

## Food and nutritional insecurity and health risk behaviors in adolescents during the COVID-19 pandemic

*Insegurança alimentar e nutricional e os comportamentos de risco e proteção para saúde em adolescentes durante a pandemia de covid-19*

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**ABSTRACT** The COVID-19 pandemic has reduced access to food and increased food insecurity. The objectives were to analyse the prevalence of Food and Nutritional Insecurity (FNI) in Brazilian adolescents during the COVID-19 pandemic according to sociodemographic characteristics and to examine the association between FNI and risk and protective behaviours in Brazilian adolescents during the that period. Cross-sectional study with data from the ‘ConVid teenagers – Behaviour Survey,’ carried out between June and October 2020, using a self-administered questionnaire via mobile phone or computer. The population was made up of teenagers aged 12 to 17, totalling 9,470. The Prevalence Ratio (PR) and 95% Confidence Interval (95% CI) were used, using Poisson regression with robust variance. The prevalence of FNI (26.1%) was higher among adolescents of black and mixed race/colour and who study in public schools. Adolescents who reported FNI had lower consumption of vegetables and fruits, less physical activity, and greater use of cigarettes and alcohol. FNI was more prevalent in adolescents with worse socioeconomic conditions, and adolescents with FNI showed a higher frequency of health risk behaviours, highlighting the importance of intersectoral public policies to reduce inequalities.

**KEYWORDS** Food insecurity. Health risk behaviors. Adolescent. COVID-19.

**RESUMO** A pandemia de covid-19 reduziu o acesso aos alimentos e aumentou a insegurança alimentar. Objetivou-se analisar a prevalência de Insegurança Alimentar e Nutricional (IAN) em adolescentes brasileiros durante a pandemia de covid-19 segundo características sociodemográficas e examinar a associação entre IAN e comportamentos de risco e proteção em adolescentes brasileiros durante esse período. Estudo transversal com dados da ‘ConVid Adolescentes – Pesquisa de Comportamentos’, realizada entre junho e outubro de 2020, utilizando-se um questionário autoaplicado por meio de celular ou computador. A população foi adolescentes de 12 a 17 anos, totalizando 9.470. Utilizou-se a Razão de Prevalência (RP) e Intervalo de Confiança de 95% (IC95%), por meio da regressão de Poisson com variância robusta. A prevalência de IAN (26,1%) foi mais elevada entre os adolescentes da raça/cor preta e parda e que estudam em escola pública. Os adolescentes que relataram IAN tiveram menor consumo de hortaliças e frutas, menor prática de atividade física e maior uso de cigarros e álcool. A IAN foi mais prevalente em adolescentes com piores condições socioeconômicas, e, adolescentes com IAN apresentaram maior frequência de comportamentos de risco para a saúde evidenciando a importância de políticas públicas intersetoriais para a redução de desigualdades.

**PALAVRAS-CHAVE** Insegurança alimentar. Comportamentos de risco à saúde. Adolescente. Covid-19.

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## Introduction

Food and Nutrition Insecurity (FNI), understood as the lack of regular and permanent access to sufficient quality food and without compromising access to other essential necessities<sup>1</sup>, is a critical public health problem and is mainly linked to worsening socioeconomic conditions<sup>2,3</sup>. Data from the POF, Brazil's Consumer Expenditure Survey, indicated that the percentage of households with FNI was 36.7 per cent in 2018<sup>4</sup>, while in 2020 it increased to 55.2 per cent (116.8 million Brazilians). Of these, 43.4 million did not have enough food, and 9 per cent (19 million) had a severe FNI<sup>5</sup>.

The COVID-19 pandemic has represented a global health challenge that has led to changes in health indicators, worsening healthcare standards for adults and young people<sup>6,7</sup>, and increased social and economic vulnerability. This also contributed to higher food prices, and lower wages and higher unemployment rates; consequently, it reduced access to food and intensified hunger and FNI<sup>8,9</sup>.

Studies indicate that FNI is associated with health risk factors throughout life, such as being overweight, unhealthy diet, smoking, alcohol consumption and physical inactivity<sup>10-13</sup>.

However, there have been few studies in Brazil on FNI and risk behaviours in adolescents during the pandemic. Furthermore, it is worth noting that most research efforts and FNI programmes are aimed at adults and children, while FNI adolescents are a neglected group of the population. But adolescence is a phase of life defined by physical, social and psychological development, in which autonomous choices about engaging in healthcare behaviours are formed and often continue into adulthood<sup>14</sup>. Therefore, understanding the context of vulnerability and health risk behaviours in adolescents is useful for guiding prevention and promotion approaches that will have an impact on outcomes in the present and in adulthood.

