

## Interpersonal violence and dietary markers among adults: evidence from the Brazilian National Health Survey 2019

Violência interpessoal e marcadores alimentares entre adultos: evidências da Pesquisa Nacional de Saúde 2019

Violencia interpersonal y marcadores dietéticos en adultos: evidencia de la Encuesta Nacional de Salud de 2019

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**Abstract** This study aimed to assess the relationship between psychological and physical interpersonal violence (IV) and healthy and unhealthy dietary markers of food consumption among Brazilian adults. The study utilized data from the 2019 Brazilian National Health Survey, which included a representative sample of 88,531 residents 18 years or older. The exposures encompassed psychological and physical IV within the 12 months preceding the interview. The outcomes focused on regular consumption ( $\geq 5$  times/week) of healthy dietary markers and unhealthy dietary markers. Multinomial logistic regression models were employed to analyze the interest relationship, considering the complex sample design. The findings revealed that male victims of psychological and physical IV had lower consumption of healthy dietary markers. Additionally, both men and women victims of psychological violence had a higher consumption of unhealthy foods. Women who reported physical violence and men who had physical violence inflicted by others were also more likely to report regular consumption of unhealthy foods. The results underscore the potential role of IV victimization as a risk factor for inadequate consumption. Further research is needed to ascertain whether similar associations occur in other populations and contexts.

**Key words** Exposure to violence, Intimate partner violence, Food consumption, Survey

**Resumo** Objetivou-se avaliar a relação entre a violência interpessoal (VI) e os marcadores de alimentação saudável e não saudável entre adultos brasileiros. O estudo utilizou dados da Pesquisa Nacional de Saúde do Brasil de 2019, que incluiu uma amostra de 88.531 residentes com 18 anos ou mais. As exposições foram a VI psicológica e física nos 12 meses anteriores à entrevista. O desfecho consistiu no consumo regular ( $\geq 5$  vezes/semana) de marcadores de alimentação saudável e não saudável. A análise utilizou modelos de regressão logística multinomial, levando em consideração o processo de amostragem. Os resultados mostraram que os homens vítimas de VI psicológica e física apresentaram menor consumo de marcadores alimentares saudáveis. Além disso, tanto os homens quanto as mulheres vítimas de violência psicológica apresentaram maior consumo de alimentos não saudáveis. As mulheres que relataram violência física e os homens que sofreram violência física infligida por outros também tinham maior probabilidade de relatar o consumo regular de alimentos não saudáveis. Os resultados ressaltam o impacto da vitimização da VI como fator de risco para um consumo alimentar inadequado. São necessárias mais pesquisas para verificar se associações semelhantes ocorrem em outras populações e contextos.

**Palavras-chave** Violência, Violência entre parceiros íntimos, Consumo alimentar, Inquérito

**Resumen** Este estudio tuvo como objetivo evaluar la relación entre la violencia interpersonal (VI) y los marcadores de alimentación saludable y no saludable en adultos brasileños. El estudio utilizó datos de la Encuesta Nacional de Salud de Brasil de 2019, que incluyó una muestra de 88.531 residentes mayores de 18 años. Las exposiciones fueron VI psicológica y física en los 12 meses previos a la entrevista. El resultado consistió en el consumo regular ( $\geq 5$  veces por semana) de marcadores de alimentación saludable y no saludable. El análisis utilizó modelos de regresión logística multinomial, considerando el proceso de muestreo. Los resultados mostraron que los hombres víctimas de VI psicológica y física tenían un menor consumo de marcadores de alimentación saludable. Además, tanto hombres como mujeres víctimas de violencia psicológica tenían un mayor consumo de alimentos no saludables. Las mujeres que reportaron violencia física y los hombres que sufrieron violencia física infligida por otros también fueron más propensos a reportar el consumo regular de alimentos no saludables. Los resultados destacan el impacto de la victimización por VI como factor de riesgo para una ingesta dietética inadecuada. Se necesita más investigación para determinar si se producen asociaciones similares en otras poblaciones y contextos.

