





Adult food consumption by household composition: an analysis of the first National Dietary Survey, Brazil, 2008–2009

Paulo Rogério Melo Rodrigues^{1,*} , Luana Silva Monteiro², Diana Barbosa Cunha³, Rosely Sichieri³  and Rosangela Alves Pereira⁴

¹College of Nutrition, Federal University of Mato Grosso, Avenida Fernando Corrêa da Costa 2367, Bairro Boa Esperança, CEP 78060-900, Cuiabá, MT, Brazil; ²Nutrition Course, Federal University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil; ³Social Medicine Institute, State University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil; ⁴Department of Social and Applied Nutrition, Federal University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil

Submitted 18 May 2018: Final revision received 4 May 2019: Accepted 23 May 2019: First published online 2 September 2019

Abstract

Objective: To evaluate differences in food consumption of Brazilian adults according to the presence of children and adolescents in the household.

Design: Averages of two non-consecutive days of food records from the first Brazilian National Dietary Survey were analysed and classified into eighteen food groups according to nutritional characteristics and use in diet. We compared the mean percentage contribution to total daily energy intake of each food group according to three groups of household composition: adults living alone or with other adults (32.7%), adults living with children (35.6%) and adults living with adolescents (31.7%).

Setting: Brazilian nationwide survey, 2008–2009.

Participants: Adults aged 20–59 years (*n* 6312; 52.1% female).

Results: Women living alone or with other adults had higher consumption of vegetables, milk and other drinks, and lower consumption of beans and rice, compared with those living with children or adolescents. Men living alone or with other adults had higher consumption of sweets & desserts and vegetables, and lower consumption of beans, compared with those living with children or adolescents. According to household income, adults in the highest tertile who lived with children or adolescents presented a mixed consumption of healthy and unhealthy foods, whereas their counterparts in the first income tertile presented a marked consumption of foods considered traditional of the Brazilian population.

Conclusions: There are differences in food consumption based on the presence of children and adolescents in the household, with greater variation according to gender and household income.

Keywords

Household composition
Food consumption
Adults
Brazilian National Dietary Survey

Household composition can influence diet quality in different contexts. Studies conducted in high-income countries showed that household composition might influence food consumption; for example, reduced consumption of fruits and vegetables was observed in women from families with children in Denmark and Great Britain^(1,2). On the other hand, higher consumption of fruits and vegetables was seen among those who lived with other people compared with those who lived alone⁽³⁾. A review study including thirty-two articles investigated the relationship between living alone and food consumption and highlighted that people living alone tend to have lower dietary diversity and lower intakes of healthy foods (fruits and vegetables), suggesting that living

alone can negatively affect diet and contribute to unfavourable health outcomes⁽⁴⁾. It should be noted that no study was found on the association between household composition and aspects of diet in low-income countries, as well as in countries undergoing rapid socio-economic development such as Brazil during the first decade of the 21st century.

Systematic review studies and meta-analysis have verified the influence of parents' habits on food consumption among children and adolescents^(5,6). This influence was observed for American female adolescents⁽⁷⁾, American children and adolescents between 2 and 18 years old⁽⁸⁾ and Australian children between 8 and 12 years old⁽⁹⁾. In Brazil, based on nationally representative data, it was

*Corresponding author. Email prmr84@gmail.com

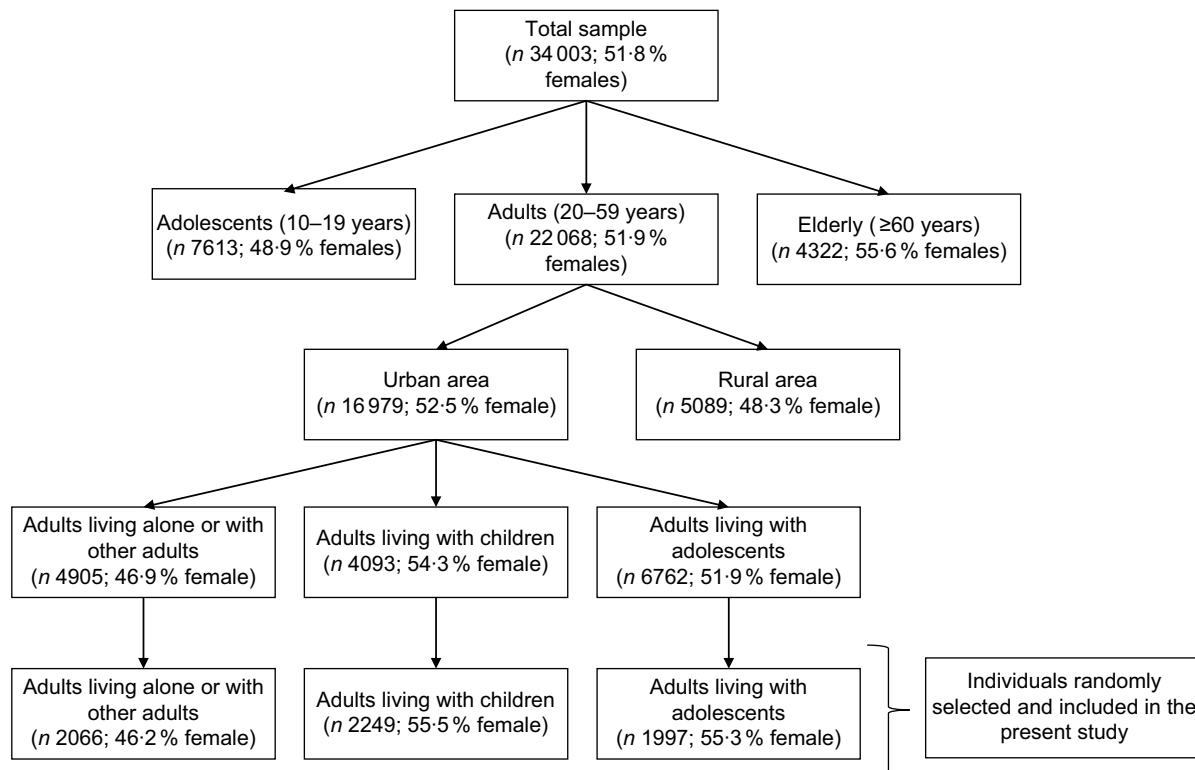


Fig. 1 Sample selection of Brazilian adults from the Brazilian National Dietary Survey evaluated according to household composition. Brazil, 2008–2009

