



## Trends in diet quality among adolescents, adults and older adults: A population-based study☆☆☆☆

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### ABSTRACT

This study aimed to monitor diet quality and associated factors in adolescents, adults and older adults from the city of São Paulo, Brazil. We conducted a cross-sectional population-based study involving 2376 individuals surveyed in 2003, and 1662 individuals in 2008 (Health Survey of São Paulo, ISA-Capital). Participants were of both sexes and aged 12 to 19 years old (adolescents), 20 to 59 years old (adults) and 60 years old or over (older adults). Food intake was assessed using the 24-h dietary recall method while diet quality was determined by the Brazilian Healthy Eating Index (BHEI-R). The prevalence of descriptive variables for 2003 and 2008 was compared adopting a confidence interval of 95%. The means of total BHEI-R score and its components for 2003 and 2008 were compared for each age group. Associations between the BHEI-R and independent variables were evaluated for each survey year using multiple linear regression analysis. Results showed that the mean BHEI-R increased (54.9 vs. 56.4 points) over the five-year period. However, the age group evaluation showed a deterioration in diet quality of adolescents, influenced by a decrease in scores for dark-green and orange vegetables and legumes, total grains, oils and SoFAAS (solid fat, alcohol and added sugar) components. In the 2008 survey, adults had a higher BHEI-R score, by 6.1 points on average, compared to adolescents. Compared to older adults, this difference was 10.7 points. The diet quality remains a concern, especially among adolescents, that had the worst results compared to the other age groups.

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☆ We note that there are no prior publications or submissions with any overlapping information, including studies and patients. The manuscript has not been and will not be submitted to any other journal while it is under consideration by The Preventive Medicine Reports and the authors declare no conflict of interest.

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<sup>2</sup> Conception and design, acquisition of data, statistical analysis and critical revision of manuscript.

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### 1. Introduction

Dietary monitoring is part of the effort toward improving the population's nutritional health. A well-designed health-surveillance program can frame political initiatives by identifying adverse tendencies in the population's eating behavior (Ballard-Barbash, 2001).

Public policies, including raising the minimum wage and income transfer programs and expansion of the family health strategy have contributed to the decline of child malnutrition in Brazil (Monteiro et al., 2010). On the other hand, changes in eating patterns and physical activity have led to a new perspective for the population's health.

Analysis of Household Budget Surveys (HBS) in Brazil (2002/03–2008/09) revealed an insufficient amount of fruits and vegetables and an excess of calories from free sugars and saturated fats in the diet (Levy et al., 2012).

Studies of the Mediterranean population revealed unfavorable trends in diet quality, characterized by higher consumption of total and saturated fat and less consumption of fruits and vegetable in 2005 compared to 2000 (Valdés et al., 2009). Data from the National Health and Nutrition Examination Survey (NHANES) showed that the diet

quality of Americans is far from optimal and, according to the Healthy Eating Index (HEI), did not improve overall between 2001/02 and 2007/08 (USDA, 2013).

Recently, dietary pattern analysis has emerged as an alternative and complementary approach to examining the relationship between diet and the risk of chronic diseases. Instead of looking at individual nutrients or foods, pattern analysis examines the effects of overall diet. There is a growing interest in using dietary quality indices to evaluate the adherence to a certain dietary pattern or current dietary guidelines (Hu, 2002).

Given all these changes in recent decades, we hypothesized that Brazilian diet quality has deteriorated over the years across all age groups. Therefore, the primary objective of this study was to monitor diet quality and associated factors in adolescents, adults and older adults from the city of São Paulo, Brazil, in 2003 and 2008, using the Brazilian Healthy Eating Index (BHEI-R).

## 2. Methods

### 2.1. Study design and population

Data were obtained from two cross-sectional, population-based surveys on health and living conditions in a representative sample of adolescents (12–19 years old), adults (20–59 years old) and older adults (60 years old or over) living in the city of São Paulo (ISA - Capital), one of the most important metropolitan cities in Brazil, conducted in 2003 and 2008.

The two surveys employed a similar sampling process. Sample selection was carried out by two-stage cluster sampling: census tracts and households. For the present study, inclusion criteria were individuals

at least 12 years of age who answered the socioeconomic and dietary survey, giving a total of 2376 subjects (814 adolescents, 746 adults and 816 older adults) for the ISA-Capital 2003 and 1662 subjects (560 adolescents, 585 adults and 517 older adults) for the ISA-Capital 2008. Further details on the sampling can be found in another publication (Castro et al., 2009).

