.00	300	0.1133
Black	2	10.53	7	36.84	10	52.63	19	
Brown	7	21.88	12	37.50	13	40.63	32	
Education level								
Never attended school	23	62.16	11	29.73	3	8.11	37	<0.0001
Complete elementary school	23	57.50	8	20.00	9	22.50	40	
Middle school	18	29.51	26	42.62	17	27.87	61	
High school	43	24.86	64	36.99	66	38.15	173	
Higher education	8	18.18	11	25.00	25	56.82	44	

Note: *p-value for the Chi-square test.

and individuals with incomplete or complete elementary school, and the lowest adherence was found in those with higher education (p=0.0027). High adherence to the pattern 4. Light and whole foods prevailed in females (p=0.0007).

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Table 4. Distribution of adherence to the eating patterns 3. Fruits and 4. Light and whole foods according to sociodemographic characteristics of older adults from *Botucatu* (SP), Brazil. 2011.

Variables	Pattern 3. Fruits							
	Low		Adherence Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								0.3710
Male	49	30.06	53	32.52	61	37.42	163	
Female	68	35.42	65	33.85	59	30.73	192	
Age group								0.5614
60-69	66	33.67	59	30.10	71	36.22	196	
70-79	36	31.58	42	36.84	36	31.58	114	
80-89	14	35.90	13	33.33	12	30.77	39	
90 or more	1	16.67	4	66.67	1	16.67	6	
Skin color								0.0004
White	90	30.00	100	33.33	110	36.67	300	
Black	8	42.11	11	57.89	0	0.00	19	
Brown	18	56.25	5	15.63	9	28.13	32	
Education level								0.0027
Never attended school	9	24.32	9	24.32	19	51.35	37	
Complete elementary school	7	17.50	12	30.00	21	52.50	40	
Middle school	21	34.43	16	26.23	24	39.34	61	
High school	59	34.10	65	37.57	49	28.32	173	
Higher education	21	47.73	16	36.36	7	15.91	44	
Variables	Pattern 4. Light and whole foods							
	Low		Adherence Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								
Male	70	42.94	40	24.54	53	32.52	163	0.0007
Female	48	25.00	75	39.06	69	35.94	192	
Age group								
60-69	77	39.29	54	27.55	65	33.16	196	0.2009
70-79	29	25.44	45	39.47	40	35.09	114	
80-89	10	25.64	14	35.90	15	38.46	39	
90 or more	2	33.33	2	33.33	2	33.33	6	
Skin color								
White	96	32.00	99	33.00	105	35.00	300	0.1346
Black	5	26.32	6	31.58	8	42.11	19	
Brown	17	53.13	9	28.13	6	18.75	32	
Education level								
Never attended school	8	21.62	9	24.32	20	54.05	37	0.0516
Complete elementary school	9	22.50	12	30.00	19	47.50	40	
Middle school	20	32.79	20	32.79	21	34.43	61	
High school	63	36.42	63	36.42	47	27.17	173	
Higher education	18	40.91	11	25.00	15	34.09	44	

Note: $^*p$-value for the Chi-square test.

Table 5 shows that high adherence to the pattern 5. Soft diet prevailed in females (p=0.0484) and in the oldest individuals (p=0.0003). No socioeconomic or demographic

characteristic was associated with the pattern 6. Traditional, confirming its highly homogeneous distribution: most of its components are consumed habitually by most older adults.

Table 5. Distribution of adherence to the eating patterns 5. Soft diet and 6. Traditional according to sociodemographic characteristics of older adults from *Botucatu* (SP), Brazil. 2011.