observed that parents' eating patterns were associated with those of their children to greater extent within the pattern of 'traditional main meal', which encompasses foods typical of the traditional Brazilian diet, such as rice and beans⁽¹⁰⁾. In addition, the availability of resources and the proportion of food expenditure may vary according to household composition, modulating the availability of food at home^(11–13). It is also possible to suppose that the presence of children and adolescents in the household determines the selection of food, owing to the particularities in nutritional needs and also food preferences⁽¹⁴⁾.

The present study aimed to evaluate differences in food consumption of adults according to the presence or absence of children and adolescents in the household, based on the analysis of the first Brazilian National Dietary Survey.

Methods

The data of the present study were obtained from the first Brazilian National Dietary Survey (Inquérito Nacional de Alimentação (INA)), conducted along with the 2008–2009 Household Budget Survey (Pesquisa de Orçamentos Familiares (POF)) developed by the Brazilian Institute of Geography and Statistics. In summary, census sectors were randomly selected from a Master Sample of Household

Budget Surveys, which includes a set of 12 800 sectors stratified according to different geographical areas and socio-economic classes. First, the sectors were randomly selected from each stratum proportional to the number of households present and, in the second step, the households were selected by simple random sampling. Of the 55 970 households from the POF 2008–2009, a sub-sample of approximately 25 % of households were randomly selected for the study on individual food consumption (INA). In all, 13 596 households and 34 003 residents at least 10 years of age were selected to compose the Brazilian National Dietary Survey⁽¹⁵⁾. Of these, 22 068 were adults (between 20 and 59 years of age). In the present study, only urban individuals were randomly selected (Fig. 1). The research protocol was approved by the Ethics Committee of the Institute of Social Medicine of the State University of Rio de Janeiro (CAAE 0011.0.259.000-11).

From each one of the three groups: (i) adults living alone or with other adults, (ii) adults living with children (under 10 years of age) and (iii) adults living with adolescents (between 10 and 19 years of age), we randomly selected one adult per household. Individuals living with both children and adolescents were not included in this analysis (*n* 2069).

The evaluation of food consumption was carried out during the 12 months of research, thus allowing all geographic and socio-economic strata to be studied.

Table 1 Distribution of demographic characteristics of Brazilian adults, according to household composition. Brazilian National Dietary Survey, Brazil, 2008–2009

Characteristic	Total		Adults living alone or with other adults (n 2066)			Adults living with children (n 2249)			Adults living with adolescents (n 1997)		
	n	%	n	%	95 % CI	n	%	95 % CI	n	%	95 % CI
Sex											
Male	2783	47.9	1004	53.8	51.6, 56.0	939	44.5	43.3, 45.7	840	44.7	42.7, 46.7
Female	3529	52.1	1062	46.2	44.0, 48.5	1310	55.5	54.3, 56.7	1157	55.3	53.3, 57.3
Monthly per capita household income											
1st tertile	2204	32.5	321	12.7	10.0, 15.4	1066	46.9	42.7, 51.1	817	39.6	35.1, 44.1
2nd tertile	1898	29.9	632	31.2	27.1, 35.4	673	29.6	25.8, 33.4	593	28.8	24.8, 32.7
3rd tertile	2210	37.6	1113	56.1	52.0, 60.2	510	23.5	20.6, 26.4	587	31.6	27.5, 35.7
Age (in years)											
Mean	36.6		38.1			32.2			39.8		
95 % CI	36.3, 37.1		37.3, 38.9			31.8, 32.8			39.1, 40.4		

Food consumption was estimated through two non-consecutive days of food records, with individuals being advised to report all foods and beverages consumed (except water), the amount consumed (using home measures or volume units), as well as the time of consumption, the day of the week and the place of consumption (inside or outside the home)⁽¹⁵⁾.

To estimate energy consumption, the table of nutritional composition and home measures of the foods consumed in Brazil were used to analyse the food consumption information obtained at INA⁽¹⁶⁾.

The averages (in grams or millilitres) of foods consumed and reported in the two days were classified into eighteen groups (see Appendix), based on those proposed by Pereira *et al.*⁽¹⁷⁾. Briefly, this grouping system considers nine major groups disaggregated into subgroups according to the nutritional characteristics of foods and beverages and their use in the diet. For the statistical analyses, the consumption of each food group was expressed in relation to its percentage contribution to total daily energy intake, keeping in the analyses the groups with energy contribution $\geq 1\%$. Food groups that had $<1\%$ contribution to total energy intake are salty snacks & crackers, instant noodles, processed meats, eggs, cheese & cheese products, breakfast cereals and oils & fats.

Per capita household income was assessed by considering the monthly per capita income of all monetary and non-monetary sources of income, including donations, signed employment, self-employment and participation in income transfer programmes. The total household income was divided by the number of household members to calculate the monthly per capita family income.

Statistical analyses

The categorical variables were described as means and 95 % CI of their proportion. To evaluate differences in the percentage of energy contribution regarding total daily energy intake according to the studied variables,

considering the household composition, the mean and 95 % CI of their distribution were used. In addition, to evaluate the effect of socio-economic conditions, we analysed the relationship between monthly per capita household income and percentage contribution of the food groups to total daily energy intake according to the composition of the household, using multivariate regression models, adjusted by age. Weighted analyses were stratified by sex and accounted for the complexity of the sample design, using the statistical software package SAS version 9.4.