**Palabras clave** Violencia, Violencia de pareja, Consumo de alimentos, Encuesta

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## Introduction

Interpersonal violence is a serious public health issue and is associated with several health problems and behaviors<sup>1</sup>. According to the World Health Organization (WHO), community and intimate partner violence (IPV) are the two types of interpersonal violence that most affect both men and women worldwide<sup>2</sup>. Regarding IPV, although men and women experience victimization at similar rates, women are more likely to experience severe abuse, resulting in physical injuries and an increased need for medical care<sup>1</sup>. In addition to the physical harm and psychological distress inflicted, the health consequences of violence can also be related to how victims cope with the abuse<sup>3</sup>.

Victims of interpersonal violence are at a higher risk of engaging in detrimental health behaviors, including substance abuse, tobacco and alcohol misuse<sup>4-6</sup>. Moreover, eating can serve as another way of responding to stress, fear, and negative thoughts. A review focusing on the neurobiology of stress exposure and eating patterns has shed light on the pathways that mediate the relationship between stress, the physiological and behavioral responses of the brain, and food consumption<sup>7</sup>. Both acute and chronic stress can trigger the activation of the neuroendocrine hypothalamic-pituitary-adrenal (HPA) axis, leading to alterations in food intake and energy balance, often manifesting as a preference for highly palatable foods. These foods characterized by their appealing taste and high caloric density, often contain a high amount of sugar and fat<sup>7,8</sup>, and are commonly found in processed and ultra-processed foods products.

Ultra-processed foods have gained popularity due to their convenience and accessibility, as they provide a quick and effortless alternative to preparing meals, both in-home and on-the-go consumption<sup>9</sup>. The substantial increase in industrialization during the past century has resulted in a market shift toward the production and distribution of ultra-processed foods to the detriment of *in natura* and traditional home-made foods in many industrialized countries<sup>10</sup>. The higher consumption of ultra-processed foods has been associated with a range of adverse health consequences, including obesity, type 2 diabetes, heart disease, certain types of cancer, and higher mortality<sup>11-13</sup>. In contrast, minimally processed or *in natura* foods, such as fresh fruits and vegetables, whole grains, and lean proteins, tend to be more nutrient-dense

and promote overall health and well-being, lowering the risk for major chronic disease<sup>14,15</sup>.

The increased participation of ultra-processed foods in the Brazilian diet has been well-documented through national household surveys<sup>16,17</sup>. In response to this concerning trend, the Ministry of Health has devised a set of guidelines based on healthy and unhealthy dietary markers to guide the Brazilian population. These guidelines encompass the consumption of fruits, vegetables, whole grains, legumes, and nuts as indicators of healthy dietary markers, while the intake of sugary beverages, processed meats, and foods high in fat, sugar, and sodium serve as unhealthy dietary markers. The application of these dietary indicators has the potential to facilitate the monitoring of the prevalence of food consumption, thereby unveiling socio-demographic disparities, including those associated with gender<sup>18</sup>. This serves as a reminder of the distinct roles and responsibilities that gender plays in matters of food preparation and related concerns.

The escalating prevalence of unhealthy food consumption has sparked discussions surrounding the risk and protective factors contributing to this shift in dietary patterns. However, the insufficiency of historical theoretical models in explaining those contemporary changes has driven the inclusion of psychosocial risk factors, such as interpersonal violence, in the debate. Regrettably, the available literature examining the association between interpersonal violence and food consumption among adults is limited and relatively recent. Furthermore, there is a dearth of representative data on both interpersonal violence and food consumption, posing a significant challenge. In recent years, two studies have emerged, highlighting a possible link between exposure to interpersonal violence and the adoption of unhealthy dietary patterns during pregnancy<sup>19</sup> and unhealthy food consumption during adolescence<sup>20</sup>. These findings underscore the importance of broadening our comprehension of the relationship between interpersonal violence and food consumption in the adult population, while also exploring potential sex differences.

