

The influence of meal and food markets in fruit and vegetable consumption among adults in the city of São Paulo

A influência dos locais de refeição e de aquisição de alimentos no consumo de frutas e hortaliças por adultos no município de São Paulo

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ABSTRACT: *Introduction:* Despite the increased consumption of fruits and vegetables in the Brazilian population, a great proportion of people do not meet the recommendations. Purchasing sites associated with fruit and vegetable consumption has not been widely explored. *Objective:* To explore the association between fruit and vegetable purchasing and consumption sites and the consumption of these foods among adults living in the city of São Paulo, Brazil. *Methods:* Cross-sectional study with 2 thousand individuals living in the city of São Paulo, aged between 20 and 59 years, participants of the “Obesogenic Environment Study in São Paulo”. The outcome was fruit and vegetable consumption measured by weekly consumption. Exposure variables included purchasing sites (supermarkets, open-air food markets, fruit and vegetable specialized markets, and corner stores) and consumption sites (full service restaurants and fast food restaurants). *Results:* The sample comprises women (52.3%) aged between 25 and 34 years (30.2%), with at least 8 years of schooling (42.8%) receiving 2 to 5 minimum wages (34.6%). Demographic and socioeconomic variables showed association with regular consumption of fruits and vegetables ($p < 0.05$). The regular consumption of meals in full service restaurant was associated with vegetables consumption. The regular consumption of meals in fast-food restaurants was not associated with vegetables consumption. Food purchasing sites were not associated with fruit or vegetable consumption. *Conclusion:* The choice of restaurant type was associated with vegetable consumption. In the studied population, food purchasing sites were not associated with fruit or vegetable consumption.

Keywords: Food consumption. Health promotion. Fruits. Vegetables. Nutritional surveys. Adult.

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RESUMO: *Introdução:* Apesar do aumento no consumo de frutas e hortaliças no Brasil, o país ainda está aquém das recomendações. O local de consumo e aquisição desses alimentos ainda é pouco explorado. *Objetivo:* Avaliar a influência dos locais de aquisição e consumo de alimentos na ingestão de frutas e hortaliças em adultos residentes no município de São Paulo. *Métodos:* Estudo transversal que avaliou 2 mil indivíduos participantes do “Estudo do ambiente *obesogênico* em São Paulo”. O desfecho do estudo foi o consumo regular de frutas e hortaliças. As variáveis de exposição foram: local de aquisição (supermercados, feiras, sacolões e mercados de bairro) e consumo de alimentos (restaurantes de serviço completo e restaurantes *fast-food*). *Resultados:* A população estudada é composta por 52,3% de indivíduos do sexo feminino, 30,2% com idade entre 25 e 34 anos, 42,8% com 8 a 11 anos de estudo e 34,6% com renda familiar de 2 a 5 salários mínimos. As variáveis demográficas e socioeconômicas associaram-se com o desfecho ($p < 0,05$). O consumo regular de refeições em restaurantes de serviço completo foi associado ao consumo de hortaliças, ao contrário do consumo de refeições em restaurantes *fast-food*. Não houve associação entre local de aquisição e consumo regular de frutas e hortaliças. *Conclusão:* Visitas regulares a restaurantes de serviço completo influenciam positivamente o consumo de hortaliças. Não foram encontradas relações entre o local de compra de frutas e hortaliças e seu consumo.

Palavras-chave: Consumo de alimentos. Promoção da saúde. Frutas. Hortaliças. Inquéritos nutricionais. Adulto.

INTRODUCTION

The consumption of fruits and vegetables is considered as a marker of a healthy diet pattern, reducing the risks of death caused by chronic non-communicable diseases due to their composition, rich in vitamins, minerals and fibers, and their low energy density. Fruits and vegetables are also part of the most complete, varied, colorful and attractive meals, with lower presence of ultra-processed foods, according to the Dietary Guide for the Brazilian Population (*Guia Alimentar para a População Brasileira*)¹⁻⁵. The minimum daily intake of these foods to obtain this healthy and protective effect is 400 g per capita, or the equivalent to 5 portions of 80 g⁶.