Results

A total of 6312 adult individuals (52.1 % female), with a mean age of 36.7 years (95 % CI 36.3, 37.1 years) and a mean monthly per capita income of \$US 369.18 (95 % CI \$US 334.35, \$US 404.00) were studied. Individuals living alone or with other adults (32.7 %) had a mean age of 38.1 years (95 % CI 37.3, 38.9 years) and a mean monthly per capita income of \$US 538.03 (95 % CI \$US 459.60, \$US 616.45). Individuals living with children (35.6 %) had a mean age of 32.2 years (95 % CI 31.8, 32.8 years) and a mean monthly per capita income of \$US 266.67 (95 % CI \$US 224.90, \$US 308.44). Finally, individuals living with adolescents (31.7 %) had a mean age of 39.8 years (95 % CI 39.1, 40.4 years) and a mean monthly per capita income of \$US 286.18 (95 % CI \$US 248.90, \$US 323.45; Table 1). Adults living alone and adults living accompanied by one or more adults did not present significant differences in the consumption of the food groups analysed in the current study, so they were grouped for the following analyses.

Women living alone or with other adults compared with those living with children had a higher contribution to total energy intake from vegetables (2.2 *v.* 1.7 %) and compared

Table 2 Percentage contribution (mean and 95 % CI) of food groups to daily total energy intake in men and women, according to household composition. Brazilian National Dietary Survey, Brazil, 2008–2009

Food group	Adults living alone or with other adults (n 2066)				Adults living with children (n 2249)				Adults living with adolescents (n 1997)			
	Men		Women		Men		Women		Men		Women	
	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI
Alcoholic beverages	3.6	1.8, 5.3	1.6	0.1, 3.1	3.9*	2.1, 5.6	0.5	0.3, 0.8	2.7*	1.5, 4.0	0.6	0.2, 0.9
Beans	9.6*,†	8.9, 10.2	7.4‡	6.8, 8.0	10.5*	9.8, 11.3	8.2	7.7, 8.8	11.7*,†	10.8, 12.7	9.0‡	8.3, 9.7
Breads	3.4	3.1, 3.7	3.1	2.9, 3.4	3.4	3.1, 3.7	3.3	3.0, 3.6	3.4	3.1, 3.8	3.6	3.3, 3.8
Broth/soups	3.7	2.9, 4.6	4.0	3.1, 4.9	3.1	2.5, 3.7	3.9	3.3, 4.5	2.9	1.3, 4.6	4.1	3.1, 5.1
Coffee/tea	11.2*	10.1, 12.3	14.7	13.4, 16.0	11.9	10.7, 13.1	13.1‡	12.1, 14.1	12.5*	11.4, 13.6	15.4‡	14.4, 16.4
Fast foods	1.3	1.0, 1.5	1.3	1.1, 1.6	1.0	0.8, 1.2	1.0	0.9, 1.2	1.0	0.7, 1.2	1.0	0.8, 1.2
Fruits	3.7*	3.2, 4.3	5.8	5.2, 6.4	3.0*	2.5, 3.4	4.8	4.2, 5.3	3.8	3.0, 4.6	5.1	4.4, 5.9
Fish & seafood	1.7	1.3, 2.0	1.7	1.4, 2.0	2.2	1.7, 2.6	1.8	1.5, 2.1	2.3	1.7, 2.8	2.1	1.7, 2.5
Meat & meat preparations	4.3	3.9, 4.6	4.3	3.8, 4.7	4.2	3.9, 4.5	3.7	3.4, 4.0	4.0	3.6, 4.4	3.9	3.5, 4.2
Milk	3.3*	2.8, 3.8	5.3‡	4.6, 6.0	2.8*	2.2, 3.4	4.3	3.7, 5.0	2.9	2.4, 3.4	3.8‡	3.3, 4.3
Other drinks	5.3	4.5, 6.0	4.8‡	4.0, 5.6	4.4	3.7, 5.2	4.1	3.5, 4.7	4.4	3.6, 5.3	3.4‡	2.9, 3.9
Pastas	2.4	2.1, 2.8	2.1	1.8, 2.4	2.8	2.4, 3.1	2.4	2.0, 2.7	2.2	1.8, 2.6	1.9	1.7, 2.2
Poultry & poultry preparations	2.5	2.1, 2.8	2.3	2.0, 2.6	2.6	2.2, 2.9	2.6	2.3, 2.9	2.2	1.9, 2.5	2.4	2.1, 2.7
Rice	8.2*	7.6, 8.9	7.0‡	6.5, 7.4	8.8	8.2, 9.4	7.8	7.3, 8.3	9.0	8.5, 9.6	8.3‡	7.8, 8.8
Roots & tubers	1.4	1.2, 1.7	1.2	1.0, 1.4	1.3	1.1, 1.5	1.1	1.0, 1.3	1.5	1.2, 1.8	1.4	1.2, 1.6
Sugar-sweetened beverages	7.8	7.0, 8.6	8.8	7.9, 9.7	7.5	6.6, 8.3	8.8	8.0, 9.6	6.4*	5.5, 7.2	8.0	7.3, 8.7
Sweets & desserts	2.4‡	2.0, 2.8	2.9	2.5, 3.2	1.7*,†	1.5, 2.0	2.9	2.6, 3.3	2.0	1.6, 2.4	2.7	2.3, 3.1
Vegetables	1.7‡	1.4, 2.0	2.2‡	1.9, 2.5	1.3	1.1, 1.5	1.7‡	1.5, 1.9	1.2*,†	1.0, 1.4	1.9	1.6, 2.1

*Statistically significant difference between men and women within the same category of household composition ($P < 0.05$).

†Statistically significant difference among men according to household composition ($P < 0.05$).

