# Self-assessment and factors associated with fruit and vegetable consumption in adults from Brasília, Brazil

Clíslian Luzia da Silva[1]
Teresa Helena Macedo da Costa[1]
Eduardo Freitas da Silva[2]

[1] Universidade de Brasília, Faculdade de Ciências da Saúde, Departamento de Nutrição. Brasília-DF, Brasil.

[2] Universidade de Brasília, Instituto de Ciências Exatas, Departamento de Estatística. Brasília-DF, Brasil.

Correspondence
Clíslian Luzia da Silva
E-mail: clislian@gmail.com

## Abstract

This study aimed to compare self-assessed intake of fruits and vegetables with the Brazilian's Food Guide recommendations and evaluate associated characteristics in subjects living in Brasilia, Federal District. Individuals were selected from a random cluster sample of residences, and 98 adults were interviewed by telephone. Frequency of intake, number of portions and self-assessed intake of fruits and vegetables were obtained. Prevalence ratio (PR) was calculated with a multiple Poisson regression with robust variance. The agreement between the self-reported and actual intake was determined using simple kappa coefficient. The majority of subjects consume less than three portions of fruits (68%) and vegetables (77%) daily. The frequency of intake of fruits and vegetables in five or more days of the week was of 69.5% and 81.5%, respectively. In the model, every one-year increase in the number of years of schooling was positively associated with a 36% increase in the adequacy of fruits and vegetables consumption (p < 0.01; CI 1.17 a 1.59). The agreement between the self- and technical assessment of fruits and vegetables intake presented low values. In this context, programs that encourage consumption of fruits and vegetables must inform the amount as well as the portion size of these foods,

**Key words:** Portion Size. Consumption. Vegetable. Fruit. Food Consumption. Recommended Dietary Allowances.

## Introduction

To prevent noncommunicable chronic diseases (NCD), the World Health Organization (WHO)[1] recommends that people consume a minimum of 400g of fruits and vegetables per day. Campaigns designed to encourage the consumption of these foods have been conducted, especially in developed countries, being called "Five-a-Day" program, which suggests that people eat five portions of fruits and vegetables on a daily basis.[2] In Brazil, a food guide was developed, which recommends six portions at least per day, divided equally into fruits and vegetables.[3]

Despite the recommendations, the majority of the population does not consume adequate amounts of fruits and vegetables. According to the Protective and Risk Factors for Chronic Diseases: a Telephone-Based Survey (Vigitel),[4] only 20% (95% CI = 19-21) of Brazilians eat five or more portions of fruits and vegetables in five or more days in the week. Among the capitals of the Brazilian states, the Federal District (FD) stands out for having the highest proportion of adults eating five or more portions of these foods in five or more days in the week. Yet, only 24% (95% CI = 20.8-27.3) of the population of the FD consume adequate amounts.[4]

Some studies identify the presence of important characteristics that may favor or hinder the consumption of these foods. The habit of consuming foods and vegetables has been positively related to the practice of physical activity,[5-9] income,[6,9-11] age and level of education [4,11,12] and inversely related to the smoking practice,[6-9] Body Mass Index (BMI) [5,6,13,14] and dietary energy density.[13] In addition, it has also been observed that gender can influence consumption of these foods, once women usually eat more fruits and vegetables than men.[4,9,11]

Knowing the benefits related to the intake of fruits and vegetables is a motivating factor to increase its consumption. [11,15-18] In a recent publication about the barriers and facilitators of the consumption of these foods by the Brasilia population, we described that the key factors to motivate the consumption of fruits and vegetables that were mentioned by this population was related to health and pleasant taste. The aspect related to health was identified in 52% of the responses for fruits intake and 57% for vegetables. The main obstacles mentioned were the unpleasant taste of vegetables (36% of the responses) and the lack of habit of eating fruit (23% of the responses).[19]

WHO recommends that initiatives designed to promote the consumption of fruits and vegetables be based on scientific evidences that emphasize the benefits of these foods for the health.[20] Even so, such messages may not be effective for those who believe that they consume an adequate amount of fruits and vegetables. [11,21-24] Thus, for the strategies that promote the intake of these foods to be effective, besides identifying the groups of people who consume less than the recommended amounts and the difficulties to increase such consumption, it is also necessary to know how much fruit and vegetable the individuals consider appropriate to eat.

