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Factors associated with fruit and vegetable intake among adults of the city of São Paulo, Southeastern Brazil

ABSTRACT

OBJECTIVE: To describe the frequency of fruit and vegetable intake by adults and to assess factors associated with this frequency.

METHODS: Cross-sectional study, carried out between October and December 2003 in the municipality of São Paulo, Southeastern Brazil. Telephone interviews were conducted on a probabilistic sample of the adult population (>18 years) living in the city of Sao Paulo and with access to land telephone lines, totaling 1,267 women and 855 men. Frequency of fruit and vegetable intake was obtained by means of a questionnaire containing short, simple questions. Association of different factors with fruit and vegetable intake was assessed by multivariate linear regression using a hierarchic model with sociodemographic variables in the first hierarchical level, behavioral variables in the second, and diet-related variables in the third.

RESULTS: Frequency of fruit and vegetable intake was higher among women. For both sexes, frequency of intake increased with age and schooling. Intake was also higher among women who reported having been on a diet during the last year. Consumption of foods indicative of an unhealthy diet – such as sugars and fats – was inversely associated with fruit and vegetable intake among subjects of both sexes.

CONCLUSIONS: Fruit and vegetable intake in the adult population of Sao Paulo was higher among women, and was influenced by age, schooling, and diet.

DESCRIPTORS: Adult. Food Consumption. Feeding Behavior. Cross-Sectional Studies. Diet Surveys.

INTRODUCTION

According to the World Health Organization (WHO), approximately 60% of all deaths registered worldwide, and 46% of the global burden of disease in 2001 were attributed to non-transmissible chronic diseases. WHO projects that in 2020 these diseases will account for 58% of the global burden of disease.[14] Experts on diet, nutrition, and prevention of chronic disease agree that, even though further research is required in order to elucidate certain mechanisms of the relationship between diet components and the development of these diseases, current scientific evidence offers strong proof of the role of the diet in preventing and controlling morbidity due to non-transmissible chronic diseases. Dietary behavior not only influences current health status, but can also determine the development of chronic diseases later in life, including cancer, cardiovascular disease, and diabetes.[14]

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Insufficient fruit and vegetable intake is one of the ten major factors behind the global burden of disease.[13] These food items are important in the composition of a healthy diet, for they provide micronutrients, fiber, and other components with functional properties.[12] Moreover, fruit and vegetables are low in energy density, i.e., they contain few calories when considering the volume of food ingested, which helps maintain a healthy body weight.[9]

Levy-Costa et al[5] (2005), in a study of the distribution and evolution of household food availability in Brazil between 1974 and 2003, showed that fruit and vegetables corresponded to only 2.3% of total calories in the diet, or approximately one-third of the level recommended by WHO. Jaime & Monteiro[4] (2005) showed that less than one-half of Brazilians eat fruit on a daily basis, and less than one-third reported daily intake of vegetables.

In the field of dietary and nutrition policies, promotion of fruit and vegetable consumption occupies an important position among the directives for promotion of a healthy diet. WHO's Global Strategy on Diet, Physical Activity and Health recommends an increase in fruit and vegetable intake as a strategy for preventing chronic diseases.[15] In Brazil, the Ministry of Health recommends, in its Dietary Guide [*Guia Alimentar*],[a] daily intake of three portions each of fruit and vegetables, highlighting the importance of varying the items consumed throughout the week.

In order to guide and encourage the implementation of public policies for increasing fruit and vegetable intake, it is necessary to know not only the current level of consumption among the population, but also the factors associated with this intake. To this end, the present study was aimed at describing the frequency of fruit and vegetable intake among adults and analyzing the factors associated with this intake.

METHODS

We conducted an observational, population-based, cross-sectional study. The study population was composed of men and women aged 18 years or older who in 2003 lived in households in the city of Sao Paulo with access to telephone land lines. Data were obtained by means of telephone interviews carried out in 2003 by the System for Monitoring Risk Factors for Non-Transmissible Chronic Diseases by telephone interview (Simtel), in operation in the city of Sao Paulo.[6] Simtel is a computer aided telephone interview (CATI) system, in which interviews are continually performed, distributed throughout the 12 months of the year, on probabilistic samples of the population aged 18 years or older living in homes with access to telephone land lines. The first stage of sampling consisted of randomly selecting 7 thousand telephone lines from the electronic land line database for the municipality of Sao Paulo. The selection took into account the databases corresponding to the Central, North, South, East, and West regions of the city, totaling 3.150 lines. The second stage of sampling consisted of randomly selecting one of the members of the household for the interview. Each telephone interview was about seven minutes in duration, and included questions on sociodemographic variables, characteristics of diet and physical activity, and reported weight and height. Based on the answers obtained, we estimated nutritional and lifestyle indicators related to the occurrence of chronic non-transmissible diseases. Further details on the Simtel methods and sampling design can be found in Monteiro et al[6] (2005).