To augment the limited literature on this topic, the present study sought to investigate the relationship between psychological and physical interpersonal violence and dietary markers of healthy and unhealthy food consumption, using a nationally representative sample of the adult population in Brazil. Our hypothesis was that the occurrence of psychological and physical

interpersonal violence would be associated with lower regular consumption of healthy foods and higher consumption of unhealthy food markers, among both men and women adults.

## Methods

### Study design and participants

This study was carried out using data from the latest edition of the Brazilian National Health Survey (NHS), conducted in 2019. The Brazilian NHS is a population-based cross-sectional study, part of the Integrated System of Household Surveys, specifically conducted to obtain data on health conditions and lifestyle and their determinants<sup>21</sup>. The study is representative of the Brazilian population living in private households in all five geographical regions including federative Units, state capitals, and metropolitan areas. The 2019 data collection was carried out from August 2019 to March 2020. The dataset is publicly available from the Government's website – <https://www.ibge.gov.br/estatisticas/downloads-estatisticas.html>.

The sampling plan utilizes a three-stage cluster process employing conglomerates: (i) census tracts, where primary sampling units are selected, with a probability proportional to their size, as defined by the number of permanent private households; (ii) households, by simple random sampling; and (iii) residents, a random selection of a resident of the selected household aged 15 or over<sup>22</sup>.

Data were collected through a structured questionnaire by trained interviewers using mobile data devices, with home-based interviews scheduled according to the most convenient time for the residents. In total, 90,846 individuals were interviewed in 2019. Of these, 88,531 residents 18 years or older were interviewed about violence and included in this study. Further methodological details of the Brazilian NHS can be found elsewhere<sup>21,22</sup>.

### Theoretical and operational model, variables, and questionnaires

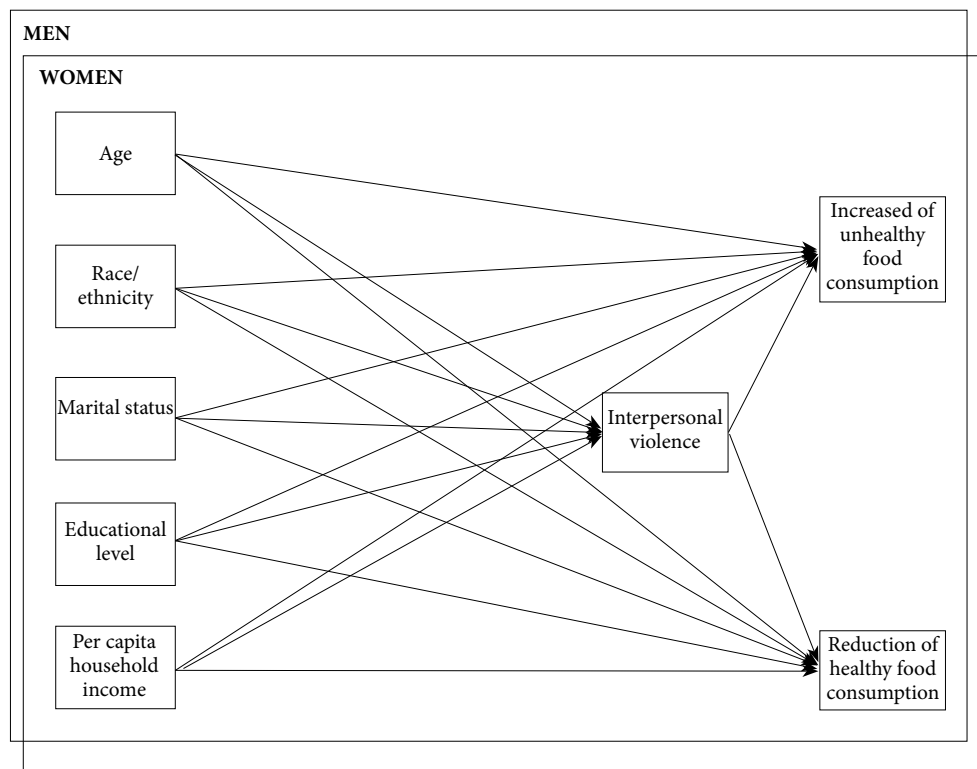
The theoretical and operational model was developed based on literature about interpersonal violence and food consumption (Figure 1). The model moves from the left to the right, respecting the temporal sequence of events. The model encompassed the determinants of exposures and outcomes (age, race/ethnicity, marital

status, educational level, and per capita household income), the exposures of interest (psychological and physical interpersonal violence), and outcomes (healthy and unhealthy dietary markers of food consumption).