The objectives of this study are to compare the characteristics and self-assessed consumption by adult individuals living in Brasilia, DF, who get or not the recommended daily intake of three portions of fruits and vegetables, as recommended by the Food Guide for the Brazilian Population; to assess the associations between adequate consumption of fruits and vegetables with the sociodemographic characteristics and classification of the nutritional status of this population. The hypotheses of the study are that the consumption of fruits and vegetables are associated with gender, BMI and level of education, and that there is a low agreement between the actual and self-assessed intake of fruits and vegetables.

## Methods

This is a descriptive study with quantitative approach. The qualitative study performed with this sample was previously published, as well as the description of the sample and criteria for elegibility.[19] A random sample of residence clusters was selected from the list of home addresses of the Brasilia Electricity Company, which covers 100% of the residences. The clusters were formed by the administrative regions that comprise Brasilia: *Asa Sul* (South Wing), *Asa Norte* (North Wing), *Vila Planalto* (Plateau Village) and the *Setor Militar Urbano* (Urban Military Sector). The sample of 250 residences was calculated from 82,680 residences, maintaining a 5%-alfa error, and a prevalence of 80% of physical inactivity was considered, which was the main outcome of a previous research that gave origin to the study sample. [25] The sample was representative of the Brasilia population. As criteria of eligibility all adult residents who agreed to participate were interviewed, being considered residents the persons who lived in the place, except visitors. Only individuals aged 20 years or over were eligible to participate in the survey, in order to avoid the inclusion of any individual with late maturity, especially males.

To participate in the study, 50% of 250 residences (n=124) were included in a systematic way and maintaining the sample randomization. The interviews were structured and conducted by phone with a person of each residence, identified as number 1 in the protocol suggested by Thomaz et al.[25] The phone calls were made at the Laboratory of Nutrition Biochemistry, Nutrition Center, University of Brasilia (UnB) and were recorded.

The respondents' free and informed consent to participate in the survey was recorded, and the methodological procedures were based on the ethical and scientific rules set by the National Health Council of the Ministry of Health. The Committee of Ethics in Human Research of the Faculty of Sciences of the University of Brasilia (register no. 101/2006) approved the project.

The sociodemographic and stature data were taken from the study protocol of Thomaz et al[25], which was performed in person at the participants' residence a year before. Current weight was informed by the respondent during the phone call. For the Brasilia population, we assumed the validity of the self-reported weight, height and BMI, considering this information appropriate for assessment of the population with due accuracy.[26] Based on the weight and height, we calculated the BMI [weight (Kg) / height (m)$^2$], and the nutritional status was determined using WHO's classification [20] for adults and that of Lipschitz[27] for elderly persons.

Information on the last year of school effectively completed was obtained and then converted into years of schooling. We considered 11 years of schooling when the primary school was completed, 11 to 14 years when the secondary school was completed and 15 years or more for college or university graduation.

A form containing questions on the frequency and portion of fruits and vegetables consumption and self-assessed consumption was used. The characteristics of consumption were obtained separately for fruits and vegetables. The questions on fruit consumption included the number of fruits or slices of fruit eaten daily. We considered a unit or slice of fruit as one portion. For vegetables, we considered the number of tablespoons of vegetables eaten each day, and one portion was equal to three tablespoons. To calculate the number of portions of vegetables consumed, the number of tablespoons informed by the respondent was divided by three. To define the number of portions of fruits and vegetables consumed on a daily basis, we considered:

(Number of portions consumed x weekly consumption frequency) /7

In the process of data analysis, the intake of fruits and vegetables was assessed separately and in whole. In the first case, consumption was assessed by considering, as reference, three daily portions of fruits and three of vegetables. For the latter, i.e., for the overall analysis, it was used the total number of portions of fruits and vegetables consumed per day by each individual, and as appropriate intake we considered six or more portions, according to the recommendations of the Food Guide for the Brazilian Population.[3]

In the individuals' self-assessment of their current intake of fruits and vegetables, they had the following options of answers: "low", "adequate", "high" or "does not know". Therefore, the subjects who responded that they believed that their consumption was low or did not know, had their responses classified into the group of self-reported inadequacy. The responses of the individuals who believed that their consumption was adequate or high were included into the group of self-reported adequacy.