In this regard, this study aimed to 1) analyse the prevalence of FNI in Brazilian adolescents during the COVID-19 pandemic according to sociodemographic characteristics; 2) examine the association between FNI and risk and protective behaviours in Brazilian adolescents during the COVID-19 pandemic.

## Material and methods

### Study design

Cross-sectional study with data from the Brazilian Health Survey 'ConVid Adolescentes – Pesquisa de Comportamentos'.

### Contents

The ConVid Adolescentes – Behaviour Survey aimed to analyse the changes in the lives of Brazilian adolescents during the period of social distancing due to the COVID-19 pandemic in the country.

Data were collected from 27 June to 12 October 2020, by a self-completion questionnaire using a mobile phone or computer with internet access

The 'virtual snowball' sampling method was used<sup>15</sup>. The 'virtual snowball' sampling method was used, starting by sending invitations to the survey to the parents of adolescents, who, after accepting their children's participation, invited other parents via social media, thereby forming the recruitment chain. To start the chain, the study's researchers chose other investigators from different Brazilian states with prior experience in studies with adolescents. In addition, public and private schools were invited to take part via an institutional email from the Oswaldo Cruz Foundation (Fiocruz). The schools that agreed to take part in the research sent the electronic questionnaires to their students.

Because the network sampling is not probabilistic, weights were calculated using post-stratification procedures to obtain the same distribution of adolescents by area of residence, gender, age groups (12–15 years; 16–17 years) and type of school (public/private), by using data from the 2015 National Survey of School Health (PeNSE) by the Brazilian Institute of Geography and Statistics (IBGE).

More information on the survey methodology can be found on the official ConVid Adolescentes – Pesquisa de Comportamentos website (<https://convid.fiocruz.br/>).

## Participants

The target population for this study was teenagers aged 12 to 17 living in Brazil during the COVID-19 pandemic. A total of 9,470 adolescents took part in the research.

## Variables

FNI was assessed using the question: “*Have you ever worried that the food would run out before your parents could afford to buy more?*” The answer options were yes; no; don’t know/don’t want to answer, with don’t know/don’t want to answer clustered under ‘no’. FNI was considered when the teenager answered ‘yes’.

The following variables were considered risk or protective behaviours during the pandemic:

1. Regular consumption of vegetables: consumption of vegetables five or more days a week.
2. Regular consumption of fruit: consumption of fruit on five or more days of the week.
3. Regular consumption of beans: consumption of beans on five or more days of the week.
4. Regular consumption of cold meats: consumption of cold meats (ham, salami, mortadella, sausage, or hamburger) on five or more days of the week.
5. Regular consumption of frozen foods: consumption of frozen foods (frozen pizza or frozen lasagne or other frozen dishes) on five or more days of the week.
6. Regular consumption of snack ‘packs’: consumption of snack ‘packs’ on five or more days of the week.
7. Regular consumption of confectionery: consumption of confectionery (chocolates, sweet biscuits, pieces of pie) on five or more days of the week.
8. Regular consumption of Chocolate Cocoa Powder: consumption of Chocolate Cocoa Powder on five or more days of the week.
9. Regular consumption of soft drinks: consumption of soft drinks on five or more days of the week.
10. Sufficient leisure-time physical activity: physical exercise for at least one hour on five or more days a week, i.e., 300 minutes a week. E.g.: playing sports, football, cycling, walking, running, physical education classes, walking or cycling to school.
11. Sedentary behaviour: spending three or more hours a day sitting down watching television, playing video games, using a computer, mobile phone, tablet or doing other activities while sitting down.
12. Cigarette consumption: cigarette smoking, regardless of quantity.
13. Consumption of alcoholic beverages: consumption of alcoholic beverages, regardless of quantity.

The sociodemographic variables were analysed:

1. Sex: female; male.
2. Age groups: 12 to 15 years; 16 to 17 years.
3. Race/skin colour: white; black; brown; other; Type of school: public; private.
4. Type of school: public; private.