The outcome variable was frequency of ingestion of fruit and vegetables, evaluated by means of a frequency score constructed based on three questions in the telephone interview: "How many days per week do you eat fruit?"; "How many days per week do you eat raw salad?"; and "How many days per week to you eat cooked vegetables, not including potatoes and manioc?" The intake frequency score was given by the sum of individual intake frequencies. For its construction, we attributed a different weight for each category of intake frequency: 0.00 for items never consumed; 0.05 for items almost never consumed; 0.46 for items consumed three to four days per week; 0.73 for foods consumed five to six days per week; and 1.00 for items consumed every day. The sum of the consumption weights for fruit, raw salads, and cooked vegetables was considered as the total frequency score for fruit and vegetables.

In order to simultaneously evaluate the entire set of factors associated with fruit and vegetable intake, we grouped these factors into three blocks (Figure 1). The first block consisted of sociodemographic characteristics – sex, age, schooling, marital status, and paid work. The second block comprised behavioral variables – smoking, physical activity during leisure (score built based on weekly frequency and duration of exercise in minutes), meals outside home, substituting snacks for meals, and dieting. The third block included variables that describe the habitual intake of healthy foods other than fruit and vegetables (beans and fish) and of foods or preparations associated with unhealthy dietary patterns (fried foods, processed meats, soft drinks, whole milk, butter or margarine, sugar [habitual intake of sweets as dessert and frequent use of sugar as a beverage sweetener], chicken with skin, and red meat with fat). For these variables, we considered intake as "habitual" when subjects reported consuming these foods at least

[a] Ministério da Saúde. Secretaria de Atenção à Saúde. Coordenação-Geral da Política de Alimentação e Nutrição. Guia Alimentar para a População Brasileira: Promovendo a alimentação saudável. Brasília;2005. (Série A. Normas e Manuais Técnicos)

one day per week. In the case of "meals outside home" and "substituting snacks for meals," the categories "almost never" and "never" were considered as "no," and categories from "every day" to "5-6 days per week" were considered as "yes."

Frequency of intake of fruit and vegetables was described by means of the percent distribution among the total population and separately for each sex. We used the chi-squared test for proportions to determine the significance of differences between sexes.

In univariate analyses, we tested the correlation between fruit and vegetable intake score and age, schooling, and household density using the Pearson correlation coefficient (r). We used Student's T test for differences in means to evaluate differences in terms of fruit and vegetable intake score between the categories of qualitative variables (paid work, physical activity during leisure, frequent meals outside home, dieting, habitual intake of sausages, sugars, fried foods, and fish). In all univariate analyses we adopted a significance level of 0.05.

We then estimated hierarchic multiple linear regression models based on the theoretical framework presented in Figure 1. For each block, we carried out an internal multiple regression analysis to select variables to be included in the final model. This intra-block analysis consisted of linear regression between the outcome variable and the other variables in that block, adopting a significance level of 0.20. After this preliminary analysis, we carried out the hierarchic modeling per se, adopting a significance level of 0.05. Variables showing associations with p-values >0.05 and <0.20 were kept in the final multivariate model for confounder control.

In order for the collected data to be representative of the city's population, we attributed a final weight to each individual, calculated based on three factors. The first of these is the inverse of the number of telephone lines in the subject's home, which corrects for the greater chance subjects from homes with more lines have of being selected. The second factor is the number of adults in the household, which corrects for the lower chance of being selected among subjects from households with more adults. The third factor equates the sociodemographic composition of the studied sample to that of the total adult population of the city. For this, we incorporated the two weighting factors mentioned above to the studied sample and then distributed subjects into 36 sociodemographic categories resulting from the stratification of the sample according to sex, age group, and schooling. The same distribution was applied to the sample of adults studied in the city during the 2000 Demographic Census, which corresponded to 10% of all households. The third weighting factor consisted of the ratio between the relative frequency of