‡Statistically significant difference among women according to household composition ($P < 0.05$).

with those living with adolescents, from milk (5.3 *v.* 3.8%) and other drinks (4.8 *v.* 3.4%). On the other hand, women living with adolescents compared with those living alone or with other adults had a greater energy consumption from beans (9.0 *v.* 7.4%) and rice (8.3 *v.* 7.0%); and compared with those living with children, from coffee/tea (15.4 *v.* 13.1%; Table 2).

Men living alone or with other adults, compared with those living with children, had a higher contribution to total energy intake from sweets & desserts (2.4 *v.* 1.7%) and compared with those living with adolescents, from vegetables (1.7 *v.* 1.2%). On the other hand, men living with adolescents compared with those living alone or with other adults had a greater energy consumption from beans (11.7 *v.* 9.6%; Table 2).

Independently of household composition, the contribution of beans to total energy intake was greater for men than for women; the same was observed for alcoholic beverages, but only among those living with children or adolescents, and for rice among those living alone or with other adults. On the other hand, the energy contribution from milk and fruits was lower for men compared with women among those living alone or with other adults and those living with children; the same was estimated for coffee/tea among those living alone or with other adults and those living with adolescents, for sweets & desserts

among those living with children, and for sugar-sweetened beverages and vegetables among those living with adolescents (Table 2).

For men living alone or with other adults, it was found that increased income resulted in a higher consumption of alcoholic beverages, fast foods, fruits, milk, other drinks, sweets & desserts and vegetables; and a lower consumption of rice and roots & tubers. Among those living with children, higher income was associated with a greater consumption of alcoholic beverages, fast foods, fruits, milk, other drinks, sugar-sweetened beverages, sweets & desserts and vegetables; and a lower consumption of beans, breads, broths/soups, coffee/tea, fish & seafood and rice. Finally, among men living with adolescents, increased income was associated with a higher consumption of alcoholic beverages, fast foods, milk, other drinks, poultry & poultry preparations and vegetables; and a lower consumption of beans, breads and coffee/tea (Table 3).

Additionally, among men, regardless of household composition, a higher contribution to total energy intake from alcoholic beverages, fast foods, fruits, milk, other drinks, sweets & desserts and vegetables was observed in the third tertile of income compared with the first and second tertiles. Conversely, in the third tertile of income, there was a smaller contribution to total energy intake from beans, breads and roots & tubers compared with the first and

Table 3 Percentage contribution (mean) of food groups to daily total energy intake in men, according to household composition and tertile of per capita household income. Brazilian National Dietary Survey, Brazil, 2008–2009

Food group	Adults living alone or with other adults (n 1004)				Adults living with children (n 939)				Adults living with adolescents (n 840)			
	Income tertile				Income tertile				Income tertile			
	1	2	3	P*	1	2	3	P*	1	2	3	P*
Alcoholic beverages	0.3	1.6	5.4	0.01	2.3	3.3	8.3	<0.001	1.6	2.1	4.6	0.06
Beans	11.2	11.8	8.0	<0.001	11.4	10.8	8.1	<0.001	14.0	11.7	9.1	0.02
Breads	3.6	3.9	3.1	<0.001	3.5	3.4	3.0	0.04	3.7	3.6	2.9	<0.001
Broth/soups	2.4	5.3	3.2	<0.001	3.4	2.8	2.7	<0.001	4.2	1.8	2.4	<0.001
Coffee/tea	11.8	13.7	9.8	<0.001	13.8	11.2	8.7	<0.001	14.9	12.9	9.3	<0.001
Fast foods	0.3	0.8	1.7	<0.001	0.7	0.8	2.0	<0.001	0.5	0.6	1.8	<0.001
Fish & seafood	2.4	1.5	1.6	0.42	2.5	2.1	1.3	<0.001	2.5	2.5	1.8	<0.001
Fruits	2.7	3.1	4.3	<0.001	2.4	2.7	4.7	<0.001	3.5	3.2	4.6	0.03
Meat & meat preparations	3.5	4.8	4.1	<0.001	3.5	5.0	4.6	0.02	3.7	4.4	4.1	0.24
Milk	2.1	3.2	3.6	<0.001	2.4	2.7	4.0	<0.001	2.2	3.0	3.7	0.01
Other drinks	1.6	3.9	6.9	<0.001	3.4	4.1	7.2	<0.001	2.2	4.1	7.4	<0.001
Pastas	2.5	1.7	2.8	<0.001	2.7	3.3	2.1	0.18	2.2	1.9	2.4	0.37
Poultry & poultry preparations	3.2	2.1	2.5	0.41	2.8	2.3	2.4	0.76	1.9	2.2	2.7	0.01
Rice	10.6	9.0	7.3	<0.001	9.6	8.2	7.8	<0.001	9.7	9.4	7.9	0.21
Roots & tubers	1.9	1.5	1.3	<0.001	1.6	1.0	1.1	<0.001	1.7	2.0	1.0	<0.001
Sugar-sweetened beverages	6.6	6.7	8.7	0.88	6.2	8.1	9.4	<0.001	5.6	5.0	8.4	<0.001
Sweets & desserts	1.2	1.6	3.1	<0.001	1.4	1.9	2.3	<0.001	1.3	2.5	2.4	0.02
Vegetables	0.5	1.4	2.1	<0.001	0.8	1.4	2.4	<0.001	0.7	1.1	1.9	<0.001

*P value of age-adjusted linear trend.

second tertiles. Compared with the first and the third tertile, the contribution of meat & meat preparations to total energy intake was greater in the second tertile. The contribution of rice to total energy intake was greater among individuals classified in the first tertile of income than for those in the second and third tertiles, except for men living with adolescents; on the other hand, the contribution of sweets & desserts to total energy intake in the lowest tertile of income was smaller than that observed in the second and third tertiles (Table 3).