This minimum consumption is fulfilled by 24% of the Brazilian population, according to survey Surveillance System of Risk and Protective Factors for Chronic Diseases (VIGITEL), conducted in 2014⁷, and by little less than one third of the Brazilian population, according to the Health National Research (PNS)⁸.

The dietary behavior is highly complex. The reasons that lead a person to consume a specific food come from the interaction of multiple influences, in different contexts and conditions, being influenced by socioeconomic and demographic characteristics⁹⁻¹⁵. The choice of locations to purchase food is also influenced by the environment and by individual characteristics^{16,17}.

In the literature, there is no consensus about the influence of the locations of food purchase and its consumption¹⁸. Studies point to possible relations between healthier diets and more access to super and hypermarkets, which offer a greater variety of foods *natural*

at more accessible prices, when compared to convenience stores and corner stores^{12,19}. Studies in the United States and in the United Kingdom present diverse results when assessing the presence of purchasing sites for fruits and vegetables, and the effect on the consumption of these foods by the population²⁰. Jaime et al.²¹ mention a significant association between the regular intake of fruits and vegetables and the density of fruit stores and fairs; however, according to Carvalho et al.²², the outdoor fruit fairs have been less visited than markets and fruit markets, and the purchase of fruits and vegetables in these spaces has decreased 19.81%.

Despite the relationships between places of food purchase and the intake of fruits and vegetables, little is assessed about the association of the consumption of these foods with the habit of eating outside the household. In the scientific literature, there are no studies demonstrating this relationship. The studies state that, among the main factors associated with the changes in dietary patterns that the Brazilian population has been undergoing in the past few decades, is the increasing habit of eating meals outside the household²³. This habit, in industrialized countries, is related with cultural, social and environmental factors²⁴. The increasing consumption of calories, fat and sodium and the low intake of fibers, iron and vitamins is associated to this behavioral change, in some studies^{25,26}.

Since most of the responsibility in the development of obesity and chronic diseases is attributed to the diet, it is important to investigate these associations, recognizing the role of the environment in the dietary behavior of the population, considering the lack of publications relating the intake of fruits and vegetables and the behavior of purchase and consumption of foods²⁷.

The objective of this study was to assess the associations between the locations of meal consumption and the locations of fruit and vegetable purchase with the regular intake of these foods among adults living in São Paulo, controlling the analysis for demographic and socioeconomic variables.

METHODS

This is a cross-sectional study conducted in São Paulo, between April and May, 2011, including 2 thousand individuals of both sexes, aged between 20 and 59 years, living or working in 13 administrative districts previously selected, which were part of the “Obesogenic Environment Study in São Paulo” (ESAO-SP). The studied fields were selected by a purposive sampling methodology, proposed by ESAO-SP, based on the administrative districts and census sectors in which the city of São Paulo is divided, according to geographic and administrative characteristics.

The purposive sample is the sampling method in which the selected areas are chosen with the purpose of representing a specific region, in relation to the criteria established for the study, aiming at ensuring that all main relevant groups for the subject are covered, and

also at guaranteeing that, in each one of the criteria, there is any diversity, so that the impact of the diversity of the objects of interest can be explored²⁸.

The city of São Paulo is divided in 96 administrative districts, which were classified in socioeconomic level terciles by using the Human Development Index (HID), and in 3 dietary environment indicators according to the density of the equipment of food purchase. After the classifications, two districts were randomly selected in each one of the 6 possible strata, and 1 extra district in case there was much refusal from the commercial businesses of the selected districts, accounting for 13 administrative districts.

In each district, 8 census sectors were randomly selected, totaling 104; of these, 18 were excluded for not containing a location of food sale, leaving 86. Among these, 4 census sectors were randomly selected in each one of the 13 districts, accounting for 52 assessed sectors.

The sample tried to contemplate the socioeconomic and spatial diversities found in the city regarding the food environment. More details on the methodology used in the sampling process can be observed in Duran et al.^{12,29}.

The sample of the individuals was conducted in a non-probability manner, by convenience, and was stratified by sex and age, using the real proportion of each district, according to Census 2000, ensuring the representativeness of the sample for that area³⁰. Data collection was conducted face to face, by a trained and supervised team, in places of great circulation of people inside the selected districts, like squares, parks and commercial businesses.

