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Citation for published version:

Segu, EM, Castro, A, Tereza Da Silva, J & Collese, TS 2023, 'Food security and fruit and vegetable consumption among preschoolers: an exploratory study during the COVID-19 pandemic', *O Mundo da Saúde*, vol. 47, e14552022, pp. 139-148. <https://doi.org/10.15343/0104-7809.2023431391481>

Digital Object Identifier (DOI):

[10.15343/0104-7809.2023431391481](https://doi.org/10.15343/0104-7809.2023431391481)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Publisher's PDF, also known as Version of record

Published In:

O Mundo da Saúde

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Food security and fruit and vegetable consumption among preschoolers: an exploratory study during the COVID-19 pandemic

Erick Martinez Seguí¹  Adriana Garcia Peloggia de Castro¹  Jacqueline Tereza da Silva²  Tatiana Sadalla Collese^{1,3} 

¹Centro Universitário São Camilo – CUSC. São Paulo/SP, Brasil.

²Global Academy of Agriculture and Food Systems. The University of Edinburgh. Edinburgh/UK.

³Departamento de Nutrição, Faculdade de Saúde Pública. Universidade de São Paulo - USP. São Paulo/SP, Brasil.

E-mail: erick_segui@hotmail.com

Abstract

Studies that assess food insecurity and its association with the consumption of fruits, legumes, and vegetables (FLV) can help identify groups and risk factors of inadequate food consumption, in order to propose assertive nutritional interventions. The aim of this study was to describe FLV consumption by children in different food security situations. This is an exploratory cross-sectional study, conducted with parents/guardians of 44 children from zero to four years old. The short version of the Brazilian Food Insecurity Scale and a Food Frequency Questionnaire were applied to parents/guardians via a telephone interview. The children were 2.6 years old on average, 56.8% were female, 67.5% were eutrophic, and 70.5% of the families were in a situation of food insecurity. For households in a situation of food security, the median consumption of FLV was 213.4 g/day (P25=97.89; P75=425.91). As for those in a situation of food insecurity, the median FLV was 105.4 g/day (P25=33.58; P75=205.16). It was concluded that the consumption of FLV by children from families in a situation of food security is higher than that of children in a situation of food insecurity, who are strongly influenced by the offer of cheap food with low nutritional quality. Public policies are needed to favor the guarantee of access to FLV of quality and at an affordable cost for all families.

Keywords: Food Insecurity. Vegetables. Nutrition. Child.

INTRODUCTION

“Food security” is understood as the situation in which, at any time, one has economic, social, and physical access to healthy and nutritious food, having dietary needs and food preferences met for an active and healthy life¹. Food insecurity, in turn, is the lack of access to quality and diversified food; it is the inability of an individual or family group to meet their nutritional and dietary needs^{2,3,4}.

At a global level, between 2015 and 2020 (beginning of the COVID-19 pandemic), cases of food insecurity remained stable². However, it was found that, in 2021, there were 46 million new cases of hunger in the world, and, in Brazil, the prevalence of hunger reached 8.6% of the population². Still in the Brazilian scenario, in 2021, it was estimated that the prevalence of severe food insecurity jumped

DOI: 10.15343/0104-7809.202343139148I

#Article selected through a summary presented at the VII Multiprofessional Congress of the Centro Universitário São Camilo, in november 2022. This study was submitted to the analytical process and meets the scope’s specifications and appreciation of the editorial board of the journal O Mundo da Saúde.

from 1.9% to 7.3%, while the prevalence of moderate or severe food insecurity went from 18.3% to 28.9%, in relation to the period between 2014 and 2016². This situation was aggravated in the year 2022, where food insecurity reached 58.7% of the population, with 15.5% experiencing severe food insecurity, that is, living with hunger⁵. It was also in this year that Brazil returned to the Hunger Map of the United Nations (UN), where 4.1% of the population faced a chronic lack of food⁶. It is a fact that the COVID-19 pandemic was (and continues to be) a major villain for the most vulnerable population, and was responsible for negative changes in diet, due to a worsening in the provision of food within homes, since access to food worsened and the unemployment rate soared^{5,7}.