Regarding the frequency of consumption, it was considered as regular consumption of fruits and vegetables the intake of these foods at least five days a week, according to the protocol used in the Protective and Risk Factors for Chronic Diseases: a Telephone-Based Survey – (Vigitel).[4]

To perform the descriptive analysis, we calculated the mean, standard deviation and proportions. A Poisson regression analysis with robust variance procedure was used, incorporating the sample weights (inverse sample inclusion probability weights), the cluster effect and stratification. [28] The adequacy of fruit and vegetable intake was considered as the dependent variable of the study. The independent variables in the model were sex, age, number of working hours per week, socioeconomic class (Class A, Classes B, C, D and E, according to the Brazilian Economic Classification[29]), marital status (Single, Married, Widowed/Divorced), years of schooling (level of education) and BMI (Kg/m$^2$). Interactions between the independent variables were tested and none of them revealed statistical significance. Multicollinearity between the variables was assessed and its effect was not detected. Prevalence ratios were calculated based on the results of the model, and the significance level adopted was $p < 0.05$.

Agreement between the self-assessed intake of fruits and vegetables and the technically assessed intake was examined, using as measure of agreement the simple kappa coefficient. [30] Data were analyzed using the software SAS v.9.2 and STATA v.10.

## Results

A total of 98 individuals participated in the survey. Table 1 shows the sociodemographic and anthropometric characteristics of the subjects in the overall sample and separately, according to the adequacy of fruit and vegetable consumption. There was a similar proportion of men and women (52%, 48%, respectively) as well between eutrophic and overweight/obese individuals (52%, 48%, respectively). Mean age was approximately 46 years (± 15.4) with more predominance in the range of 20 to 59 years (84%). The majority of the interviewees were married (59%) and the level of education was 15 years or over (55%). Regarding working hours, the majority worked 40 hours a week or more (52%).

When analyzing the subjects according to their adequate fruit and vegetable consumption, it was found that most of them (83%, n=81) did not get the recommended amount of fruits and vegetables proposed by the Food Guide for the Brazilian Population[3] (Table 1). Knowing that such foods should compose 8 to 12% of the total energy value (TEV) and considering a 2000-kcal diet, the mean calorie value of the fruits and vegetables intake by the subjects considered with inadequate consumption is equivalent to 120kcal (± 66.4), corresponding to only 6% of the TEV.

**Table 1**. Socio-demographics and classification of the nutritional status of adults in Brasília, Federal District, according to the consumption of fruits and vegetables – 2007.

| VARIABLE | Inadequate[a] (N = 81) | | Adequate[b] (N = 17) | | Total (N = 98) | |
|---|---|---|---|---|---|---|
| | nº | % | nº | % | nº | % |
| SEX | | | | | | |
| Male | 42 | 52 | 9 | 53 | 51 | 52 |
| Female | 39 | 48 | 8 | 47 | 47 | 48 |
| AGE (years) | | | | | | |
| 20-39 | 32 | 40 | 3 | 18 | 35 | 36 |
| 40-59 | 35 | 43 | 12 | 71 | 47 | 48 |
| >=60 | 14 | 17 | 2 | 12 | 16 | 16 |
| MARITAL STATUS | | | | | | |
| Single | 20 | 25 | 3 | 18 | 23 | 23 |
| Married | 49 | 60 | 9 | 53 | 58 | 59 |
| Separated/ Widowed | 12 | 15 | 5 | 29 | 17 | 17 |
| SCHOOLING (years) | | | | | | |
| <11 | 11 | 14 | 0 | 0 | 11 | 11 |
| 11-14 | 30 | 37 | 3 | 18 | 33 | 34 |
| >=15 | 40 | 49 | 14 | 82 | 54 | 55 |
| SOCIAL CLASS | | | | | | |
| A and B | 64 | 79 | 17 | 100 | 81 | 83 |
| C, D and E | 17 | 21 | 0 | 0 | 17 | 17 |
| WORKING HOURS (weekly) | | | | | | |
| 0 to 19 | 17 | 21 | 7 | 41 | 24 | 24 |
| 20 to 39 | 20 | 25 | 3 | 18 | 23 | 23 |
| > or =40 | 44 | 54 | 7 | 41 | 51 | 52 |

| VARIABLE | Inadequate[a] (N = 81) | | Adequate[b] (N = 17) | | Total (N = 98) | |
|---|---|---|---|---|---|---|
| NUTRITIONAL STATUS | | | | | | |
| Eutrophic | 43 | 53 | 8 | 47 | 51 | 52 |
| Overweight/obese | 38 | 47 | 9 | 53 | 47 | 48 |

[a]: Consume less than six portions of fruits and vegetables per day

[b]: Consume six or more portions of fruits and vegetables per day

According to Table 2, it can be seen that sex, age, working hours, social class, marital status and BMI variables are not associated with adequate consumption of fruits and vegetables. However, the level of education, expressed in the number of years of schooling, is directly associated with the consumption of these foods, and for every one-year increase of formal education, the prevalence of adequacy of fruit and vegetables intake increases by 36%.