Inclusion criteria were age – between 20 and 59 years – and location of residence or circulation, inside the districts selected in the sampling areas. There were no losses in the questionnaires used. One questionnaire was not fully answered, however, the data available were used.

The dependent variables of the study are the regular consumption of fruits and the regular intake of vegetables — daily intake of any portion —, which were obtained with the questions “On how many days of the week do you usually eat lettuce and tomato, or any other raw vegetable?” and “On how many days of the week do you usually eat cooked vegetables with the food or in the soup, like, for example, cabbage, carrot, chayote, eggplant and zucchini, not to mention potatoes, manioc or yam?”. The answers were given in weekly frequency of consumption. The outcome “regular consumption of fruits and vegetables” was determined by the intake of each type of food (fruits and vegetables) on five or more days of the week¹⁴.

The variables related with the location of consumption of meals outside the household were: “regular intake of meals in full service restaurants” and “regular intake of meals in fast-food restaurants”. The information was obtained by the questions “On how many days of the week do you usually have lunch or dinner, in this neighborhood, at restaurants (kilo, self-service, barbecue place or *a la carte*)?”, considered, in this study, full service restaurants – and “On how many days of the week do you usually have lunch or dinner, in this neighborhood, in snack bars, bakeries or bars?” – considered, in this study, fast-food restaurants. The “regular intake of meals at full service restaurants” and the “regular intake of meals

at fast-food restaurants” were considered as the consumption on one or more days of the week in these locations.

To obtain data about the locations of purchase of fruits and vegetables, the question was: “Of the locations below, where do you buy fruits and vegetables more often?”; the possible answers were: supermarkets and hypermarkets, fruit stores, outdoor fairs our neighborhood markets.

The demographic and socioeconomic variables were: sex referred by the interviewee; age calculated based on the interviewee’s date of birth; schooling, obtained by the question: “Until what grade did you study?”; and family income, obtained by the question: “What is the total approximate income of your family?”, measured in minimum wages (up to one minimum wage, from one to two minimum wages, from two to five minimum wages, from five to ten minimum wages, and more than ten minimum wages).

The descriptive analysis of the quantitative variables was conducted by using measures of central tendency and dispersion, and the qualitative variables were described according to the absolute and relative frequencies. The associations between the demographic and socioeconomic variables with the regular intake of fruits and vegetables were tested with the Pearson’s χ^2 test for nominal variables, and with the linear trend test for ordinal variables. The descriptive level of the test was $p < 0.05$.

To analyze the independent effect of the variables of location of consumption and purchase of foods with the intake of fruits and vegetables, the odds ratio (OR) was calculated for each category related with the location of intake: regular consumption at full service restaurants, regular consumption at fast-food restaurants and non-regular consumption in both locations – and for each category of location for food purchase – supermarket, fruit store, outdoor fairs and neighborhood markets – adjusted by sex, age, schooling and family income, considering a 5% significance level and 95% confidence interval (95%CI). Data was analyzed using the software Statistical Package for the Social Sciences (SPSS), version 17.0.

This study was submitted to and approved by the Research Ethics Committee of the School of Public Health at Universidade de São Paulo (FSP/USP). The participation of the individuals was based on the signature of the Informed Consent Form.

RESULTS

Of the individuals analyzed, 52.3% were female; the prevalent age was 25 to 34 years (30.2%); schooling years, between 8 and 11 (42.8%); and Family income, from 2 to 5 minimum wages (34.6%). Most of the population (67.9%) reported the regular intake of fruits, and 74.9%, of vegetables (Table 1).

The regular consumption (\geq once a week) of main meals at full service restaurants and at fast-food restaurants was reported by 30.4 and 22.5% of the population, respectively.

The most frequent location of fruit and vegetable purchase was the fruit store (39.6%), followed by the supermarket (34.3%) (Table 1).

Table 1. Distribution of the studied population according to the demographic and socioeconomic variables, indicators of the intake of fruits and vegetables and locations of consumption and purchase of foods. São Paulo, 2011.