For women who lived alone or with other adults, the increase in income tertile was associated with a higher energy consumption from alcoholic beverages, fast foods, fruits, milk, other drinks, sweets & desserts and vegetables; and a lower energy consumption from beans, breads, coffee/tea and roots & tubers. Among those women living with children, the increase in income tertile was associated with a higher consumption of energy from alcoholic beverages, fast foods, fruits, milk, other drinks, sugar-sweetened beverages, sweets & desserts and vegetables; and a lower consumption of energy from beans, broths/soups, coffee/tea, fish & seafood, poultry & poultry preparations and rice. Among those women living with adolescents, the increase in income tertile was associated with a higher contribution to total energy intake from fast foods, fruits, milk, other drinks, sugar-sweetened beverages, sweets & desserts and vegetables; and a lower energy contribution from beans, breads, coffee/tea, fish & seafood and rice (Table 4).

Analogously to the results observed in men, among women, regardless of household composition, alcoholic beverages, fast foods, fruits, milk, other drinks, sweets &

desserts and vegetables made a greater contribution to total energy intake in the third than in the first and second tertiles of income. The contribution of beans, breads and coffee/tea to total energy intake was greater for women classified in the first tertile of income compared with the second and third tertiles. Likewise, meat & meat preparations presented a higher contribution to energy intake for women in the second tertile of income compared with the first and the third tertiles (Table 4).

Discussion

In the present study, household composition, particularly the existence of children or adolescents in the household, seems to influence food consumption of Brazilian adults, especially women, along with the per capita household income.

Results similar to those observed in the Brazilian population have been verified by studies conducted in other countries. In the Australian Longitudinal Study on Women's Health, Elstgeest *et al.*⁽¹⁴⁾ identified differences in the dietary patterns of women according to the presence of children at home after a period of 6 years. The authors observed that the dietary patterns of women who lived with children from the beginning of the evaluation were characterized by higher energy consumption, as well as higher adherence to the 'high-fat and sugar', 'meat' and 'cooked vegetables' patterns, and lower adherence to the patterns of 'Mediterranean-style' and 'fruit'. Women who lived with

Table 4 Percentage contribution (mean) of food groups to daily total energy intake in women, according to household composition and tertile of per capita household income. Brazilian National Dietary Survey, Brazil, 2008–2009

Food group	Adults living alone or with other adults (n 1062)				Adults living with children (n 1310)				Adults living with adolescents (n 1157)			
	Income tertile				Income tertile				Income tertile			
	1	2	3	P*	1	2	3	P*	1	2	3	P*
Alcoholic beverages	0.1	0.7	2.5	<0.001	0.2	0.7	0.8	0.01	0.3	0.3	1.1	<0.001
Beans	9.5	8.4	6.3	<0.001	9.8	7.5	6.0	<0.001	10.9	8.5	7.0	<0.001
Breads	3.4	3.3	2.9	<0.001	3.5	3.5	2.9	<0.001	3.7	3.6	3.3	<0.001
Broth/soups	2.3	4.8	4.0	<0.001	4.5	3.1	3.4	<0.001	4.3	3.9	4.1	0.10
Coffee/tea	18.1	16.7	12.8	<0.001	15.0	12.5	10.0	<0.001	17.2	15.1	13.3	<0.001
Fast foods	0.4	0.7	1.9	<0.001	0.6	1.0	2.1	<0.001	0.5	1.1	1.7	<0.001
Fish & seafood	2.4	1.8	1.4	0.47	2.3	1.5	1.1	<0.001	2.8	1.7	1.6	<0.001
Fruits	4.6	5.2	6.5	<0.001	4.1	5.3	5.5	<0.001	3.5	5.2	7.2	<0.001
Meat & meat preparations	4.2	5.0	3.9	<0.001	3.3	4.4	3.6	0.04	3.8	4.4	3.4	0.04
Milk	3.2	4.3	6.3	<0.001	3.2	4.0	7.0	<0.001	3.0	3.8	4.8	<0.001
Other drinks	2.2	3.4	6.2	<0.001	2.9	4.2	6.5	<0.001	1.8	3.5	5.4	<0.001
Pastas	2.5	2.2	1.9	0.41	2.3	2.8	1.8	<0.001	1.8	2.2	1.9	0.77
Poultry & poultry preparations	2.6	2.2	2.3	0.12	2.9	2.2	2.5	0.04	2.4	2.6	2.4	0.96
Rice	6.3	7.9	6.6	<0.001	8.8	7.8	5.9	<0.001	9.5	8.2	6.8	<0.001
Roots & tubers	1.7	1.3	0.9	<0.001	1.1	1.1	1.3	<0.001	1.6	1.6	1.0	<0.001
Sugar-sweetened beverages	6.9	7.5	10.0	0.99	7.4	9.6	10.7	<0.001	6.3	7.8	10.4	<0.001
Sweets & desserts	1.5	2.5	3.4	<0.001	2.2	3.0	4.2	<0.001	2.1	2.4	3.9	<0.001
Vegetables	0.6	2.1	2.6	<0.001	1.3	1.8	2.4	<0.001	1.2	1.6	2.9	<0.001

*P value of age-adjusted linear trend.

children during this study period increased their consumption of the 'high-fat and sugar' 'fruit' and 'cooked vegetables' patterns. On the other hand, women who did not live with children at any time increased their adherence to the 'Mediterranean-style' pattern and decreased the 'high-fat and sugar' pattern, suggesting that living with children influences the adoption of less healthy food patterns⁽¹⁴⁾.

Similarly, Groth *et al.*⁽¹⁾ also found that Danish women living in families with children had lower intakes of fruits and vegetables, compared with those who lived alone or accompanied but without children. Rogers and Pryer⁽²⁾, comparing the adequacy of fruit and vegetable intake between the periods of 1986–1987 and 2000–2001 in British adults, found that living with children was negatively associated with adherence to nutritional recommendations for the consumption of these foods. One possible explanation for this association is that women living with children have a higher demand of family responsibilities and less time to spend on food decisions and preparation^(18,19). In addition, mothers may privilege healthy eating, such as fruits, for the consumption of children.