Interpersonal violence was measured using the module V of the Brazilian NHS. In the 2019 edition, this module included five questions about the occurrence of acts of psychological and five questions about physical interpersonal violence in the 12 months previous to the interview. The questions used for measuring psychological interpersonal violence were: '*In the last 12 months, had anyone...*': (i) offend, humiliate, or ridicule you in front of other people? (ii) yelled at you or cursed at you? (iii) use social media or cell phone to threaten, offend, curse, or expose your images without your consent? (iv) verbally threatened to hurt you or someone important to you? (v) destroy something of yours on purpose? The physical interpersonal violence was reported from the following questions: '*In the last 12 months, has anyone...*': (i) hit or slap you?; (ii) push you, hold you tightly, or throw something at you with the intention of hurting you?; (iii) punch, kick, or drag you through your hair; (iv) try or actually strangle, choke, or burn you in purpose; (v) threaten or wound you with a knife, fire gun, or some other weapon or object? In line with the literature, a positive answer to one or more items from each pool of questions indicated the presence of psychological and/or physical interpersonal violence.

The questionnaire also includes inquiries regarding the primary perpetrator of violent acts. In cases where the respondent has experienced multiple instances of violence or a recurring incident within the past twelve months, they were asked to focus on the most severe situation. For all analysis, respondents were classified as not victims of interpersonal violence; victims of intimate partner violence (i.e., spouse or partner; ex-spouse or ex-partner; boyfriend/girlfriend), and victims of interpersonal violence perpetrated by others (i.e., acquaintances or strangers).

Healthy and unhealthy food consumption was assessed through self-response questions of six food items, through the question '*How many days of the week do you usually eat/drink ...?*' which should be filled out with a number from zero to seven day/week. In the analysis, we considered regular food intake the consumption, of at least, five times or more per week for each food item<sup>23</sup>. Beans; vegetables; and fruits were considered healthy food markers, while artificial fruit juices (canned, packaged, or powdered



**Figure 1.** Theoretical model.

Source: Authors.

juices); soft drinks; and sweets and/or confectionery foods (biscuits or sandwich cookies, chocolate, jelly, candies, and others) were identified as ultra-processed and labeled as unhealthy food markers<sup>24</sup>. For the main analysis, the consumption of three indicators of healthy food was grouped and classified based on the number of items that were regularly consumed (none, one, two or three items). The same categorization was applied to the three indicators of unhealthy food.

The demographic and socioeconomic variables were collected with a multithematic questionnaire. Data on sex was collected exclusively with males and females' categories. The age was collected in years and categorized into four groups (< 20, 20-39, 40-59, and ≥ 60 years). The race/ethnicity was collected by self-reported skin color and classified according to the Brazilian Institute of Geography and Statistics (IBGE) as white, black, and brown/mixed. The marital status was classified into four groups: married,

single, widow, and separated. The educational level was classified as none, incomplete middle school, complete middle school, complete high school, and complete higher education. The information about the per capita household income was collected in a continuous way and categorized according to IBGE in under ¼ minimum wage, ¼ to ½ minimum wage, ½ to 1 minimum wage, 1-2 minimum wage, 2-5 minimum wage, ≥ 5 minimum wage for descriptive analysis. The minimum wage in Brazil in 2019 was R\$998, approximately US\$253 – considering the average exchange rate in 2019: R\$1/US\$3.945.