### Data analyses

The data was described according to relative frequency and 95% Confidence Interval (95%CI). Firstly, the prevalence of FNI was estimated according to the sociodemographic variables and the association was analysed using the Prevalence Ratio (PR) and 95% CI, obtained using Poisson regression with robust variance. Subsequently, the prevalence of risk behaviours was estimated among teenagers with or without FNI, and the association was verified using the crude PR (95%CI) and adjusted for sex, age group, type of school and race/colour. The analyses were carried out using the 'svy' procedure (considering post-stratification weights) suitable for analysing data obtained using a complex sampling plan

in the Stata 15.1 software. The significance level adopted was 5%.

### Ethical considerations

Before the adolescent could answer the questionnaire, a parent or responsible adult had to accept the Informed Consent Form (ICF) and then the teenager also had to accept the ICF. All responses were anonymous, and the participants were not identified in any way.

ConVid Adolescentes – Pesquisa de Comportamentos was approved by the Brazilian Ministry of Health's National Commission of Ethics in Research (Opinion number 4,100,515 - CAAE 30598320.1.0000.5241).

### Results

A total of 9,470 adolescents were assessed. Of these, 50.2% were female, 67.7% were between 12 and 15 years old, 46.6% were brown, 85.9% studied in public schools and 26.1% reported FNI (*table 1*).

The prevalence of FNI was higher among black (38.3%; PR: 1.94; 95%CI: 1.63 - 2.30) and brown (29.3%; PR: 1.49; 95%CI: 1.30 - 1.69) adolescents studying in public schools (28.7%; PR: 2.73; 95%CI: 2.29 - 3.25). There was no difference according to sex or age group (*table 1*)

Table 1. Food insecurity according to sociodemographic characteristics. ConVid Adolescentes – Pesquisa de Comportamentos, 2020

Variables	Total	Food insecurity	
		Yes % (95% CI)	PR (95% CI)
<b>Total</b>		<b>26,1 (24,6 - 27,6)</b>	
<b>Sex</b>			
Boys	49,7 (48,1 - 51,4)	25,5 (23,1 - 28,1)	-
Girls	50,3 (48,6 - 51,9)	26,6 (25,0 - 28,4)	1,04 (0,93 - 1,17)
<b>Age group</b>			
12-15 years	67,7 (66,3 - 69,0)	26,0 (24,0 - 28,0)	-
16-17 years	32,3 (30,9 - 33,7)	26,3 (24,3 - 28,3)	1,01 (0,90 - 1,12)

Table 1. Food insecurity according to sociodemographic characteristics. ConVid Adolescentes - Pesquisa de Comportamentos, 2020

Variables	Total	Food insecurity	
		Yes % (95% CI)	PR (95% CI)
<b>Race/skin colour</b>			
White	40,1 (38,5 - 41,7)	19,7 (17,8 - 21,8)	-
Black	9,7 (8,8 - 10,7)	38,3 (33,1 - 43,7)	1,94 (1,63 - 2,30)
Brown	46,6 (44,9 - 48,3)	29,3 (27,0 - 31,8)	1,49 (1,30 - 1,69)
Others	3,6 (3,0 - 4,4)	20,7 (14,8 - 28,2)	1,05 (0,74 - 1,47)
<b>Type of school</b>			
Private	14,1 (13,3 - 14,9)	10,5 (8,8 - 12,3)	-
Public	85,9 (85,1 - 86,7)	28,7 (27,0 - 30,4)	2,73 (2,29 - 3,25)

Source: Elaborated by the authors.

Table 2 presents the association between FNI and health risk behaviours in Brazilian adolescents. Among adolescents who reported FNI, there was lower regular intake of vegetables (PRadj: 0.83; 95%CI: 0.73 - 0.94) and fruit (PRadj: 0.85; 95%CI: 0.75 - 0.96), lower

leisure-time physical activity (PRadj: 0.79; 95%CI: 0.65 - 0.95) and greater use of cigarettes (PRadj: 2.12; 95%CI: 1.49 - 3.02) and consumption of alcoholic drinks (PRadj: 1.19; 95%CI: 1.01 - 1.40).