According to the National Child Food and Nutrition Study (ENANI-2019)⁸, which assessed food insecurity in Brazilian children under five years of age, approximately 47% of Brazilian families have some degree of food insecurity. This directly reflects on the diet of these children, who lack diversified dishes, which, consequently, are replaced by nutritionally poor and/or ultra-processed foods^{9,10,11}. This situation can trigger nutritional deficiencies that harm child development and can generate long-term losses that are often irreversible^{4,12,13}.

Adequate consumption of fruits, legumes, and vegetables (FLV) is of paramount importance for maintaining cardiovascular health and disease prevention in adults and

children¹⁴. Among the main vitamins and minerals present in this food group and which are fundamental for the development of preschool and school children, are: 1) Non-heme iron – prevention of anemia iron deficiency and improvement in both school performance and in the learning process; 2) Vitamin A – prevention of xerophthalmia and infectious diseases; 3) Vitamin C – improves immunity and aids in the absorption of iron; and 4) Vitamin E – antioxidant function and prevention of hemolysis^{15,16,17,18}. Although many children are born healthy, some develop, throughout their lives, the so-called Chronic Non-Communicable Diseases due to an unbalanced diet, rich in sugars and sodium^{14,19}.

Considering the pandemic context, the low socioeconomic levels, and the high prevalence of food insecurity in Brazil, the development of studies that make it possible to associate the different food security situations with the consumption of FLV could enable a better identification of groups and risk factors and, consequently, a proposal for more assertive nutritional interventions consistent with the reality of the population. Thus, this study sought to verify whether there is a difference in the consumption of fruits and vegetables by children in situations of food security and insecurity; therefore, the objective was to describe the consumption of FLV in different situations of food security. Hypothesis: FLV consumption by preschoolers living in food insecure households is lower than that of those living in food secure households.

MATERIALS AND METHODS

This is a cross-sectional study, carried out in a public day care center in the city of Sao Paulo. Parents or guardians of children from zero to four years of age enrolled in the day care center were included in the study. The sample was characterized according to con-

venience.

The coordinators of the study site informed the parents or guardians of the children about the study being carried out at the school, via WhatsApp®, with a short video about the details of the study and an invitation to partici-

pate. If interested, potential participants could contact the research team to receive more information about the study, and those who so were interested signed the Informed Consent Form (ICF) to participate in the study.

Below the eligibility criteria to participate in the study are defined:

Inclusion criteria

Preschoolers (aged between zero and four years old) enrolled in the selected public school, with complete information on sex, age, Brazilian Food Insecurity Scale (BFIS), and Food Frequency Questionnaire (FFQ), as well as the Informed Consent Form (ICF) duly signed.

Exclusion criteria

Inability of parents or guardians to respond to questionnaires through telephone interviews.

Data collection and instruments

In March 2022, standardized interviews were carried out individually with the parents/guardians of the children. These interviews were conducted by trained researchers via Whatsapp® and completed by the interviewer on the Google Forms® digital platform. At first, a standard text message was sent to the parents/guardians with the identification of the interviewer and an invitation to schedule the audio call via Whatsapp® to carry out the interview. When the parent/responsible for the child did not respond to the message, three other attempts at contact were made, on different days, to schedule the interview.

During the interviews, a socioeconomic questionnaire²⁰, the short version of the Brazilian Food Insecurity Scale (BFIS)²¹, and the Food Frequency Questionnaire (FFQ) were applied.

The BFIS is made up of five questions that address potential monetary difficulties and

their impact on family nutrition. It aims to measure the perception of food insecurity and hunger at the family level^{8,21}. We opted for the short version of the BFIS, which contains five questions. When, in the sum of the scores, only one question is positive, the household is already classified as being in a situation of food insecurity²¹.