### Data analysis

The descriptive analysis consisted of univariate descriptions of the study population (total and according to sex) through their relative frequencies and their respective 95% confidence intervals. Multinomial logistic regression mod-

els were used to analyze the relationship between psychological and physical interpersonal violence with the number of regular consumption of healthy and unhealthy dietary markers (0, 1, 2-3 items). Adjusted odds ratios (OR) were estimated. According to the theoretical causal model presented in Figure 1, all multiple regression analyses were adjusted for age, race/ethnicity, educational level, marital status, and per capita household income and stratified by sex. We further assessed the relationship between interpersonal violence and regular consumption of dietary markers, analyzing this relationship separately by each food item (healthy dietary markers: beans, fruits, and vegetables; unhealthy dietary markers: artificial fruit juices, soft drinks, and sweets). To do so, we used adjusted logistic regression models. We included the same set of confounders used in the multinomial logistic regression. The multinomial model was used because the literature highlights the importance of avoiding the consumption of ultra-processed foods, given the well-documented adverse health effects associated with their intake<sup>11-13</sup>. However, it is important to note that the literature does not establish a clear dose-response relationship between exposure to interpersonal violence and the consumption of ultra-processed foods<sup>19,20</sup>. All the analyses were performed using Stata Statistical Software 15.0, considering the complex sample design.

### Ethics

The Brazilian NHS was approved by the National Commission for Research Ethics (CONEP; nº 3.529.376) following the principles outlined in the Declaration of Helsinki. All participants provided informed consent through a self-administered questionnaire after the survey was explained to them. The interviewer was oriented to assure privacy during the application and the questions could be read and filled out by the interviewee. The Brazilian NHS database is publicly available on the website IBGE, with no identifying information about the participants<sup>25</sup>.

### Results

The socioeconomic and demographic characteristics of the sample are described in Table 1. The sex distribution of the study population exhibited a relatively balanced composition (53.2% female). Approximately 75% of individuals were aged between 20 and 59 years. More than half

of them reported their race/ethnicity as brown/mixed or black, while almost 50% were married by the time of the interview. Regarding educational level and *per capita* household income, more than 50% of the sample completed high school or higher education, and 31.7% had *per capita* household income between one to two minimum wages (R\$998/U\$253 to R\$1,996/U\$506).

The prevalence of psychological and physical violence is also presented in Table 1. From the total sample, 17.4% reported having been victims of psychological violence in the 12 months before the interview. The prevalence of psychological violence perpetrated by intimate partner was higher in women than men (5.9% vs 2.4%). The prevalence of psychological violence perpetrated by others was more frequent than the violence perpetrated by an intimate partner (13.1% vs 4.3%, respectively). Physical violence perpetrated by other than intimate partner was higher in men (3.4% vs 2.0%), while physical violence perpetrated by intimate partner was higher in women (2.2% vs 0.7%). In addition, 4.2% of the sample reported having suffered physical violence, 2.7% perpetrated by others, and 1.5% perpetrated by an intimate partner) (Table 1).

Regarding food consumption, almost 70% of the sample reported regular consumption of beans, 45% reported regular consumption of fruits, and 55% regular consumption of vegetables. The prevalence of regular consumption of beans was higher in men, while regular consumption of fruits and vegetables was higher in women. The prevalence of regular consumption of artificial fruit, soft drinks, and sweets were 13.3%, 9.2%, and almost 15%, respectively. The prevalence of regular consumption of artificial fruit juice and soft drinks was higher in men, with no sex difference for sweets (Table 1).

Concerning the number of regular consumption of healthy and unhealthy dietary markers, approximately one in ten men and women reported no consumption of healthy dietary markers items, about one-third reported consumption of one item, and more than a half reported regular consumption of two or more items (54.7% and 59.6%, men and women, respectively). Regarding unhealthy dietary markers, almost two-thirds of men and women reported no consumption of unhealthy dietary markers. The consumption of 1 item was reported by 24.9% of men and 22% of women; and 7% and 6% of men and women, respectively, reported the consumption of 2-3 items (data

**Table 1.** The study population demographic, socioeconomic, violence victimization, and dietary markers of healthy and unhealthy food consumption profile – Brazilian National Health Survey 2019 (n = 88,531).