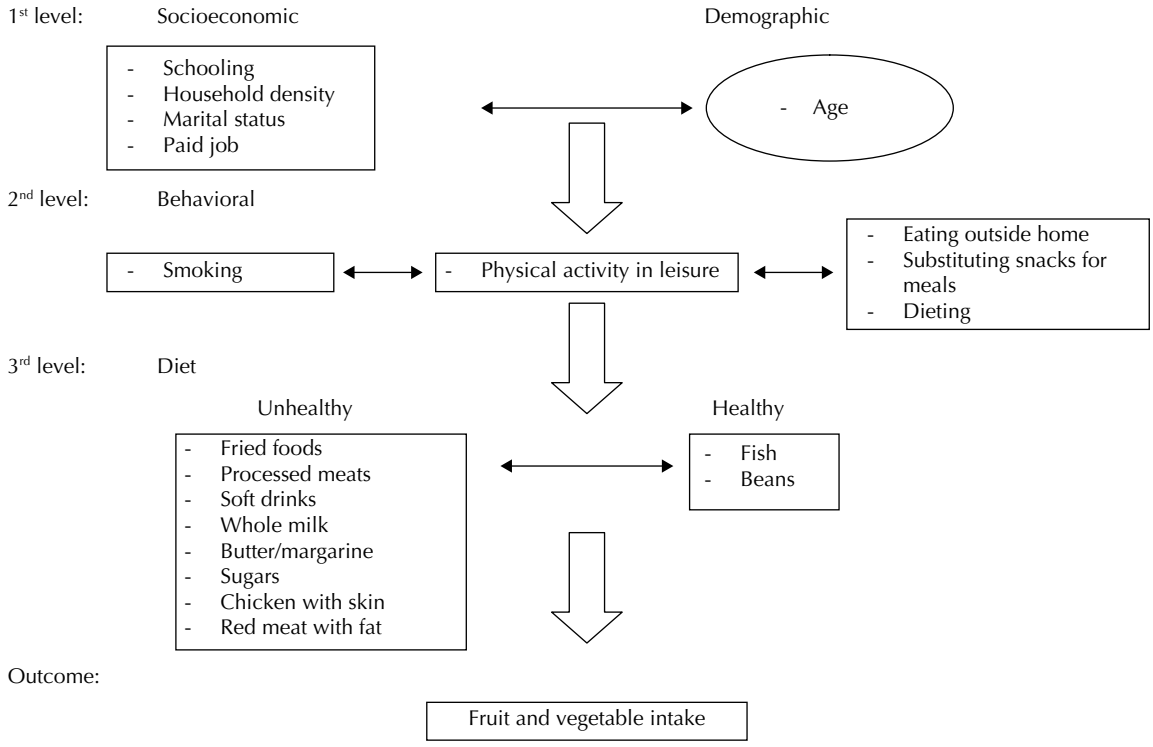


Figure 1. Theoretical framework, structured into hierarchical blocks, for analysis of fruit and vegetable intake among adults living in the city of Sao Paulo, Southeastern Brazil.

individuals determined for the Census sample and the relative frequency determined for the studied sample in each of the 36 sociodemographic categories.[a]

Data analysis was carried out using SPSS software, considering 95% confidence intervals and a 5% significance level.

Since interviews were carried out by telephone, free informed consent was replaced by verbal consent, obtained at the time of the first telephone contact with the subject. The present study was approved by the Research Ethics Committee of the Faculdade de Saúde Pública da Universidade de São Paulo.

RESULTS

Of the initial sample of 3,150 lines, 645 were considered ineligible: these included lines no longer in service (235), business telephones (138), non-existent numbers (109), and lines in homes which were probably closed (163). Among the 2,505 eligible telephone lines – approximately 80% of the initial total – there were 157 refusals (6.3%). Another 37 (1.4%) lines were lost due to busy signal or to reaching fax and answering machines, after ten attempts.

The study population comprised 2,122 subjects, of which 1,267 were female and 855, male. Mean age was 40.55 years (sd=16.41) for women and 39 years (sd=15.31) for men. Women had on average 7.91 years of schooling (sd=4.46) and men, 8.17 years (sd=4.31). Among women, 48.6% reported not having a paid job; this was also true for 19.1% of men.