On the other hand, besides the effect of the presence of children at home, Hanna and Collins⁽⁴⁾ suggest that living alone can negatively affect aspects of the diet, such as low consumption of healthy foods (fruits and vegetables). Similarly, in studies with Australian women^(3,20), those living alone had lower intakes of fruits, vegetables and meat, as well as lower intake of calcium, compared with those who lived with another adult. In the present study, living alone or with other adults also influenced the diet; however, this aspect changed according to the sex of the adult and the level of per capita income of the household.

Thus, it reinforced the idea that household composition can influence the quality of the diet. According García-González *et al.*⁽²¹⁾, women take responsibility for the entire cooking process in families. In this context, recent evidence links home cooking with healthier dietary choices and better adherence to nutritional guidelines as important tools to achieving a better and healthy diet^(22–24).

Most of the studies investigating the effect of household composition on food consumption have been conducted in elderly populations⁽⁴⁾. According to Hunter *et al.*⁽³⁾, this concern can be explained because with ageing there is an increasing number of individuals living alone and it is, therefore, necessary to identify ways to help people plan the purchase and preparation of healthy foods, such as fruits and vegetables. Aspects that may explain the influence of household composition on food consumption are the availability of resources and the proportion of income on food expenditures^(11–13) as well as different dietary needs and preferences of different age groups, such as children and adolescents⁽¹⁴⁾.

Differences in diet quality due to socio-economic conditions of individuals can be explained by the variation in the cost of food⁽²⁵⁾. In this context, there has been an inverse relationship between energy density and cost per kilojoule of food, with lower costs for foods such as refined grains and products with added sugar and fats, and higher costs for fruits and vegetables^(26,27). In the present study, there is a greater maintenance of traditional eating habits at lower income levels, possibly associated with eating meals prepared at home. However, individuals of higher socio-economic level seem to be losing traditional habits of the Brazilian diet, and although they presented higher



consumption of healthy food markers such as fruits, milk and vegetables, they also showed higher consumption of unhealthy food markers such as alcoholic beverages, fast foods, sweets & desserts and sugar-sweetened beverages. On the other hand, individuals in the first income tertile presented higher consumption of rice, beans, breads, fish & seafood and starchy foods, compared with the last income tertile.

In addition, the present study highlights the fact that the consumption of sugar-sweetened beverages is higher in households with children or adolescents, increasing with household income. This is very concerning, since it may be reflecting high consumption also among children and adolescents, who are vulnerable groups from the point of view of health and nutrition. Sugar-sweetened beverages are considered a marker of poor diet quality and have been associated with weight gain and other important metabolic disorders^(28,29). Thus, the consumption of these beverages should be discouraged, as has already been done in countries such as Chile, Finland, France and Mexico^(30,31).

In the same sense, moderation in the consumption of low-quality diet markers such as sweets & desserts, fast foods and alcoholic beverages should be encouraged, especially considering their increase among families with higher socio-economic status. In the Brazilian Strategic Action Plan for Coping with Noncommunicable Chronic Diseases, alcohol intake is a public health priority, with the objective to reduce abusive alcoholic consumption by 10% by 2022, since it is considered a risk factor for diseases such as cancer, CVD, liver and mental diseases (including depression), as well as accidents and violence⁽³²⁾.

Another concerning issue is the consumption of fish & seafood, milk and dairy, and fruits, which are considered markers of good quality of the diet, that presented lower consumption in the low-income households with children or adolescents compared with households with adults only. Public policy actions should promote the access to these foods⁽³¹⁾, which are usually more expensive and less accessible to low-income families.

Estimating the weekly cost of a diet in Ireland based on current nutritional recommendations, Friel *et al.*⁽¹¹⁾ found that the percentage of weekly household income required to purchase the stipulated food basket (containing cereals, bread, potatoes, fruits, vegetables, dairy products, meat, products with high sugar and fat content) would be 80, 69 and 38% for households comprising 'single parents with one child', 'two adults with two children' and 'single elderly persons', respectively.

In Brazil, using food availability data from POF 2002/2003, comparing adult-equivalent and per capita measures for energy availability of the Brazilian population, Claro *et al.*⁽³³⁾ observed that differences in home energy availability varied between 92 kJ/d (22 kcal/d; home with adults and adolescents) and 1791 kJ/d (428 kcal/d; home with elderly people), indicating that, when assessing home energy availability, per capita measures may

underestimate the real energy availability, ignoring differences in the composition of households. In this sense, the present study shows an advance in the evaluation of the individual food consumption of adults assessed in the INA, considering the composition of the households and verifying significant differences for the majority of the food groups studied according to the presence or not of children, adolescents or other adults.

A possible limitation of the present study is the method used to obtain information on food consumption, since under-reporting is possible with the use of food records. However, food records present, as advantages, not relying on memory and providing more accurate information regarding the quantities consumed⁽³⁴⁾. In addition, in the INA, strategies such as continuous training and supervising of interviewers and providing a written manual for the participants were used to reduce measurement errors. Although food consumption under-reporting was not evaluated in the present analysis, Lopes *et al.*⁽³⁵⁾ used doubly labelled water to assess the dietary assessment method adopted in the INA and indicated that the energy intake underestimation is approximately 30%.

The strength of the present study is the pioneering analysis that evaluates the effect of household composition on individual food consumption based on a representative sample of the Brazilian population, allowing the identification of groups that are more vulnerable to inadequate food consumption, such as women living with children or adolescents. The presence of children or adolescents may impact the diet of adults by increasing or reducing the consumption of specific food groups; this effect may be influenced by the per capita household income.

In this sense, it is worthwhile to observe that alcoholic beverages, fast foods, milk, other drinks, sweets & desserts and vegetables presented a common behaviour, independent of household composition, and therefore may be the object of general public policies. However, food groups such as sugar-sweetened beverages, fish & seafood, milk and dairy, fruits and rice, which presented different consumption trends according to household composition, should be the object of public health recommendations that consider the presence of vulnerable groups in the household.