|                                                | <b>Total</b><br><b>% (95%CI)</b> | <b>Men</b><br><b>% (95%CI)</b> | <b>Women</b><br><b>% (95%CI)</b> |
|------------------------------------------------|----------------------------------|--------------------------------|----------------------------------|
| Age (years)                                    |                                  |                                |                                  |
| < 20                                           | 3.9 (3.6; 4.2)                   | 4.1 (3.7; 4.6)                 | 3.8 (3.4; 4.2)                   |
| 20-39                                          | 39.2 (38.6; 39.8)                | 40.9 (40.0; 41.8)              | 37.7 (36.9; 38.4)                |
| 40-59                                          | 35.3 (34.7; 35.9)                | 35.0 (34.2; 35.9)              | 35.5 (34.8; 36.3)                |
| ≥ 60                                           | 21.6 (21.2; 22.0)                | 20.0 (19.4; 20.6)              | 23.0 (22.4; 23.7)                |
| Race/ethnicity                                 |                                  |                                |                                  |
| White                                          | 43.9 (43.3; 44.5)                | 43.2 (42.3; 44.1)              | 44.5 (43.7; 45.3)                |
| Black                                          | 11.6 (11.3; 12.0)                | 11.7 (11.2; 12.3)              | 11.6 (11.1; 12.1)                |
| Brown/Mixed                                    | 44.5 (43.9; 45.1)                | 45.1 (44.2; 45.9)              | 43.9 (43.2; 44.7)                |
| Marital status                                 |                                  |                                |                                  |
| Married                                        | 43.8 (43.3; 44.5)                | 48.6 (47.8; 49.5)              | 39.7 (38.9; 40.5)                |
| Single                                         | 7.1 (6.8; 7.4)                   | 5.4 (5.0; 5.8)                 | 8.6 (8.2; 9.0)                   |
| Widow                                          | 6.9 (6.6; 7.1)                   | 2.4 (2.1; 2.6)                 | 10.8 (10.4; 11.3)                |
| Separated                                      | 42.2 (41.6; 42.8)                | 43.6 (42.8; 44.5)              | 40.9 (40.1; 41.7)                |
| Educational level                              |                                  |                                |                                  |
| None                                           | 4.9 (4.6; 5.1)                   | 4.8 (4.5; 5.1)                 | 4.9 (4.6; 5.3)                   |
| Incomplete middle school                       | 24.8 (24.4; 25.3)                | 25.8 (25.2; 26.6)              | 23.9 (23.3; 24.6)                |
| Complete middle school                         | 18.0 (17.5; 18.5)                | 19.1 (18.3; 19.8)              | 17.0 (16.4; 17.6)                |
| Complete high school                           | 36.5 (36.0; 37.1)                | 36.1 (35.2; 37.0)              | 37.0 (36.2; 37.8)                |
| Complete higher education                      | 15.8 (15.3; 16.2)                | 14.2 (13.6; 14.8)              | 17.2 (16.6; 17.8)                |
| Per capita household income                    |                                  |                                |                                  |
| < ¼ minimum wage                               | 7.4 (7.1;7.7)                    | 6.8 (6.4;7.2)                  | 8.0 (7.6;8.4)                    |
| ¼ to ½ minimum wage                            | 14.7 (14.3;15.2)                 | 13.8 (13.3;14.4)               | 15.5 (14.9;16.2)                 |
| ½ to 1 minimum wage                            | 25.3(24.7;25.9)                  | 25.2 (24.4;26.0)               | 24.5 (24.7;26.3)                 |
| 1 to 2 minimum wages                           | 31.7 (31.0;32.2)                 | 32.2 (31.3;33.1)               | 31.1 (30.4;31.9)                 |
| 2 to 5 minimum wages                           | 15.7(15.2;16.3)                  | 16.4 (15.7;17.1)               | 15.1 (14.5;15.8)                 |
| ≥ 5 minimum wages                              | 5.2 (4.8;5.6)                    | 5.6 (5.1;6.1)                  | 4.8(4.4;5.3)                     |
| Psychological violence                         |                                  |                                |                                  |
| None                                           | 82.6 (82.2; 83.1)                | 84.0 (83.3; 84.7)              | 81.4 (80.8; 82.1)                |
| Perpetrated by intimate partner                | 4.3 (4.0; 4.5)                   | 2.4 (2.1; 2.7)                 | 6.0 (5.5; 6.4)                   |
| Perpetrated by others                          | 13.1 (12.7; 13.5)                | 13.6 (13.0; 14.3)              | 12.6 (12.1; 13.2)                |
| Physical violence                              |                                  |                                |                                  |
| None                                           | 95.8 (95.6; 96.1)                | 95.9 (95.6; 96.3)              | 95.8 (95.4; 96.1)                |
| Perpetrated by intimate partner                | 1.5 (1.3; 1.7)                   | 0.7 (0.5; 0.8)                 | 2.2 (2.0; 2.5)                   |
| Perpetrated by others                          | 2.7 (2.5; 2.9)                   | 3.4 (3.1; 3.7)                 | 2.0 (1.8; 2.3)                   |
| Regular consumption of beans                   |                                  |                                |                                  |
| No                                             | 31.7 (31.2; 32.2)                | 25.1 (24.4; 25.8)              | 37.5 (36.7; 38.2)                |
| Yes                                            | 68.3 (67.8; 68.8)                | 74.9 (74.2; 75.6)              | 62.5 (61.8; 63.3)                |
| Regular consumption of fruits                  |                                  |                                |                                  |
| No                                             | 54.9 (54.4; 55.5)                | 60.8 (60.0; 61.7)              | 49.7 (48.9; 50.5)                |
| Yes                                            | 45.1 (44.5; 45.6)                | 39.2 (38.3; 40.0)              | 50.3 (49.5; 51.1)                |
| Regular consumption of vegetables              |                                  |                                |                                  |
| No                                             | 44.8 (44.3; 45.4)                | 49.3 (48.4; 50.2)              | 40.9 (40.1; 41.7)                |
| Yes                                            | 55.2 (54.6; 55.7)                | 50.7 (49.8; 51.6)              | 59.1 (58.3; 59.9)                |
| Regular consumption of healthy dietary markers |                                  |                                |                                  |
| None                                           | 10.9 (10.5; 11.2)                | 10.3 (9.8; 10.8)               | 11.4 (10.9; 11.9)                |
| 1 item                                         | 31.8 (31.3; 32.4)                | 35.0 (34.1; 35.8)              | 29.1(28.3; 29.8)                 |
| 2-3 items                                      | 57.3 (56.7; 57.9)                | 54.7 (53.9; 55.6)              | 59.5 (58.8; 60.3)                |