Variable	n	%
Sex (n = 2,000)		
Female	1,046	52.3
Male	954	47.7
Age (n = 2,000) (years)		
20 to 24	345	17.2
25 to 34	604	30.2
35 to 44	522	26.1
45 to 54	378	18.9
≥ 55	151	7.6
Schooling (n = 1,999) (years)		
≤ 8	709	35.4
8 to 11	855	42.8
> 11	435	21.8
Family income (n = 2,000) (MW)		
≤ 2	648	32.4
2 to 5	692	34.6
> 5	307	15.3
ND	353	17.7
Regular intake of fruits ^a (n = 1,999)		
Yes	1,358	67.9
No	641	32.1
Regular consumption of vegetables ^a (n = 2,000)		
Yes	1,497	74.8
No	503	25.2

Continue...

Table 1. Continuation.

Variable	n	%
Regular intake of fruits and vegetables ^a (n = 1,999)		
Yes	1,106	55.3
No	893	44.7
Regular intake of meals ^b at full service restaurants (n = 2,000)		
Yes	609	30.4
No	1,391	69.6
Regular intake of meals ^b at fast-food restaurants (n = 1,999)		
Yes	450	22.5
No	1,549	77.5
Places to purchase fruits and vegetables (n = 1,136)		
Supermarket	390	34.3
Neighborhood market	182	16.0
Fruit store	450	39.6
Outdoor fair	114	10.1

MW: minimum wages; ND: not declared; ^aregular intake of fruits and vegetables: consumption of any portion on five or more days of the week; ^bregular intake of meals: consumption of main meals (lunch and/or dinner) on one or more days of the week.

All variables – both demographic and socioeconomic – were associated with the regular consumption of fruits and vegetables ($p < 0.05$). A higher frequency in the regular intake of fruits was observed among female individuals (71.6%), showing a linear increase with age, schooling and family income (Tabela 2).

There were the same associations for the regular consumption of vegetables, with a difference in the distribution of the age variable, with higher frequency of consumption in the population aged between 45 and 54 years (83.6%) (Table 2).

The regular intake of meals at full service restaurants was not associated with the consumption of fruits, but with the intake of vegetables, after the adjustment for the demographic and socioeconomic characteristics (respectively, OR = 1.51; 95%CI 1.14 – 1.98). The regular intake of meals at fast-food restaurants was not associated with the intake of fruits or vegetables (Table 3).

There was no statistically significant association between the location of fruit and vegetable purchase and the intake of these foods (Table 4).

DISCUSSION

The findings in this study allow to state possible associations between the regular consumption of meals at full service restaurants and the regular consumption of vegetables; however, they do not allow this association with the regular intake of fruits. There is no association between the consumption of fruits and vegetables and the regular intake of meals at fast-food restaurants, according to the data analyzed.

The data presented reinforce the evidence that points to the influence of demographic and socioeconomic factors regarding the consumption of fruits and vegetables^{8,31} in the

Table 2. Association between indicators of the consumption of fruits and vegetables and demographic and socioeconomic variables. São Paulo, 2011.

Variables	Regular intake of fruits ^a (n = 1,999)		p-value	Regular intake of vegetables ^a (n = 2,000)		p-value
	Yes n (%)	No n (%)		Yes n (%)	No n (%)	
Sex (n = 2,000)						
Female	748 (71.6)	297 (28.4)	< 0.001*	819 (78.3)	227 (21.7)	< 0.001*
Male	610 (63.9)	344 (36.1)		678 (71.1)	276 (28.9)	
Age (n = 2,000) (years)						
20 to 24	222 (64.3)	123 (35.7)	0.002**	205 (59.4)	140 (40.6)	< 0.001**
25 to 34	404 (67.0)	199 (33.0)		435 (72.0)	169 (28.0)	
35 to 44	342 (65.5)	180 (34.5)		419 (80.3)	103 (19.7)	
45 to 54	272 (72.0)	106 (28.0)		316 (83.6)	62 (16.4)	
≥ 55	118 (78.1)	33 (21.9)		122 (80.8)	29 (19.2)	
Schooling (n = 1,999) (years)						
≤ 8	451 (63.7)	257 (36.3)	< 0.001**	510 (71.9)	199 (28.1)	< 0.001**
8 to 11	579 (67.7)	276 (32.3)		629 (73.6)	226 (26.4)	
> 11	327 (75.2)	108 (24.8)		357 (82.1)	78 (17.9)	
Family income (n = 1,647) (MW)						
≤ 2	399 (61.6)	249 (38.4)	< 0.001**	453 (69.9)	195 (30.1)	< 0.001**
2 to 5	470 (67.9)	222 (32.1)		540 (78.0)	152 (22.0)	
> 5	237 (77.2)	70 (22.8)		247 (80.5)	60 (19.5)	