Conclusion

Household composition, particularly the existence of children or adolescents in the household, seems to influence food consumption in Brazilian adults, particularly women, and shows differences according to the household income. Thus, considering that household composition and income act as a barrier or facilitator of food consumption and modulate the diet quality, the design of public policies to promote healthy eating may be improved by using information on the family characteristics.

Acknowledgements

Acknowledgements: The authors are thankful to the Ministry of Health of Brazil and the Brazilian Institute of Geography and Statistics for supporting the Brazilian National Dietary Survey (INA). **Financial support:** This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. **Conflict of interest:** The authors declare no conflict of interest. **Authorship:** P.R.M.R. contributed to data analysis and interpretation and manuscript writing. L.S.M. contributed to data analysis and interpretation and manuscript writing. D.B.C. contributed to data analysis and interpretation and manuscript writing. R.S. contributed to study design and supervising, data interpretation, and manuscript conception and final revision. R.A.P. contributed to the study design and supervising, data analysis and interpretation, and manuscript conception, writing and final revision. **Ethics of human subject participation:** The research protocol was approved by the Ethics Committee of the Institute of Social Medicine of the State University of Rio de Janeiro (CAAE 0011.0.259.000-11) on 19 July 2011. All subjects gave their informed consent for inclusion before they participated in the study, which was conducted in accordance with the Declaration of Helsinki.

References

- Groth MV, Fagt S & Brøndsted L (2001) Social determinants of dietary habits in Denmark. *Eur J Clin Nutr* **55**, 959–966.
- Rogers S & Pryer JA (2012) Who consumed 5 or more portions of fruit and vegetables per day in 1986–1987 and in 2000–2001? *Public Health Nutr* **15**, 1240–1247.
- Hunter W, McNaughton S, Crawford D *et al.* (2010) Does food planning mediate the association between living arrangements and fruit and vegetable consumption among women aged 40 years and older? *Appetite* **54**, 533–537.
- Hanna KL & Collins PF (2015) Relationship between living alone and food and nutrient intake. *Nutr Rev* **73**, 594–611.
- Pearson N, Biddle S & Gorely T (2009) Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. *Public Health Nutr* **12**, 267–283.
- Wang Y, Beydoun M, Li J *et al.* (2011) Do children and their parents eat a similar diet? Resemblance in child and parental dietary intake – systematic review and meta-analysis. *J Epidemiol Community Health* **65**, 177–189.
- Bauer K, Neumark-Sztainer D, Fulkerson J *et al.* (2011) Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight and body composition. *Int J Behav Nutr Phys Act* **8**, 25.
- Zuercher J, Wagstaff D & Kranz S (2011) Associations of food group and nutrient intake, diet quality, and meal sizes between adults and children in the same household: a cross-sectional analysis of US households. *Nutr J* **10**, 131–143.
- Robinson LN, Rollo ME, Watson J *et al.* (2014) Relationships between dietary intakes of children and their parents: a cross-sectional, secondary analysis of families participating in the Family Diet Quality Study. *J Hum Nutr Diet* **28**, 443–451.
- Massarani FA, Cunha DB, Muraro AP *et al.* (2015) Agregação familiar e padrões alimentares na população brasileira. *Cad Saude Publica* **31**, 2535–2545.
- Friel S, Walsh O & McCarthy D (2006) The irony of a rich country: issues of financial access to and availability of healthy food in the Republic of Ireland. *J Epidemiol Community Health* **60**, 1013–1019.
- Coelho AB, Aguiar DRD & Fernandes EA (2009) Padrão de consumo de alimentos no Brasil. *Rev Econ Soc Rural* **47**, 335–362.
- Borges CA, Claro RM, Martins APB *et al.* (2015) Quanto custa para as famílias de baixa renda obterem uma dieta saudável no Brasil? *Cad Saude Publica* **31**, 137–148.
- Elstgeest LEM, Mishra GD & Dobson AJ (2012) Transitions in living arrangements are associated with changes in dietary patterns in young women. *J Nutr* **142**, 1561–1567.
- Instituto Brasileiro de Geografia e Estatística (2011) *Pesquisa de Orçamentos Familiares, 2008–2009. Análise do Consumo Alimentar Pessoal no Brasil (Household Expenditure Survey 2008–2009. Analysis of the Personal Food Consumption in Brazil)*. Rio de Janeiro: IBGE and Ministério do Planejamento, Orçamento e Gestão.
- Instituto Brasileiro de Geografia e Estatística (2011) *Pesquisa de Orçamentos Familiares, 2008–2009. Tabelas de Composição Nutricional dos Alimentos Consumidos no Brasil (Household Expenditure Survey 2008–2009. Nutrition Composition Tables of Food Consumption in Brazil)*. Rio de Janeiro: IBGE and Ministério do Planejamento, Orçamento e Gestão.
- Pereira RA, Duffey KJ, Sichieri R *et al.* (2012) Sources of excessive saturated fat, trans fat and sugar consumption in Brazil: an analysis of the first Brazilian nationwide individual dietary survey. *Public Health Nutr* **17**, 113–121.
- John JH & Ziebland S (2004) Reported barriers to eating more fruit and vegetables before and after participation in a randomized controlled trial: a qualitative study. *Health Educ Res* **19**, 165–174.
- Devine CM (2005) A life course perspective: understanding food choices in time, social location, and history. *J Nutr Educ Behav* **37**, 121–128.
- Ball K, Mishra GD, Thane CW *et al.* (2004) How well do Australian women comply with dietary guidelines? *Public Health Nutr* **7**, 443–452.
- García-González Á, Achón M, Alonso-Aperte E *et al.* (2018) Identifying factors related to food agency: cooking habits in the Spanish adult population – a cross-sectional study. *Nutrients* **10**, 217.
- Chen RC, Lee MS, Chang YH *et al.* (2012) Cooking frequency may enhance survival in Taiwanese elderly. *Public Health Nutr* **15**, 1142–1149.
- Reicks M, Trofholz A, Stang J *et al.* (2014) Impact of cooking and home food preparation interventions among adults: outcomes and implications for future programs. *J Nutr Educ Behav* **46**, 259–276.
- Wolfson J, Clegg Smith C, Frattaroli S *et al.* (2016) Public perceptions of cooking and the implications for cooking behaviour in the USA. *Public Health Behav* **19**, 1606–1615.
- Darmon N & Drewnowski A (2015) Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis. *Nutr Rev* **73**, 643–660.
- Drewnowski A & Specter SE (2004) Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr* **79**, 6–16.
- Lee JH, Ralston RA & Truby H (2011) Influence of food cost on diet quality and risk factors for chronic disease: a systematic review. *Nutr Diet* **68**, 248–261.
- Powell LM & Maciejewski ML (2018) Taxes and sugar-sweetened beverages. *JAMA* **319**, 229–230.
- Ferretti F & Mariani M (2019) Sugar-sweetened beverage affordability and the prevalence of overweight and obesity in a cross section of countries. *Global Health* **15**, 30.