it continues

**Table 1.** The study population demographic, socioeconomic, violence victimization, and dietary markers of healthy and unhealthy food consumption profile – Brazilian National Health Survey 2019 (n = 88,531).

|                                                  | <b>Total</b><br>% (95%CI) | <b>Men</b><br>% (95%CI) | <b>Women</b><br>% (95%CI) |
|--------------------------------------------------|---------------------------|-------------------------|---------------------------|
| Regular consumption of artificial fruit juice    |                           |                         |                           |
| No                                               | 86.7 (86.3; 87.1)         | 86.0 (85.3; 86.6)       | 87.4 (86.8; 88.0)         |
| Yes                                              | 13.3 (12.9; 13.7)         | 14.0 (13.4; 14.7)       | 12.6 (12.0; 13.2)         |
| Regular consumption of soft drinks               |                           |                         |                           |
| No                                               | 90.8 (90.4; 91.1)         | 88.4 (87.8; 89.0)       | 92.8 (92.4; 93.3)         |
| Yes                                              | 9.2 (8.9; 9.6)            | 11.6 (11.0; 12.2)       | 7.2 (6.7; 7.6)            |
| Regular consumption of sweets                    |                           |                         |                           |
| No                                               | 85.2 (84.7; 85.6)         | 85.6 (84.9; 86.2)       | 84.8 (84.2; 85.4)         |
| Yes                                              | 14.8 (14.4; 15.3)         | 14.4 (13.8; 15.1)       | 15.2 (14.6; 15.8)         |
| Regular consumption of unhealthy dietary markers |                           |                         |                           |
| None                                             | 70.0 (69.5; 70.6)         | 68.0 (67.1; 68.8)       | 71.8 (71.1; 72.6)         |
| 1 item                                           | 23.3 (22.8; 23.9)         | 24.9 (24.1; 25.7)       | 22.0 (21.3; 22.7)         |
| 2-3 items                                        | 6.7 (6.3; 7.0)            | 7.1 (6.6; 7.6)          | 6.2 (5.8; 6.7)            |