Table 2. Risk and Protective behaviours associated with food and nutritional insecurity. ConVid Adolescentes - Pesquisa de Comportamentos, 2020

	Food insecurity			
	Yes % (95% CI)	No % (95% CI)	RPb (95% CI)	RPaj (95% CI)
Vegetable consumption	26,1 (23,3 - 29,1)	32,1 (30,4 - 33,8)	0,81 (0,72 - 0,92)	0,83 (0,73 - 0,94)
Fruit consumption	27,8 (24,9 - 30,9)	32,9 (31,2 - 34,7)	0,85 (0,75 - 0,95)	0,85 (0,75 - 0,96)
Bean consumption	61,1 (57,9 - 64,1)	56,2 (54,3 - 58,1)	1,09 (1,02 - 1,16)	1,05 (0,99 - 1,12)
Consumption of cold meats:	17,3 (14,6 - 20,3)	14,6 (13,3 - 16,1)	1,18 (0,97 - 1,43)	1,18 (0,97 - 1,44)
Frozen food consumption	4,1 (2,9 - 5,7)	4,6 (3,8 - 5,6)	0,88 (0,61 - 1,28)	0,84 (0,57 - 1,24)
Snack Packs consumption	7,1 (5,4 - 9,4)	6,4 (5,4 - 7,5)	1,12 (0,81 - 1,56)	1,08 (0,77 - 1,51)
Consumption of confectionery:	18,4 (15,7 - 21,4)	16,8 (15,5 - 18,3)	1,10 (0,92 - 1,30)	1,15 (0,96 - 1,38)
Chocolate Cocoa Powder consumption	15,7 (13,3 - 18,4)	17,8 (16,5 - 19,2)	0,88 (0,74 - 1,05)	0,96 (0,80 - 1,15)
Consumption of soft drinks	11,4 (9,3 - 13,7)	11,5 (10,4 - 12,8)	0,99 (0,79 - 1,23)	0,97 (0,77 - 1,22)
Leisure-time physical activity	13,0 (10,9 - 15,4)	16,7 (16,4 - 18,2)	0,78 (0,64 - 0,94)	0,79 (0,65 - 0,95)
Sedentary behaviour	69,3 (66,1 - 72,3)	70,4 (68,5 - 72,1)	0,98 (0,93 - 1,03)	1,02 (0,97 - 1,08)
Cigarette Smoking	4,13 (3,1 - 5,4)	1,8 (1,4 - 2,3)	2,28 (1,60 - 3,25)	2,12 (1,49 - 3,02)
Consumption of alcoholic beverages	14,8 (12,9 - 17,0)	12,1 (11,1 - 13,2)	1,23 (1,04 - 1,45)	1,19 (1,01 - 1,40)

Source: Elaborated by the authors.

Note: PR adjusted for sex, age, type of school and race/skin colour.

## Discussion

Among the adolescents assessed in this study, 26.1% reported FNI, which was higher among those of Black and brown skin colour, public school students and residents of the Southeast region. FNI was associated with lower fruit and vegetable consumption, insufficient leisure-time physical activity, smoking, and alcohol consumption.

The prevalence of FNI was high among adolescents, meaning that a significant proportion of Brazilian adolescents do not have their right to adequate food guaranteed. Brazil's removal from the United Nations (UN) Hunger Map in 2014 was a world-renowned milestone towards promoting the human right to an adequate and healthy diet<sup>16</sup>. However, the austerity measures and the dismantling of anti-hunger policies meant that Brazil was back on the hunger map in 2018<sup>17</sup>. Furthermore, the situation may have been exacerbated by the COVID-19 pandemic in 2020<sup>18</sup>. A Global Report on Food Crises estimated that the number of people living in FNI situations could double in 2020 compared to 2019, due to the economic crisis caused by the COVID-19 pandemic<sup>18,19</sup>.

FNI was higher among adolescents of Black and brown race/ skin colour and among public school students. By considering Black and brown race/ skin colour and public schools as a proxy for worse socioeconomic status and greater vulnerability, this reveals unequal access to food. The literature shows worse health and working conditions, lower wages, lower income, greater likelihood of poverty and less access to health services due to race or skin colour, especially among individuals of Black and brown race/colour<sup>20-23</sup>. Considering the pandemic context, Brazilian data showed that households headed by Black and brown people were most affected by food shortages, hunger, and moderate or severe food insecurity<sup>24</sup>.

Regarding the higher prevalence of FNI in adolescents from public schools, this is also associated with socioeconomic conditions. The

Brazilian National School Feeding Programme ensures an adequate and healthy diet, as well as guaranteeing food and nutritional security, along with health education actions for public school students<sup>25</sup>. However, educational activities were interrupted during the pandemic because of the country's health emergency. In this context, as the school meals are often the only complete meal that students have access to during the day, social isolation has limited access to food and consequently increased food insecurity and hunger<sup>26</sup>. Therefore, adolescents stayed at home and were exposed to the greatest risk of food insecurity.