The applied FFQ was previously validated to classify FLV intake in South American children¹⁶. More information about the development of this FFQ²² and its reliability and validity²³ has been published. In this questionnaire, questions include topics such as how often and how much FLV are consumed by the child over the past three months. Foods are separated into four different groups such as fresh fruits, raw vegetables, cooked vegetables, and vegetable soup. These groups were defined in nine intake frequencies, as follows: (1) never/less than once a month; 2) 1-3 times a month; 3) 1 time a week; 4) 2-4 times a week; 5) 5-6 times a week; 6) Once a day; 7) 2-3 times a day; 8) 4-5 times a day; 9) 6 or more times a day²³. All quantitative answers were computed in grams/day; however, in the interview, they were answered in portions. After converting the consumption of FLV to grams/day, it was verified that these data did not present a normal distribution, so the median was used in the interpretation of the data. Children whose consumption of FLV was considered implausible (over 600 grams/day) had their consumption of FLV replaced by the consumption of another child of similar sex, age, and food security or insecurity situation. In total, ten children had to have their values imputed due to this factor.

In addition to interviews with parents/guardians, anthropometric measurements were collected from the children in March 2022. These anthropometric measurements were taken at school, by trained professionals, in a

private room, with the children barefoot and wearing light clothes. The collected variables were measured according to the standard reference anthropometric parameters of the World Health Organization (WHO) manual. Weight was measured on an Ultra Slim W801 digital scale, with a maximum capacity of 150 kg and accuracy of 0.1 kg (Blue Sky). Height was measured using a wall stadiometer, with a 111 mm scale (Sanny). For those children who could not attend on the day of anthropometry, weight and height reported by parents or guardians in the questionnaire were considered. All BMI were duly calculated, dividing weight by height squared (kg/m^2) and duly classified according to the WHO, using tables to assess children according to sex and age²⁴. To use the tables, children were divided into groups from zero to six months, from six months to one year, and so on, up to four years of age. The possible classifications were

eutrophic, accentuated thinness, thinness, risk of overweight, overweight, and obese²⁵.

Data analysis

The STATA 14 package (Stata Corp., College Station, TX, USA) was used for statistical analyses, and the Shapiro-Wilk test was used to investigate the distribution of FLV consumption in grams/day. Variable distributions were analyzed using absolute and relative frequency, mean, and confidence interval (95%).

Ethics

The protocol of this study was guided by the ethical norms for research involving human beings, contained in resolution 466/12 of the National Health Council, and was approved by the National Ethics and Research Commission (CONEP), under opinion number 5.863.246. The individuals were informed of the research objectives, as well as the methods adopted and the possible risks of their participation.

RESULTS

Of all the parents/guardians of the 94 children enrolled in the school during the invitation to participate in the study, 68 signed the ICF. However, 10 of them moved to another city or transferred their child/dependent to another school (something common in the age group attended by the Child Education Centers), and 9 did not respond to the interviewer to schedule the interview, even after 3 contact attempts. Therefore, 49 research participants remained, 44 of whom were eligible and who answered all questionnaires. According to table 1, the children were 2.6 years old on average, 56.8% female and 43.2% male. With regards to nutritional status, 67.5% of children were classified as eutrophic, 5% thin, 17.5% at risk of over-

weight, 7.5% overweight, and 2.5% obese. No child was classified as having accentuated thinness. Parents or guardians are mostly white (52.3%) and black/brown (47.7%). Regarding socioeconomic issues, 47.7% of children have parents or guardians who are civilly or religiously married, 38.6% are in a stable marital relationship, and 13.6% are single or separated. With respect to monthly net income, 50% earn between one and two minimum wages, 27.3% less than one minimum wage, and the rest of the participants earn more than 3 minimum wages. As for education, 18.2% of the children's parents did not start high school. Also in table 1, the data referring to the BFIS revealed that 70.5% (n=31) of the children are classified as

being in food insecure households (≥ 1 point out of 5 in the BFIS scale). Only 29.5% (n=13) of the children in the sample lived in food secure households.