The numeric and percent distribution of the population according to frequency of fruit and vegetable intake is presented in Table 1. Daily intake of fruit was more

Table 1. Numeric and percent distribution of the studied population according to sex and fruit and vegetable intake variables. City of Sao Paulo, Southeastern Brazil, 2003.

Frequency of intake	Women (n=1,267)		Men (n=855)		Total (n=2,122)		p**
	n	%	n	%	n	%	
Fruit							<0.001
Daily	587	51.7	346	35.0	932	43.9	
5 to 6 days/week	62	5.4	44	4.4	105	5.0	
3 to 4 days/week	155	13.6	188	19.0	342	16.1	
1 to 2 days/week	172	15.1	249	25.3	421	19.8	
Almost never	121	10.7	138	14.0	259	12.2	
Never	39	3.4	23	2.3	61	2.9	
Raw salad							<0.001
Daily	598	52.7	394	39.9	992	46.8	
5 to 6 days/week	91	8.0	123	12.4	214	10.1	
3 to 4 days/week	182	16.1	209	21.2	391	18.4	
1 to 2 days/week	168	14.8	168	17.0	336	15.8	
Almost never	65	5.7	71	7.2	136	6.4	
Never	31	2.7	22	2.2	53	2.5	
Cooked vegetable							<0.001
Daily	272	23.9	113	11.4	384	18.1	
5 to 6 days/week	82	7.2	61	6.2	143	6.7	
3 to 4 days/week	306	26.9	234	23.7	540	25.4	
1 to 2 days/week	310	27.4	349	35.4	660	31.1	
Almost never	111	9.8	156	15.8	267	12.6	
Never	55	4.8	74	7.5	129	6.1	
Total		100.0		100.0		100.0	

* Values weighted according to number of adults in household, multiplied by the inverse of the number of telephone lines and by the 2000 Demographic Census correction factor.
** Descriptive level of the test and difference in proportions between men and women p<0.05

[a] Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Gestão Estratégica e participativa. VIGITEL Brasil 2006 – Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília; 2007.

Table 2. Factors associated with fruit and vegetable intake among women, identified by hierarchic multiple linear regression analysis. City of Sao Paulo, Southeastern Brazil, 2003.

Variable block	β	95% CI		P	Adjusted r^2 (p of model)
Sociodemographic					
Age	0.012	0.009	0.015	<0.001	0.081
Schooling	0.044	0.033	0.054	<0.001	(<0.001)
Behavioral					
Eating outside home	0.100	-0.013	0.213	0.083	0.096
Diet in last year	0.194	0.097	0.291	<0.001	(<0.001)
Diet					
Sugar	-0.281	-0.404	-0.157	<0.001	0.114
Processed meats	-0.079	-0.167	-0.009	0.080	(<0.001)

* Values weighted according to number of adults in household, multiplied by the inverse of the number of telephone lines and by the 2000 Demographic Census correction factor.

frequent among women (51.7%), and daily intake of cooked vegetables was two times greater among women than among men (p<0.001). Intake frequency scores for fruit and vegetables ranged from zero to three, with a mean of 1.67 (sd=0.78) among women and 1.50 (sd=0.75) among men.

For the female population (Table 2), the sociodemographic factors positively and significantly correlated with frequency of fruit and vegetable intake were age (p<0.001) and greater schooling (p<0.001). The only variable in the behavioral block positively associated with the outcome was having been on diet in the year preceding the interview (p<0.001). Among other foods, only sugar intake (p<0.001) was significantly correlated with lower fruit and vegetable intake.

Among men (Table 3), sociodemographic factors significantly correlated to fruit and vegetable intake were older age (p<0.001), greater schooling (p<0.001) and having a paid job (p=0.016). In the behavioral block, frequent meals outside home (p=0.041) and physical activity during leisure (p=0.002) were associated with greater intake of these foods. As to consumption of other foods, there was a positive correlation between the habit of eating fish and fruit and vegetable intake (p<0.001).

Figure 2 represents the various factors correlated with frequency of fruit and vegetable intake among men and women.