MW: minimum wage; ^aregular intake of fruits and vegetables: consumption of any portion on five days or more of the week; *descriptive level of the Pearson's χ^2 association test: $p < 0.05$; **descriptive level of the linear trend test: $p < 0.05$.

Table 3. Crude and adjusted association between the intake of fruits and vegetables and the place of regular consumption of meals. São Paulo, 2011.

Variable	Odds ratio for the regular consumption of fruits and vegetables ^a			
	Fruits		Vegetables	
	Crude	Adjusted* (95%CI)	Crude	Adjusted* (95%CI)
Regular intake of meals ^b at full service restaurants				
No	1.00	1.00	1.00	1.00
Yes	1.01 (0.89 – 1.34)	1.04 (0.82 – 1.33)	1.43 (1.13 – 1.79)	1.51 (1.14 – 1.98)
Regular intake of meals ^b at fast-food restaurants				
No	1.00	1.00	1.00	1.00
Yes	0.86 (0.690 – 1,073)	0.88 (0.68 – 1.12)	1.05 (0.82 – 1.34)	1.06 (0.80 – 1.40)

95%CI: 95% confidence interval; ^aregular intake of fruits and vegetables: consumption of any portion on five or more days of the week; ^bregular intake of meals: consumption of main meals (lunch and/or dinner) on one or more days of the week; *odds ratio adjusted by sex, age, schooling and family income.

Table 4. Crude and adjusted association between the consumption and the locations to purchase fruits and vegetables. São Paulo, 2011.

Variable	Odds ratio for the regular consumption ^a of fruits and vegetables			
	Fruits		Vegetables	
	Crude	Adjusted* (95%CI)	Crude	Adjusted* (95%CI)
Places to purchase fruits and vegetables				
Supermarket				
No	1.00	1.00	1.00	1.00
Yes	1.08 (0.82 – 1.42)	0.99 (0.73 – 1.32)	0.98 (0.73 – 1.31)	0.78 (0.56 – 1.10)
Neighborhood market				
No	1.00	1.00	1.00	1.00
Yes	0.90 (0.64 – 1.28)	1.01 (0.69 – 1.48)	0.96 (0.66 – 1.41)	0.99 (0.64 – 1.51)
Outdoor fair				
No	1.00	1.00	1.00	1.00
Yes	0.89 (0.69 – 1.16)	0.90 (0.67 – 1.20)	1.08 (0.81 – 1.43)	1.21 (0.87 – 1.69)
Fruit store				
No	1.00	1.00	1.00	1.00
Yes	1.32 (0.84 – 2.07)	1.39 (0.84 – 2.30)	0.93 (0.59 – 1.47)	1.15 (0.66 – 2.00)

95%CI: 95% confidence interval; ^aregular intake of fruits and vegetables: consumption of any portion on five or more days of the week; *odds ratio adjusted by sex, age, schooling and family income.

studied population. The intake was higher among women, and growing with age, schooling⁸ and family income³.

The population analyzed here presented with regular consumption of fruits and vegetables (55.3%) higher than the usually observed in other Brazilian studies, for example, in Florianópolis (50.1%) and in the city of São Paulo (35.5%)⁷. This consumption, higher than that observed in the main national studies, can be justified by the fact that the study population represents the areas defined for the study, and not the city of São Paulo in general, so some variations are possible in the characteristics of the population analyzed.