In the FFQ, the median total consumption

of FLV was 155.6 grams/day. For children living in households with food security, a median of 213.4g/day was observed. Those in a situation of food insecurity, in turn, had a median of 105.4g/day of FLV (Table 2).

Table 1 – Socioeconomic characteristics of preschoolers enrolled in a public day care center and their parents/guardians in number (n), percentage (%) according to the household's food (in)security situation. Sao Paulo, 2022.

| Characteristics | Total (n = 44) | Food insecurity (n = 31) | Food security (n = 13) |
|---|----------------|--------------------------|------------------------|
| | n (%) | n (%) | n (%) |
| Age | | | |
| ≤ 24 months | 11 (25.00) | 6 (16.40) | 4 (30.80) |
| > 25 - 48 months | 33 (75.00) | 25 (80.60) | 9 (69.20) |
| Sex | | | |
| Female | 25 (56.82) | 18 (58.06) | 7 (53.85) |
| Male | 19 (43.18) | 13 (41.94) | 6 (46.15) |
| BMI (kg/m²)/Age (n = 40)! | | | |
| Underweight | 2 (5.00) | 1 (3.70) | 1 (7.69) |
| Eutrophic | 27 (67.50) | 18 (66.67) | 9 (69.23) |
| Risk of overweight | 7 (17.50) | 5 (18.52) | 2 (15.38) |
| Overweight | 3 (7.50) | 2 (7.41) | 1 (7.69) |
| Obesity | 1 (2.50) | 1 (3.70) | -- |
| Color or race of parent/guardian | | | |
| Black/Brown | 21 (47.72) | 17 (54.84) | 4 (30.77) |
| White | 23 (52.28) | 14 (45.16) | 9 (69.23) |
| Parent/guardian's marital status | | | |
| Married civilly or religiously | 21 (47.73) | 17 (54.84) | 4 (30.77) |
| Stable marital union | 17 (38.64) | 9 (29.03) | 8 (61.54) |
| Single or separated | 6 (13.64) | 5 (16.13) | 1 (7.69) |
| Number of Child/Dependent | | | |
| ≤2 | 34 (77.27) | 31 (75.60) | 13 (100) |
| >2 | 10 (22.73) | 10 (24.40) | - |
| Parent/guardian's education level | | | |
| Up to Elementary | 8 (18.18) | 7 (22.58) | 1 (7.69) |
| Incomplete high school | 3 (6.82) | 3 (9.68) | - |
| Complete high school | 15 (34.09) | 9 (29.03) | 6 (46.15) |

to be continued...

...continuation table 1

| Characteristics | Total (n = 44) | Food insecurity (n = 31) | Food security (n = 13) |
|-----------------------------|----------------|--------------------------|------------------------|
| | n (%) | n (%) | n (%) |
| Incomplete technical course | 1 (2.28) | 1 (3.23) | - |
| Complete technical course | 3 (6.81) | 3 (9.68) | - |
| Incomplete higher education | 5 (11.36) | 2 (6.45) | 3 (23.08) |
| Complete higher education | 8 (18.18) | 5 (16.13) | 3 (23.08) |
| Incomplete graduate course | 1 (2.28) | 1 (3.23) | - |
| Monthly net income | | | |
| <1 minimum wage | 12 (27.27) | 9 (30.00) | 3 (23.08) |
| 1≤ to ≤2 minimum wages | 22 (50.00) | 15 (50.00) | 7 (53.85) |
| 3≤ to ≤4 minimum wages | 7 (15.90) | 6 (20.00) | 1 (7.69) |
| 5≤ to ≤9 minimum wages | 2 (4.54) | - | 2 (15.38) |

BMI: Body Mass Index classified according to age by the growth curves of the World Health Organization (WHO)²⁶;
! 4 missing data

BFIS: Short version of the Brazilian Food Insecurity Scale.