DISCUSSION

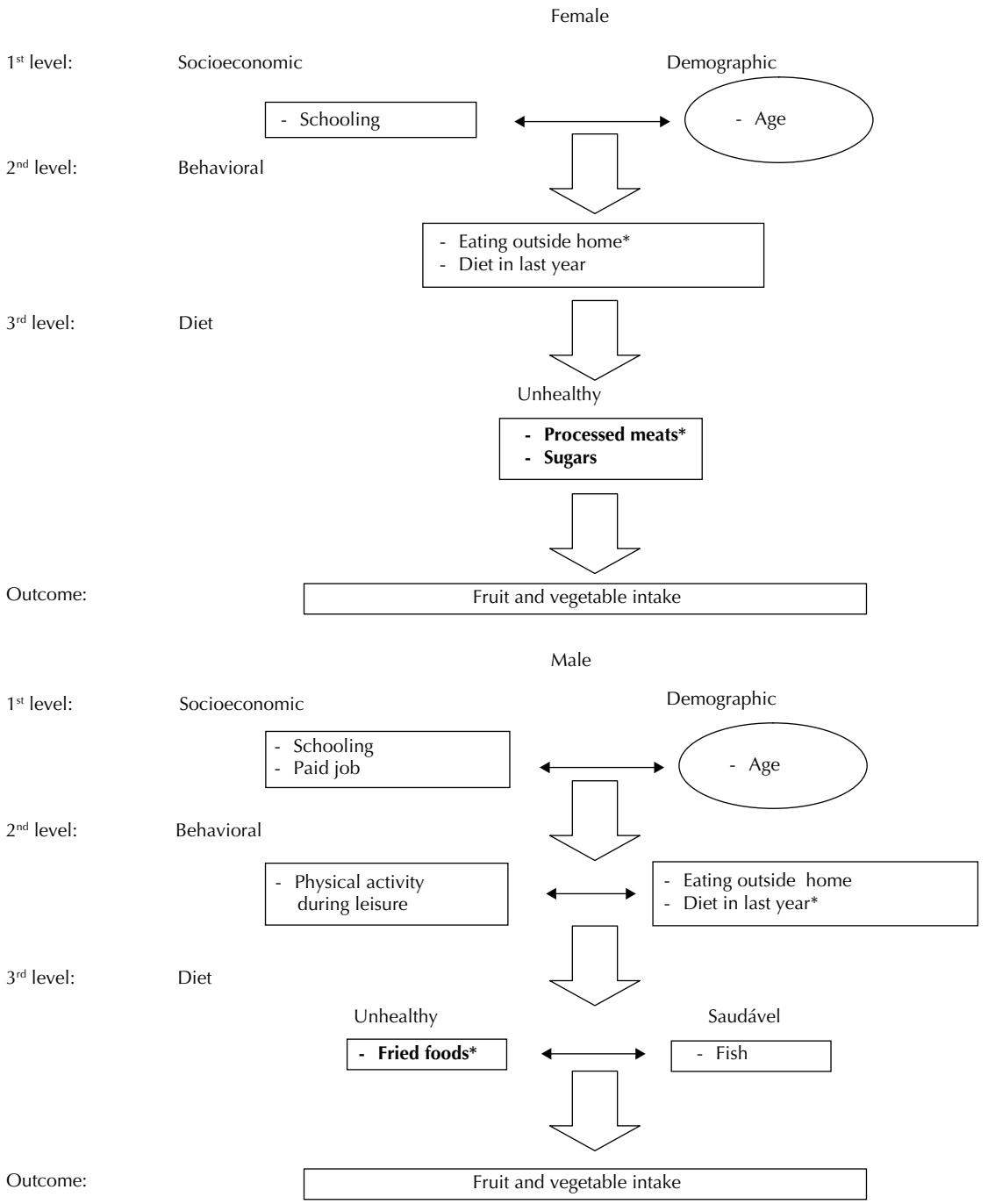
Women showed higher frequency of fruit and vegetable intake than men, as did older and more educated subjects of both sexes.

The correlation found between frequency of fruit and vegetable intake and age and schooling, among both

Table 3. Factors associated with fruit and vegetable intake among men, identified by hierarchic multiple linear regression analysis. City of Sao Paulo, Southeastern Brazil, 2003.

Variable block	β	95% CI		p	Adjusted r^2 (p of model)
Sociodemographic					
Age	0.012	0.009	0.016	<0.001	0.089
Schooling	0.040	0.030	0.051	<0.001	(<0.001)
Paid job	0.153	0.029	0.277	0.016	
Behavioral					
Physical activity in leisure	0.233	0.085	0.381	0.002	0.105
Eating outside home	0.109	0.004	0.214	0.041	(<0.001)
Diet in last year	0.099	-0.027	0.224	0.122	
Diet					
Fried foods	-0.084	-0.190	0.022	0.121	0.151
Fish	0.330	0.239	0.420	<0.001	(<0.001)

* Values weighted according to number of adults in household, multiplied by the inverse of the number of telephone lines and by the 2000 Demographic Census correction factor.