Regarding the meals outside the household, several studies point to worse nutritional quality of the meals in this context^{23,32}, however, this study does not corroborate others mentioned earlier, since it presents a positive relationship between the intake of vegetables and the meals had at full service restaurants. The access to healthy foods varies according to the type of business and the socioeconomic status of the population in the city of São Paulo²⁹. The restaurants that charge per kilo can represent an alternative for a healthy diet outside the household, since the variety of choice is higher³³.

However, further studies are necessary to assess the availability and the intake of fruits in this type of business. This study did not mention a relationship between the consumption of fruits and the meals had at full service restaurants, and we did not find studies that tried to demonstrate that specific association for fruits, only for foods *natural* in general^{34,35}.

The consumption of meals at fast-food restaurants was not associated with the consumption of fruits and vegetables. Since the intake of these foods, presented by the studied population, was higher than that found in previous analyses⁷, maybe the intake in this population is not influenced by the consumption or not of meals at fast-food restaurants; that is, the individuals who consume fruits and vegetables are not affected by the regular intake of meals at fast-food restaurants. However, it is still necessary to understand how the presence of this type of restaurant can affect and change the dietary behavior and the health of the population, for the implementation of effective strategies to stimulate healthy diets, even if outside the household¹².

For the evaluation of locations of food purchase, the supermarkets (34.3%) and the fruit stores (39.6%) prevailed in the preference of the population, leaving the neighborhood markets (16.0%) in third in the order of preference for the purchase of fruits and vegetables, and the outdoor fairs (10.0%) in fourth.

The findings in this study are in accordance with the study conducted in Rio Grande do Sul as to the preference of food purchase at supermarkets (59.77%) and fruit stores, and these results were expected by the authors, who observed, in other studies, the "prevalence of super and hypermarkets in the preference of consumers as to the purchase of foods around the world"¹⁰. This fact is also shown in several studies that conclude that fresh food markets, like outdoor fairs, have lost importance and have been replaced by supermarkets³⁶⁻³⁸, which are preferred by the Brazilian population for the purchase of foods, according to national studies³⁹.

However, in this study, for the population analyzed, the place of fruit and vegetable purchase did not present a relationship with the frequency of consumption of these foods. This finding can be explained by the hypothesis that, in this population, the regular intake of fruits and vegetables is already consolidated, regardless of the location preferred by people to buy these items.

A study conducted in Belo Horizonte, based on the data from VIGITEL, observed that the increasing consumption of fruits and vegetables is directly related with the density of the equipment available to sell these items³. In São Paulo, the highest density of supermarkets and fruit stores is associated with the regular intake of fruits and vegetables, especially in the lower income categories¹².

However, these studies do not approach the relationship between the type of equipment used to sell these foods and the frequency of consumption, but the density of equipment in the region.

The dietary environment and the pattern of food purchase are still little explored in Brazil^{21,29,40}. Therefore, some comparisons cannot be made due to the lack of data referring to the subject. These relationships should be searched in new studies, in order to get to know and design, in a more robust way, the behavior of the purchase in the population, related with the consumption of foods.

A limitation of this study is related with the application of questionnaires for the evaluation of food consumption, which involves possible bias in the measurement of the frequent diet due to errors in the memory of the interviewee, which overcame the underestimation of dietary intake^{41,42}. The differences of methods to assess the intake of foods and the categorization of data may also have damaged the comparison with other studies, however, the same parameters of evaluation and categorization of the main national surveys were considered for comparison.

CONCLUSION

It is concluded that the regular intake of fruits and vegetables is influenced by sex, age, schooling and Family income. The conduction of meals at full service restaurants has a positive influence on the intake of vegetables, however, it does not affect the consumption of fruits. There were no associations between the choice of locations to purchase fruits and vegetables and the intake of these foods.

Based on the analysis of the data in this study, and on the comparison with others, it is recommended that meals outside the household be conducted, preferably, at full service restaurants, such as those charged by the kilogram, which are a good option in comparison to fast-food restaurants, since they also count on fast service and ensure greater access to healthier meals.

New studies are necessary to investigate about how the dietary environment, specifically locations of food purchase and consumption, may influence the intake of fruits and vegetables. These data are not consolidated in the scientific literature, which has scarce and superficial information to perform comparisons and robust conclusions.

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