Table 2 – Consumption of fruits, legumes, and vegetables by preschoolers according to the family's food (in) security situation. Sao Paulo, 2022.

| | Mean | Standard Deviation | P50 | P25 | P75 |
|-------------------------------------|--------|--------------------|--------|-------|--------|
| Total fruits and vegetables (g/day) | 188.03 | 151.07 | 155.55 | 69.63 | 304.15 |
| Food Security | 252.12 | 158.59 | 213.38 | 97.89 | 425.91 |
| Food Insecurity | 161.16 | 141.86 | 105.38 | 33.58 | 205.16 |

DISCUSSION

It was observed that those children from households in a situation of food security consumed more than twice as much FLV (213.38 g/day) compared to those in a situation of food insecurity (105.38 g/day). Despite this, attention is drawn to the fact that children in both situations analyzed had a consumption of FLV below the recommendation of 400g/day proposed by the WHO²⁷.

A study conducted in Rio de Janeiro identified that children under three years old who lived in a family in a situation of food insecurity had a poorly diversified diet, mainly being poor in FLV⁹. Another study, carried out at

a Primary Care Center in the state of Ceará, compared food consumption and the situation of food insecurity in preschoolers and observed that the more severe the level of food insecurity, the less rich in FLV the diet of these children was¹⁰. However, this fact is still not consistent in the literature, since other studies show that the consumption of FLV by children is not always linked to the situation of food security or insecurity at home, although there are more studies with adults^{28,29,30}.

With regards to food choices, it is urgent to reinforce nutritional education programs, with a focus on better health promotion through

food³¹. Income Transfer Programs (ITP) by public policies, when managed correctly, can also be great allies to reduce cases of food insecurity (especially when emphasizing the exercise of equity)³¹. However, the ITP must be accompanied by a good food and nutrition education program, otherwise, there may be a greater consumption of ultra-processed foods and, thus, nutritional deficiencies would remain³². Added to this, public policies aimed at food security are essential, especially considering poor food choices and limited access to healthy foods³³. Thus, the importance of sustainable food systems should be mentioned, which have a direct impact on the access that food insecure families have to healthy food, by encouraging food culture and traditions, as well as local agriculture³³.

In the absence of a sustainable food system, the world's population has been facing a series of issues, the main ones being: (1) reduction in the supply of healthy foods, one of the factors responsible for the worsening of the obesity pandemic; and (2) the excessive use of pesticides, especially in conventional agriculture, whose target is the production of commodities (such as soy, corn, and cotton), which reduce soil, water, and food quality (affecting human and animal health) and negatively impact the lives of insects and pollinating animals (which are essential for maintaining biodiversity). Moreover, due to the fact that the commodities in focus are few, there is a reduction in food diversity and an increase in the vulnerability of agricultural production in the face of extreme weather events. Furthermore, the third issue (3) is the great waste of food in the different stages of the food chain, equivalent to one third of world production, more than enough to supply the population in a situation of hunger^{33,34,35,36,37}. A hegemony in food systems in the production of low-quality foods (generally, hyperpalatable), and the disruption of public policies aimed at food secu-

urity make these three issues mentioned above more evident, giving rise to the so-called Global Syndemic³³. This concept, in short, concerns the mutuality of the three pandemics – malnutrition, obesity, and climate change³³.