**Table 2.** Prevalence ratios and association between adequate consumption of fruits and vegetables with the socio-demographics and nutritional status of adults in Brasília, Federal District – 2007.

| VARIABLE | PR[a] | 95% CI[b] | p-value |
|---|---|---|---|
| SEX | | | |
| Male x Female | 1.62 | 0.76 a 3.47 | 0.21 |
| AGE | 1.01 | 0.96 a 1.06 | 0.75 |
| ESTADO CIVIL | | | |
| Divorced/Widowed x Married | 1.86 | 0.65 a 5.30 | 0.24 |
| Single x Married | 1.62 | 0.55 a 4.76 | 0.37 |
| SOCIAL CLASS | | | |
| A x B,C,D and E | 1.60 | 0.53 a 4.82 | 0.40 |
| WORKING HOURS (weekly) | 0.98 | 0.94 a 1.01 | 0.25 |
| NUTRITIONAL STATUS (BMI) | 0.94 | 0.87 a 1.02 | 0.16 |
| SCHOOLING (years) | 1.36 | 1.17 a 1.59 | <0.01 |

[a]Prevalence ratio

[b] Confidence interval

When we compare the agreement between self-assessed consumption of fruits and vegetables and the technical assessment of such consumption (Table 3), we can see that the Kappa value and the 95% confidence interval (CI) were higher for fruits than for vegetables (Kappa = 0.41; 95% CI = 0.22-0.59; Kappa = 0.24; 95% CI = 0.09-0.39, respectively). Knowing that agreement is substantial for Kappa values between 0.60 and 0.79, moderate between 0.40 and 0.59 and poor <0.40, we can infer that the agreement had a moderate level of variation for fruits and poor for vegetables. We can also observe that nearly half of the individuals with inadequate vegetable consumption consider it as adequate (47%), while 27% of the individuals that consume fruits below the recommended amounts believe that they have adequate consumption of this food.

Considering the standard intake of fruits and vegetables, we can observe a low percentage of individuals with adequate intake (31.5% n=31, 23.5% n=23, respectively), while a high percentage of the individuals has a frequency intake of these foods of five or more days per week (69.5% n=68 and 81.5% n=80, respectively).

**Table 3**. Self-assessed consumption according to adequate consumption of fruits and vegetables by adults in Brasília, Federal District – 2007.

| Self-assessed consumption | Fruits | | | | Vegetables | | | |
|---|---|---|---|---|---|---|---|---|
| | < 3 portions | | >= 3 portions | | < 3 Portions | | >= 3 portions | |
| | N | % | N | % | N | % | N | % |
| Adequate | 18 | 27 | 22 | 71 | 35 | 47 | 19 | 83 |
| Inadequate | 49 | 73 | 9 | 29 | 40 | 53 | 4 | 17 |
| Kappa | 0.41 | | | | 0.24 | | | |
| 95% CI | 0.23 – 0.59 | | | | 0.09 – 0.39 | | | |

## Discussion

This study found a high proportion of individuals with insufficient intake of fruits and vegetables. Similar result was found for the Brazilian population in 2011, in the study Protective and Risk Factors for Chronic Diseases: a Telephone-Based Survey – Vigitel. [4] In addition, it was found that among the subjects with inadequate intake, it would be necessary to double the amount of fruits and vegetables to meet the amount recommend by the Food Guide of three daily portions of each of these foods. [3]

The percentage of individuals with inadequate consumption of fruits and vegetables found in the present study is higher than that reported in other countries. Such proportion is 20% higher than that found in a study conducted by Ashfield-Watt *et al.*[31] with English people, while in a sample of 10 European countries it was found that eight of them showed lower proportions of subjects with inadequate intake of fruits and vegetables, with percentages ranging from 37% to 78%.[32]