Variables	Pattern 5. Soft diet							
	Low Adherence		Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								0.0484
Male	62	38.04	56	34.36	45	27.61	163	
Female	56	29.17	60	31.25	76	39.58	192	
Age group								0.0003
60-69	74	37.76	70	35.71	52	26.53	196	
70-79	37	32.46	37	32.46	40	35.09	114	
80-89	6	15.38	9	23.08	24	61.54	39	
90 or more	1	16.67	0	0.00	5	83.33	6	
Skin color								0.6374
White	104	34.67	95	31.67	101	33.67	300	
Black	6	31.58	7	36.84	6	31.58	19	
Brown	7	21.88	11	34.38	14	43.75	32	
Education level								0.0781
Never attended school	20	54.05	9	24.32	8	21.62	37	
Complete elementary school	18	45.00	12	30.00	10	25.00	40	
Middle school	21	34.43	21	34.43	19	31.15	61	
High school	47	27.17	59	34.10	67	38.73	173	
Higher education	12	27.27	15	34.09	17	38.64	44	
Variables	Pattern 6. Traditional							
	Low Adherence		Moderate		High		n	p^*
	n	%	n	%	n	%		
Gender								
Male	53	32.52	48	29.45	62	38.04	163	0.3027
Female	65	33.85	68	35.42	59	30.73	192	
Age group								
60-69	69	35.20	62	31.63	65	33.16	196	0.4511
70-79	37	32.46	42	36.84	35	30.70	114	
80-89	11	28.21	11	28.21	17	43.59	39	
90 or more	1	16.67	1	16.67	4	66.67	6	
Skin color								
White	99	33.00	99	33.00	102	34.00	300	0.8821
Black	5	26.32	6	31.58	8	42.11	19	
Brown	12	37.50	11	34.38	9	28.13	32	
Education level								
Never attended school	12	32.40	10	27.03	15	40.54	37	0.3242
Complete elementary school	16	40.00	7	17.50	17	42.50	40	
Middle school	15	24.50	23	37.70	23	37.70	61	
High school	59	34.10	63	36.42	51	29.48	173	
Higher education	16	36.30	13	29.55	15	34.09	44	

Note: $^*p$-value for the Chi-square test.

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DISCUSSION

The various dietary patterns found by the present study show that this population has different dietary preferences. Unlike findings made in Brazil some years ago, older adults are not limiting their diets to a monotonous list of foods mostly consisting of Brazilian staples, like rice and beans. The study sample also adhered to other patterns that may reflect the local culture (characterized by the intake of pasta, potato salad with mayonnaise, and desserts on weekends), the Western diet (high in carbohydrates and fats), specific situations (like intake of healthier or diet/light foods), and chewing difficulties (such as the soft diet, high in soft, cooked foods).

The eating pattern 5. Soft diet contains foods consumed mostly by women and the oldest adults.

An eating pattern containing easy-to-chew and pureed foods is expected in studies of very old individuals either because of affordability, ease of preparation, poor masticatory ability due to dentures, or even swallowing problems caused by certain diseases.

A qualitative analysis of the habitual diet of 308 older adults seen at a geriatric service of *São Paulo* found a high intake of vegetables and attributed the finding to the intake of soups; soups are frequently consumed by older adults and vegetables are their main ingredient[17].

The last national food intake survey conducted by the *Instituto Brasileiro de Geografia e Estatística* (IBGE, Brazilian Institute of Geography and Statistics), the 2008-2009 *Pesquisa de Orçamentos Familiares* (POF, Family Budget Survey), found that older adults consume more whole milk than other adults and adolescents[18].

The eating pattern 6. Traditional was given this name because of the presence of rice and beans, staples of the Brazilian diet, and because of the similarity between this pattern and other patterns found in Brazilian studies given this same name[19,20]. Moreover, lettuce and tomato were correlated with these two traditional items, placing them in the same eating pattern and confirming the preference of the study sample for lettuce and tomato salad.

A study investigated the meals consumed at home in the city of *São Paulo*[21] and found that the most common meal consisted of rice, pinto beans, main course (meat or eggs), French fries, and lettuce and tomato salad. Although the authors refer specifically to *São Paulo* city's cuisine, the components of this meal are very similar to those of the pattern 6-Traditional consumed by older adults from *Botucatu* (SP).

The eating pattern 2. Snacks and weekend meal was also found in the study population and consisted of foods high in carbohydrates and saturated and trans fats.