The results of this study show that health risk behaviours during the pandemic were more prevalent in adolescents who reported FNI. The significant associations between adolescents reporting FNI and lower consumption of fruit and vegetables can be explained by the financial inability to buy them because food is expensive<sup>27</sup>. Fruit and vegetables are protective factors against Chronic Non-Communicable Diseases ('NCDs') because they contain fundamental nutrients for health, such as vitamins, minerals, and fibre. However, their consumption is influenced by economic factors, such as family income and food prices<sup>27</sup>. In the pre-pandemic period, there was already a reduction in the consumption of these foods in Brazil as a result of the economic crisis and the implementation of austerity policies<sup>28</sup>, in the pre-pandemic period, Brazil was already seeing a reduction in the consumption of these foods as a result of the economic crisis and the implementation of austerity policies, and during the pandemic the situation worsened with a reduction in the consumption of healthy food among adults and adolescents<sup>6,7</sup>.

A study of the adult population of the United States of America during the pandemic also revealed that food insecure individuals consumed fruit and vegetables fewer times a day and were more likely to perceive cost as a hurdle to fruit and vegetable consumption<sup>29</sup>. The results highlight the need to guarantee

adequate food assistance and the establishment of a set of macroeconomic policies to overcome the FNI, fostering better financial income conditions, decreasing food prices and poverty.

The association between FNI and physical inactivity in adolescents was found in the present and other studies<sup>13,30</sup>, but this connection is not yet well documented in the literature, which would require further research to explain the underlying physiological and psychological mechanisms that may be involved in this association. One possible explanation for this finding is that, due to the high-energy density that physical activity requires and the lack of food and nutrients, individuals with FNI don't feel well enough to do physical activity<sup>30,31</sup>. Studies also indicate that physical activity among adolescents is associated with higher parental education, higher income and better socioeconomic conditions<sup>32</sup>. Considering the pandemic scenario, it is important to emphasize that most adolescents remained in social isolation, without performing physical activities or interacting with friends<sup>7</sup>.

The results also showed an increase in smoking and alcohol consumption among adolescents who reported FNI. Smoking and alcohol consumption are risk factors for health, including NCDs<sup>33</sup>. An economic or health crisis can predispose to an increase in these habits due to the influence of tobacco and alcohol on the individual's mood, causing a feeling of relief from stress, anguish, and sadness<sup>34,35</sup>. As a social determinant of health, FNI has a complex relationship with other social and economic factors at the individual and collective levels that influence health behaviour, including substance use<sup>36</sup>. In addition, studies show that individuals with FNI prioritize the purchase of non-nutritious foods, such as alcohol and tobacco, which can be explained by a lack of resources to plan, prioritize and live their lives<sup>37,38</sup>. The results also reinforce the importance of health promotion actions aimed at adopting or maintaining healthy

behaviours, as well as strategies for preventing the use of tobacco and alcohol and encouraging people to stop smoking and drinking alcohol.

It is important to highlight some limitations of this study. Firstly, the use of a virtual questionnaire may not reach all population strata, since not everyone has access to the internet, leading to underestimation or overestimation of the proportion of indicators; however, this limitation was minimized due to the use of post-stratification weightings. Secondly, the survey only looked at the frequency of food consumption in the adolescents' diet, not the quantity. Thirdly, the FNI was assessed by only one question, and this was not specifically for the period of the pandemic, emphasizing the importance and necessity of new studies using validated scales.

ConVid Adolescentes – Pesquisa de Comportamentos (ConVid Adolescents – Behaviour Survey) was one of the first nationwide surveys to assess topics such as diet, physical activity, tobacco and alcohol consumption, mental health and social distancing during the pandemic, making it possible to analyse the determinants of FNI in this age group at such a unique time in Brazil and worldwide.

## Conclusions

FNI was present in 26.1 percent of Brazilian adolescents and was more prevalent in adolescents from lower socioeconomic backgrounds. Adolescents with FNI had a higher frequency of health risk behaviours, such as lower consumption of fruit and vegetables, insufficient leisure-time physical activity, smoking, and alcohol consumption.

These results indicate the importance of adequate care, with the integration of intersectoral public policies to reduce socioeconomic inequalities that have become even worse with the COVID-19 pandemic and the strengthening of health protection and promotion measures.

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## Collaborators

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