It should be noted that the differences in the results found could be explained by the food guide recommendations and the description of the fruits and vegetables group in each country. While countries in Europe recommend five portions a day, the Food Guide for the Brazilian Population prescribes a daily intake of six portions of these foods, assuming a 2000-kcal diet and 12% of the energy in the diet supplied by fruits and vegetables.[3] So, the total amount recommended by the Guide is 570g/day, which exceeds approximately 40% of the amount recommended by WHO[1] and considers a larger number of individuals as with inadequate consumption. Moreover, differently from Brazil, in other countries fruit juices are not considered in the fruit portions nor tubers and roots in the vegetable group, which can also explain the discrepancy.

Among the sociodemographic variables in the study, only the level of education was associated positively with the consumption of fruits and vegetables. It was found that for every extra year of education, the prevalence of adequacy of fruit and vegetable intake increased substantially. Similar results were also found in the literature. [33-35] In fact, there are evidences that the higher the education level of an individual the greater the concern about the effect of diet on diseases,[36] as well as a higher awareness of the need to change the diet when necessary and the quality of the foods eaten, [21] which makes that more educated individuals have healthier eating patterns. [37]

It was not found association between the BMI and the intake of fruits and vegetables. This result agrees with study carried out by Neutzling *et al.*,[9] which investigated the intake of fruit and vegetables by adults in a southern city in Brazil. Studies that find association between these variables are usually longitudinal and relate the fruits and vegetables intake with protection against weight increase.[38,39]

No studies examining separately the number of portions of fruits and vegetables consumed by the adult population in the Federal District were found. Thus, this is the first survey that presents the results with such details. Like in other studies,[31-33, 37, 40,41] we found differences in the pattern of consumption of fruits and vegetables by adults in Brasilia, showing the need to analyze these foods separately instead of considering them as a single food group.

We confirm the study hypothesis of moderate and poor agreement between the self-assessed consumption of fruits and vegetables and the technical assessment of such consumption. In this regard, it highlights the lack of knowledge of the respondents regarding the amount of these foods that should be eaten on a daily basis. Taking into account that the majority of the sampled individuals consume fruits and vegetables regularly (five or more times a week), it could be inferred that the subjects considered more the frequency of intake than the amount consumed in their current self-assessment. Other studies show the lack of knowledge of the recommended amount of fruits and vegetables. [17,24]

Special attention should be paid to the subjects assessed as having an inadequate consumption of fruits and vegetables and who believed that they were eating sufficient portions of these foods. Scientific evidences show that one of the major obstacles found to changing eating habits is the belief that there is no need for changes, once current consumption is perceived as sufficiently healthy. [21, 22, 23, 24] This attitude is reported as unrealistic optimism by Raats&Sparks[42] and is present in people who consider themselves as below the average population at risk.

The findings of this study show the need for future researches that would examine the intake of fruits and vegetables separately and by low-income populations, where the determinant factors of consumption would have other characteristics. We also suggest that more information be available to the public on the adequate consumption of fruits and vegetables separately. Such measure might improve the population's knowledge on appropriate consumption and achieve a favorable response, especially in the groups with higher education level, who wrongly consider themselves adequate.

Among the limitations of this study, it could be considered the small sample size and large confidence interval values for the prevalence ratios of the model presented. However, the methodology used (Poisson regression with robust variance) provides a better estimate of the prevalence ratios, which in turn represent effect measures more significantly in cross-sectional studies and likely produce intervals with smaller ranges.[28] Furthermore, it should be highlighted the importance of this work because it used a probabilistic and representative sample of the target population, assuring the quality of the results obtained. It should be noted that the contribution of this research lies on identifying the characteristics related to self-assessment and understanding of the information provided by the food guide, which should be considered by food and nutrition

managers, nutritionists and educators. The new edition of the food guide, which provides information on the composition of dishes and preparations, including fresh foods such as fruits and vegetables, should be monitored to confirm its effectiveness.

## Conclusion and Recommendations

From the results of this study, we conclude that the majority of individuals consume fewer fruits and vegetables than the recommended amounts, do not know how much of these foods should be eaten daily, and that more years of education are associated with an adequate consumption of these foods. Thus, we recommend that campaigns and programs designed to encourage fruit and vegetable intake inform the amounts to be consumed and the portion size, in order to favor the right perception and choice of the foods to be consumed.

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