This eating pattern reflects the regional tradition of eating pasta, potato salad with mayonnaise, and dessert, usually on weekends with the family; and the modern practice of consuming fast foods, also on weekends and in the company of others. The participants who preferred this pattern were usually males with higher education levels and better income.

Instituto Brasileiro de Geografia e Estatística's 2008-2009 POF also confirms that individuals from the highest socioeconomic classes consume more soda, baked and deep-fried savory snacks, pizzas, sweets, and ham[18].

Another eating pattern identified herein was the 1. Healthy pattern, containing foods high in fiber, monounsaturated fatty acids, and phenolic compounds; low in energy density and fat content; and with omega-3 fatty acids.

Income was reversely associated with adherence to the 1. Healthy pattern. High adherence to this eating pattern was found in individuals with incomplete or complete elementary school, and low adherence in those with high education level. These results oppose those of other Brazilian studies[18,22].

Alves *et al.*[22] identified the eating patterns of adult women from *Rio Grande do Sul* and found that healthy patterns prevailed in women with higher family income per member and education level.

The 2008-2009 POF found that individuals with higher incomes consume more raw leaf vegetables[18].

This contradictory result requires future studies to determine the eating patterns of individuals with low income and education level from *Botucatu* (SP), since some resident-related characteristics, such as the habit of fishing and maintaining community gardens in the city's outskirts, may promote the intake of healthy foods (eating pattern 1. Healthy).

Some 2008-2009 POF findings corroborate the study finding of an inverse relationship between income and the intake of some healthy foods. According to this national survey, low-income individuals present a higher intake of many food items considered healthy besides rice and beans, such as fish, salted fish, and sweet potato[18].

The eating pattern 3. Fruits identified herein consisted only of fruits. High adherence to this pattern prevailed in whites and those with incomplete and complete elementary school education. Similarly to the eating pattern 1. Healthy, higher income reduces an individual's likelihood of adhering to the 3. Fruits pattern.

Additionally, fruits were not in the same pattern as non-starchy vegetables and other healthy foods, possibly because their intake was not sufficiently correlated with that of non-starchy vegetables and other foods.

Perozzo *et al.*[23] also found that fruits and non-starchy vegetables occurred in different eating patterns of adult women from *Rio Grande do Sul*.

The pattern 4. Light and whole foods seems to be preferred by health-conscious individuals who try to prevent or improve health problems. Adherence to this pattern prevailed in women, but decreased with income.

Generally, the inverse relationship between family income per member and the intake of light and whole foods is unexpected because this pattern contains some items that cost more, such as extra-virgin olive oil and whole bread. However, foods consumed mainly by people who are trying to lose weight or control blood sugar, like oatmeal, skimmed milk, and fruit juice, are not necessarily expensive.

The present study implemented some measures to reduce the number of bias sources, such as interviewer training and the establishment of participant inclusion and exclusion criteria. Nevertheless, not all bias sources can be fully eliminated.

The occurrence of bias cannot be discarded because individuals aware of the positive and negative effects of foods can overestimate or underestimate their intake. There is also memory bias, since these individuals are older and may have difficulties remembering what they ate, requiring longer interviews and careful question wording.

The type of instrument used, the FFQ, assessed a long intake period (one year), which also contributes to memory bias. To reduce memory bias, the interviews focused only on intake frequency, giving the participants more time to think and answer more accurately.

The Food Frequency Questionnaire seems to have an inherent reporting error effect because it tends to overestimate the intake of non-starchy vegetables when compared with other food intake assessment instruments[24]. However, Hu *et al.*[25] compared two eating patterns called prudent and Western, extracted from a FFQ and a 24-hour recall (considered the instrument of reference), and found that the two patterns extracted from the FFQ were comparable to those extracted from the 24-hour recall.

Researchers widely recognize the subjective nature of factor analysis for determining eating patterns, so they must decide how many and what types of patterns will be derived and analyzed. This calls for thorough detailing of the study methods. To minimize

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subjectivity, the present study selected the best solution, which entails keeping the factors above the "elbow" in the scree plot, representing the optimal number of factors. The role of the researcher is to determine the interpretability of the factors selected by statistical methods and then define which solution is closest to the actual dietary patterns of the study participants.