* Variables kept in the model as controls
Variables in bold type showed negative correlation with fruit and vegetable intake.

Figure 2. Factors associated to fruit and vegetable intake among adult men living in the city of Sao Paulo, Southeastern Brazil – Final Model.

men and women, has already been shown in other studies. Pearson et al[8] (2005), in a cross-sectional study carried out in South Yorkshire, United Kingdom, found a slight increase in vegetable consumption with increasing age. Thompson et al[11] (2005) found a positive association between schooling and fruit and vegetable intake in the population of the United States. In an epidemiological study carried out in Brazil, Jaime & Monteiro[4] (2005) also found a positive influence of age and schooling on fruit and vegetable intake.

Among behavioral variables, having been on diet in the year preceding the interview was positively correlated with frequency of fruit and vegetable intake among women only. Among men, physical activity during leisure was positively correlated with the outcome. Similar results were reported in other studies, such as that by Jago et al[3] (2005), which included adults from the city of Bogalusa, in the Unites States. In this study, Jago et al[3] found fruit and vegetable intake to be greater among those who practiced physical activities. Thompson et al[11] (2005), in a multicenter study carried out in the US, concluded that the association between the habit of eating frequently outside home and greater frequency of fruit and vegetable intake among men may be related to the greater variety of food that can be found in restaurants. Likewise, a qualitative study[1] among clients of various food courts in the city of Sao Paulo found that the wider variety of foods available at restaurants allowed users to have a more diverse diet than that provided by food available at home.

Generally speaking, our results regarding the relationship between fruit and vegetable intake are consistent with the literature on the subject. Our analyses show that consumption of foods rich in sugar and fat is inversely associated with fruit and vegetable intake. A similar association was detected by Forshee & Storey[2] (2001), in a study of children and adolescents. Levy-Costa et al[5] (2005) alerted for an alarming increase in sugar availability, and decrease in fruit and vegetable availability, taken place in Brazil in recent years.

The present survey differs from the majority of studies addressing the determinants of fruit and vegetable intake frequency in that it uses a telephone-based questionnaire, which imposes a number of limitations. One cannot discard the possibility of measurement bias, since Simtel does not include adults living in homes without a telephone land line. To minimize this bias, we adopted a weighting strategy to make the sociodemographic condition of the sample compatible with that of the 2000 Demographic Census for the municipality of Sao Paulo. Furthermore, the cross-sectional design does not allow for adequate evaluation of causal relationships. The difference in methods used for evaluating diet and for defining and characterizing fruit and vegetables may have compromised comparability with other studies of fruit and vegetable intake in the population.

Epidemiological investigations based on telephone interviews have also been carried out in other countries. The Centers for Disease Control and Prevention (CDC)[a] have developed a short questionnaire for evaluating fruit and vegetable consumption by telephone interview, which is used in the Behavioral Risck Factor Surveillance System (BRFSS), a periodic survey carried out in the United States. Serdula et al[10] (1993) compared this questionnaire to other, more extensive, evaluation methods, finding moderate correlation (Spearman correlation coefficients ranging from 0.47 to 0.57). Simtel is a telephone-based system for monitoring chronic disease risk factors that is newer than the system operating in the United Sates, and is the first such system to be developed on Latin America, being characterized by practicality, low cost, and agility.[6] A study of the validity of food and drink intake indicators found moderate reproducibility (kappa=0.57), 46.4% specificity, and 71.6% sensitivity for fruit and vegetable intake when compared to classifications based on three 24-hour recall questionnaires.[7]

Based on our results, we conclude that frequency of fruit and vegetable intake in the adult population of the municipality of Sao Paulo falls short of current recommendations, especially among the younger, less educated population. Knowledge of factors associated with fruit and vegetable intake frequency may help guide initiatives aiming to promote consumption of these foods by the population of the city of Sao Paulo.

[a] Center for Disease Control and Prevention. BRFSS: Behavior Risk Factor Surveillance System. [cited 2007 Jan 27]. Available from: http://apps.nccd.cdc.gov/brfss

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