30. Cabrera Escobar MA, Veerman JL, Tollman SM *et al.* (2013) Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. *BMC Public Health* **13**, 1072.
31. World Health Organization (2015) Using price policies to promote healthier diets. http://www.euro.who.int/__data/assets/pdf_file/0008/273662/Using-price-policies-to-promote-healthier-diets.pdf (accessed April 2019).
32. Malta DC & Silva JB (2013) Brazilian strategic action plan to combat chronic non-communicable diseases and the global targets set to confront these diseases by 2025: a review. *Epidemiol Serv Saude* **22**, 151–164.
33. Claro RM, Levy RB, Bandoni DH *et al.* (2010) Per capita versus adult-equivalent estimates of calorie availability in household budget surveys. *Cad Saude Publica* **26**, 2188–2195.
34. Trabulsi J & Schoeller DA (2001) Evaluation of dietary assessment instruments against doubly labeled water, a biomarker of habitual energy intake. *Am J Physiol Endocrinol Metab* **281**, E891–E899.
35. Lopes TS, Luiz RR, Hoffman DJ *et al.* (2016) Misreport of energy intake assessed with food records and 24-h recalls compared with total energy expenditure estimated with DLW. *Eur J Clin Nutr* **70**, 1259–1264.

Appendix

Food groups reported by Brazilian adults from the Brazilian National Dietary Survey evaluated according to household composition. Brazil, 2008–2009

Food group	Food items consumed
Alcoholic beverages	<i>Cachaça</i> , fruit cocktails, <i>caipirinha</i> , beer (with or without alcohol), champagne, distillates, wine
Beans	Beans, lentils, chickpeas, soya, <i>feijoadá</i> , tofu
Breads	Bread and butter/margarine, hamburger bun, sliced loaf, French bread roll, <i>bisnaguinha</i> (subtly sweet small roll), whole-wheat bread, bread (non-specified), toast
Broth/soups	Broth (meat, <i>mocotó</i> , fish, tomato, green and beans), cream (onion, cheese and vegetables), soup (vegetables, meat, etc.), <i>tacacá</i> , <i>tucupi</i> in broth
Coffee/tea	Traditional maté, yerba maté, <i>chimarrão</i> (a traditional South American caffeine-rich infused drink made from fresh yerba maté leaves), tea, organic maté, tea with flour, instant coffee, cappuccino, coffee, coffee with milk
Fast foods	Calzone, pizza, hot dogs, hamburger (sandwich), assorted sandwiches, <i>misto-quente</i> or <i>frio</i> (hot or cold ham and cheese sandwich), French fries
Fish & seafood	Fish, shellfish, seafood, shrimp dumpling, cod cake, pasta with fish
Fruits	Avocado, pineapple, açai, acerola, plum, banana (lady's finger banana, Burro or Chunky banana, yellow Cavendish or Dwarf Cavendish banana, plantain or cooking banana, etc.), cajá-manga, cajarana, cashew, persimmon, cherry, fruit (non-specified), guava, soursop, ingá, jabuticaba, jackfruit, orange, lemon and lime, apple, papaya, mango, mangaba, watermelon, cantaloupe or honeydew, tangerine, strawberry, pear, peach, sugar apple, fruit salad, tamarind, tanja, grape, raisin
Meat & meat preparations	Beef meat, goat, capybara, lamb, alligator, pork, meat, viscera burger
Milk	Whole cow's milk, goat's milk, milk powder, fermented milk, flavoured milk, yoghurt, fruit vitamin, curdled milk
Other drinks	Soya drink, sugarcane juice, fruit juice
Pastas	Spaghetti, lasagne, capeletti, cannelloni, gnocchi, ravioli, yakissoba, pancake
Poultry & poultry preparations	Chicken, chester, quail, chicken gizzard, chicken liver, chicken burger, duck, turkey
Rice	Rice (polished, parboiled, needle, etc.), rice preparations (risotto, etc.)
Roots & tubers	Cassava, potato, sweet potato, carrot, yam, arracacha, corn, tapioca
Sugar-sweetened beverages	Soft drinks, isotonic, energy drinks, powdered juice, industrialized refreshments
Sweets & desserts	Candies, lollipops, bubble gum, cereal bars, sweet biscuits, cakes, bonbons, pies, chocolate, <i>cocada</i> (coconut candy or confectionery), fruit preserves, gelatine, jams, pudding, ice cream
Vegetables	Pumpkin, courgette, leafy vegetables and leafy greens, chard, garlic, leeks, asparagus, olive, aubergine, beetroot, onion, carrot, mushroom, chayote, cauliflower, pea pod, cucumber, peppers, okra, radish, cabbage, tomato, pod