The Research Ethics Committee of the School of Public Health, University of São Paulo, approved the study protocol. All participants provided all the data required and signed the informed consent form.

### 2.2. Data collection

A structured questionnaire collecting demographic (sex, age and race), socioeconomic (head of household education and household income per capita), family (family household members), anthropometric (body weight and height) and lifestyle characteristics (smoking habits, alcohol consumption and leisure-time physical activity) was applied by trained interviewers at the participants' homes during the periods March to December 2003 and September 2008 to March 2009. All data are shown in Table 1.

The nutritional status was assessed by body mass index (BMI = weight/stature<sup>2</sup>) (CDC, 2012; WHO, 1998; Lipschitz, 1994) and the leisure-time physical activity (active/not active) was defined as the practice of physical activity for at least 30 min per day, five days a week at moderate intensity, or at least 20 min a day three days a week in vigorous intensity, using the International Physical Activity Questionnaire (IPAQ), long version.

Food intake was measured by one 24-h dietary recall, considering all seasons of the year and days of the week, contributing to daily variation in dietary intake. Data were collected using the multiple-pass method,

**Table 1**  
Weighted percentage distribution of studied population according to sociodemographic, anthropometric and lifestyle characteristics. ISA 2003 and 2008. São Paulo, SP, 2003–08.

Variables	ISA 2003		ISA 2008	
	n	% <sup>a</sup> (CI 95%)	n	% <sup>a</sup> (CI 95%)
Sex				
Male	1163	44.92 (42.21–47.62)	722	46.90 (44.36–49.44)
Female	1213	55.08 (52.38–57.79)	940	53.10 (50.56–55.64)
Age group (years)				
12 a 19 <sup>b</sup>	814	19.84 (17.66–22.01)	560	15.14 (12.93–17.34)
20 a 59	746	68.42 (66.19–70.65)	585	71.00 (68.00–74.01)
60 or older	816	11.74 (10.22–13.27)	517	13.86 (11.62–16.10)
Race <sup>c</sup>				
White	1509	61.22 (57.30–65.15)	963	58.46 (52.72–64.20)
Non white	856	38.78 (34.85–42.70)	697	41.54 (35.80–47.28)
House head's education <sup>c</sup>				
Up to 4 years <sup>b</sup>	1033	39.27 (35.44–43.09)	595	22.65 (18.82–26.48)
5–8 years	481	23.65 (20.71–26.60)	407	22.10 (16.86–27.36)
9–11 years <sup>b</sup>	426	20.55 (17.67–23.44)	418	35.44 (29.81–41.07)
12 years or more	405	16.53 (12.96–20.09)	216	19.81 (13.94–25.66)
Nutritional status <sup>c</sup>				
Underweight	187	5.48 (04.24–6.72)	96	4.05 (03.20–04.91)
Normal weight	1224	58.57 (55.47–61.66)	899	54.02 (50.67–57.36)
Overweight	670	35.95 (33.03–38.88)	590	41.93 (38.74–45.12)
Leisure-time physical activity <sup>c,d</sup>				
Active <sup>b</sup>	177	07.03 (05.21–08.85)	253	14.41 (11.81–17.00)
Not active <sup>b</sup>	2018	92.97 (91.15–94.79)	1407	85.59 (83.00–88.19)
Smoking habits <sup>c</sup>				
Never smoked	1641	67.53 (64.86–70.21)	1155	64.17 (60.45–67.87)
Former smoker	363	14.21 (11.71–16.70)	274	16.04 (13.21–18.86)
Smoker	334	18.26 (15.76–20.76)	232	19.79 (16.44–23.14)
Alcoholic beverage consumption <sup>c</sup>				
No	1341	50.43 (46.78–54.07)	962	47.89 (44.69–51.08)
Yes	1024	49.57 (45.93–53.22)	699	52.11 (48.92–55.31)

n - number of individuals in the unweighted sample.

CI 95% - Confidence Interval 95%.

<sup>a</sup> Prevalence in the weighted sample.

<sup>b</sup> Intervals do not overlap, so we have (at least) 95% confidence that the true values are not equal.

<sup>c</sup> Exclusion of individuals with ignored information.

<sup>d</sup> Active individual with a physical activity practice of at least 30 min of low or moderate intensity physical activity daily, five or more days of the week, or practice of at least 20 min of vigorous intensity physical activity daily, 3 or more days of the week.

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