Another limitation related to eating patterns derived by factor analysis regards their low stability and the high specificity of the results. These characteristics hinder comparisons between studies. Even so, this technique enables expressing the actual intake of the study population and provides useful information for the development of intervention measures[8].

Although dietary pattern particularities vary between populations, many similarities can be found between certain patterns. Newby *et al.*[26] suggests that similarity may stem from the good consistency of the dietary patterns determined by factor analysis, suggesting that they can be reasonably reproduced.

Since a golden standard for identifying dietary patterns does not yet exist, the present study, which used exploratory factor analysis, should be the starting point for future validation studies that investigate other methods of dietary pattern derivation.

CONCLUSION

A population of older adults has a diversity of dietary patterns that are often associated with specific sociodemographic characteristics.

Dietary assessment of these older adults resulted in six eating patterns that coherently reproduced the different dietary characteristics of Botucatu's older population and revealed the food preferences of some older adult subgroups.

The study findings can be the starting point for the development of more effective primary care measures that promote healthy eating habits because the study sample represents users of the primary health care network.

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CONTRIBUTORS

PM FERREIRA project design and execution, data analysis and interpretation, article writing and critical review, and approval of the final version of the article. SJ PAPINI critical review and approval of the final version. JE CORRENTE data analysis and interpretation, article writing and critical review, and approval of the final version of the article.

REFERENCES

1. Brasil. Ministério da Saúde. Obesidade: determinantes do sobrepeso e obesidade. Brasília: Ministério da Saúde; 2006 [acesso 2010 ago 10]. Disponível em: <http://189.28.128.100/nutricao/docs/geral/doc_obesidade.pdf>.
2. Freitas AMP, Philippi ST, Ribeiro SML. Listas de alimentos relacionadas ao consumo alimentar de um grupo de idosos: análises e perspectivas. Rev Bras Epidemiol. 2011[acesso 2011 ago 14]; 14(1): 161-77. Disponível em: <http://www.scielo.br/scielo.php?pid=S1415-790X2011000100015&script=sci_arttext>.
3. Campos MTFS, Monteiro JBR, Ornelas APRC. Fatores que afetam o consumo alimentar e a nutrição do idoso. Rev Nutr. 2000 [acesso 2011 set 5]; 13(3): 157-65. Disponível em: <http://www.scielo.br/pdf/rn/v13n3/7902.pdf>. doi: 10.1590/S1415-52732000000300002
4. Gollub EA, Weddle DO. Improvements in nutritional intake and quality of life among frail homebound older adults receiving home-delivered breakfast and lunch. JADA. 2004; 104(8):1227-35.
5. Arbonés G, Carbajal A, Gonzalvo B, Gonzales-Gróss M, Joyanes M, Marques-Lopes I, *et al*. Nutrición y recomendaciones dietéticas para personas mayores. Grupo de trabajo "Salud pública" de La Sociedad Espanhola de Nutrición (SEN). Nutr Hosp. 2003; 18(3):109-37.
6. Olinto MTA. Padrões alimentares: análise de componentes principais. In: Kac G, Sichieri R, Gigante DP, Organizadores. Epidemiologia nutricional. Rio de Janeiro: Fiocruz; 2007.

7. Hu FB. Dietary patterns analysis: A new direction in nutritional epidemiology. Curr Opin Lipidol. 2002; 13(1):3-9.

8. Jacques PF, Tucker KL. Are dietary patterns useful for understanding the role of diet in chronic disease? Am J Clin Nutr. 2001; 73(1):1-2.

9. Brasil. Ministério da Saúde. Departamento de Informática do SUS. Informações de Saúde. Brasília: Ministério da Saúde; 2011 [acesso 2011 dez 6]. Disponível em: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?ibge/cnv/popSP.def>.