It is important to emphasize that this study was carried out during the COVID-19 pandemic. During this period, it is known that the country returned to the Hunger Map of the World Health Organization, in which 4.1% of the Brazilian population faced a chronic lack of food and cases of food insecurity were accentuated, generating direct impacts on the diet of homes confined in quarantine^{6,7,38,39,40}. Considering that low family income is one of the main points to classify a situation of food insecurity, and that the pandemic brought countless new cases of unemployment (approximately 14.9 million citizens above 14 years of age), purchasing power, as well as access to healthy foods, was drastically reduced^{41,42,43,44,45}. This fact alone would be enough to justify the lower FLV consumption by these children in a more vulnerable situation. However, added to this, the prices of in natura or minimally processed foods in the state of Sao Paulo received a 12% increase until 2022, due to circulation restrictions, protectionist export and import policies, and, especially, the Global Syndemic, which has been aggravated in recent years and, due to the COVID-19 health crisis, has intensified the socioeconomic vulnerabilities of the population^{41,46}. Therefore, it is important to promote public policies that encourage social equity by boosting local trade in fresh and in natura foods, which are grown by small farmers in the region⁴⁷. Furthermore, it should be considered that social isolation measures also ended up contributing to children's food insecurity, since their main source of food was the meals offered in schools; however, due to the suspension of face-to-face classes, such meals were restricted.

It is noteworthy that an inadequate diet in

childhood (especially up to five years of age) can generate a series of long-term consequences, such as changes in metabolism and cognitive functioning, and damage to social skills and mental health^{4,12,13,48}. A study, carried out in Argentina, evaluated the eating habits of children aged between 2 and 5 years who are food insecure and demonstrated that food insecurity is closely linked to a low socioeconomic level and this, in turn, generates a series of consequences for children's diet and nutrition⁴⁹. These data corroborate the present study, since more than 70% of the studied population received less than two minimum wages and, consequently, is in a situation of food insecurity (70.45%). Bortolini, Vitolo, Gubert and Santos⁵⁰ evaluated the eating habits of children aged 6 to 36 months and the

factors associated with diet quality, based on data from the National Survey of Demography and Health (NSDH), and pointed out that diet diversity is not only linked to factors such as region of residence, socioeconomic class, and degree of food insecurity, but also to low maternal education. Another study reiterates this information, stating empirically that a low level of education of the head of the family is associated with cases of food insecurity at home³¹. In the present study, approximately 20% of the sample did not start high school, which may suggest this influence on the different cases of food insecurity among children and a choice of nutritionally poorer foods (for example, packaged snacks, crackers, artificial juices, etc.) at the time of purchases to the detriment of FLV.

CONCLUSION

The consumption of FLV by children from food secure households is higher than that of children from food insecure households. It is suggested that a low level of education of the head of the family and low socioeconomic levels, aggravated by the COVID-19 pandemic, are accentuators of the inadequate consumption of FLV.

Additional studies are still necessary to better understand whether the household's

food insecurity situation influences FLV consumption in preschoolers, especially studies with representative samples of this population in Brazil. Furthermore, studies are needed to assess the physical and financial accessibility that families have to quality fruits and vegetables, the knowledge of parents/guardians about the importance of consuming these foods, and the determinants of parental food choices.

ACKNOWLEDGMENTS: To all children, their parents or guardians, and the school for voluntarily agreeing to participate in this study. To Centro Universitário São Camilo for the opportunity and for the scholarship offered for this Scientific Initiation program, Notice nº 020-2022. To the master's students who actively participated in data collection and ensured reliable information for this study.

“This work was supported by a Researcher Links Climate Challenge Workshop Grant, ID 714964985, and funded by the British Council to implement activities in the run up to COP26 (the 26th United Nations Climate Change Conference of the Parties)”

Author Statement CREdiT

Conceptualization: Segui, EM; Collese, TS; Castro, AGP. Methodology: Collese, TS. Validation: Collese, TS; daSilva, JT. Statistical analysis: Segui, EM; da Silva JT. Formal analysis: Segui, EM; daSilva, JT; Collese, TS; Castro, AGP. Research: Collese, TS. Resources: Collese, TS. Writing-preparation of the original draft: Segui, EM; Collese, TS; Castro, AGP. Writing-revision and editing: Segui, EM; Collese, TS; Castro, AGP; daSilva, JT. Visualization: Collese, TS. Supervision: Collese, TS; Castro, AGP. Project administration: Collese, TS

All authors read and agreed with the published version of the manuscript.

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Received: 09 december 2022.

Accepted: 16 march 2023.

Published: 05 april 2023.