10. Instituto Brasileiro de Geografia e Estatística. Censo demográfico. Brasília: IBGE; 2011 [acesso 2011 nov 20]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/indicadores_sociais_municipai/indicadores_sociais_municipais_tab_pdf.shtm>.

11. Pala V, Sieri S, Masala G, Palli D, Panico S, Vineis P, *et al*. Associations between dietary pattern and lifestyle, anthropometry and other health indicators in the elderly participants of the EPIC-Italy cohort. Nutr Metab Cardiovasc Dis. 2006; 16(3):186-201.

12. Haveman-Nies A, Tucker KL, Groot LCPGM, Wilson PWF, Staveren WA. Evaluation of dietary quality in relationship to nutritional and lifestyle factors in elderly people of the US Framingham Heart Study and the European SENECA study. Eur J Clin Nutr. 2001; 55(10):870-80.

13. Lin H, Bermudez OI, Tucker KL. Dietary patterns of Hispanic elders are associated with acculturation and obesity. J Nutr. 2003; 133(11):3651-7.

14. Corrente JE, Marchioni DML, Fisberg RM. Validation of a FFQ (Food Frequency Questionaire) for older people. J Life Sic. 2013; 7(8):878-82.

15. Hair JF, Anderson RE, Tatham RL, Black WC. Análise multivariada de dados. Porto Alegre: Artmed; 2005.

16. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010: características da população e dos domicílios. Resultados do Universo. Brasília: IBGE; 2011 [acesso 2011 nov 20]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/caracteristicas_da_populacao/tabelas_pdf/tab1.pdf>.

17. Marucci MFN. Aspectos nutricionais e hábitos alimentares de idosos matriculados em ambulatório geriátrico [doutorado]. São Paulo: Universidade de São Paulo; 1992.

18. Instituto Brasileiro de Geografia e Estatística. Análise do consumo alimentar pessoal no Brasil: Pesquisa de Orçamentos Familiares 2008-2009. Brasília: IBGE; 2011[acesso 2011 nov 17]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pof/2008_2009_analise_consumo/pofanalise_2008_2009.pdf>.

19. Sichieri R, Castro JFG, Moura ASM. Fatores associados ao padrão de consumo alimentar da população brasileira urbana. Cad Saúde Pública. 2003; 19(1):47-53. doi: 10.1590/S0102-311X2003000700006

20. Neumann AICP, Martins IS, Marcopito LF, Araújo EAC. Padrões alimentares associados a fatores de risco para doenças cardiovasculares entre residentes de um município brasileiro. Rev Panam Salud Pública. 2007 [acesso 2011 ago 20]; 22(5):329-39. Disponível em: <http://www.scielosp.org/pdf/rpsp/v22n5/a06v22n5.pdf>.

21. Putz C. História da gastronomia paulistana. São Paulo: Guia D; 2004.

22. Alves ALS, Olinto MTA, Costa JSD, Bairros FS, Balbinotti MAA. Padrões alimentares de mulheres adultas residentes em área urbana no sul do Brasil. Rev Saúde Pública. 2006 [acesso 2011 ago 20]; 40(5):865-73. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-89102006000600017>.

23. Perozzo G, Olinto MTA, Dias-da-Costa JS, Henn RL, Sarriera J, Pattussi MP. Associação dos padrões alimentares com obesidade geral e abdominal em mulheres residentes no Sul do Brasil. Cad Saúde Pública; 2008 [acesso 2011 set 5]; 24(10):2427-39. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2008001000023>.

24. Togo P, Osler M, Sorensen TIA, Heitmann BL. Food intake patterns and body mass index in observational studies. Int J Obes. 2001; 25(12):1741-51.

25. Hu FB, Rimm E, Smith-Warner SA, Feskanich D, Stampfer MJ, Ascherio A, *et al*. Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. Am J Clin Nutr. 1999; 69(2):243-9.

26. Newby PK, Muller D, Hallfrisch J, Qiao N, Andres R, Tucker KL. Dietary patterns and changes in body mass index and waist circumference in adults. Am J Clin Nutr. 2003; 77(6):1417-25.

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