CI: confidence interval. \* Value of the minimum wage in Brazil in 2019: R\$998 (approximately US\$253, considering exchange rate in 2019: R\$1/US\$3.945).

Source: Authors.

not shown in Tables). Adjusted analyses of the relationship between interpersonal violence and dietary markers showed that both psychological and physical violence were risk factors for a lower prevalence of regular consumption of healthy food items in men. As can be seen in the adjusted models, men who reported having been victims of psychological or physical violence, no matter if perpetrated by an intimate partner or not, were less likely to present regular consumption of 2-3 healthy food items, in comparison with those men who did not report interpersonal violence (OR: 0.70, 95%CI: 0.50-0.97; and OR: 0.82, 95%CI: 0.70-0.97, for violence perpetrated by an intimate partner and perpetrated by others, respectively). This relationship did not occur among women (Table 2).

In contrast, psychological and physical violence were risk factors with a higher prevalence of regular consumption of unhealthy food items. Women who reported physical violence ( $\text{OR}_{\text{intimate partner}}^{2-3\text{item}}: 1.90, 95\%CI: 1.30-2.77$ ;  $\text{OR}_{\text{by others}}^{2-3\text{item}}: 2.28, 95\%CI: 1.52-3.43$ ) and men who reported physical violence perpetrated by other than intimate partner ( $\text{OR}_{2-3\text{item}}: 1.65, 95\%CI: 1.18-2.31$ ); were also more likely to report regular consumption of two or three unhealthy food items. Furthermore, men and women who have suffered psychological violence, independent of who perpetrated it, were more likely to report regular consumption of

a higher number of unhealthy food items (example – results by intimate partner:  $\text{OR}_{1\text{item}}^{\text{female}}: 1.23$  vs  $\text{OR}_{2-3\text{items}}^{\text{female}}: 1.34$ ;  $\text{OR}_{1\text{item}}^{\text{male}}: 1.37$  vs  $\text{OR}_{2-3\text{items}}^{\text{male}}: 2.23$ ) (Table 3).

When we assessed the relationship between interpersonal violence and each food item separately, we observed that psychological violence perpetrated by an intimate partner was associated with higher regular consumption of artificial fruit juice (only in men) and soft drinks (in men and women). Physical violence perpetrated by other than intimate partner was positively associated with regular consumption of soft drinks and sweets in men and women. Women who were victims of physical violence perpetrated by intimate partner presented higher regular consumption of artificial fruit juice and soft drinks (Table 4).

Psychological violence perpetrated by others was negatively related to regular consumption of beans and vegetables in men, and regular consumption of beans in women. Additionally, physical violence perpetrated by others was negatively related to regular consumption of beans, while when perpetrated by an intimate partner it was associated with lower regular consumption of vegetables in men. Finally, psychological violence perpetrated by others was positively associated with regular consumption of soft drinks (only in men) and sweets (in men and women) – see Table 4.

**Table 2.** Adjusted associations between psychological and physical interpersonal violence and healthy food consumption according to sex – Brazilian National Health Survey 2019.

| Exposure<br>to interpersonal violence     | Regular consumption of healthy dietary markers |                           |                           |                           |
|-------------------------------------------|------------------------------------------------|---------------------------|---------------------------|---------------------------|
|                                           | Men                                            |                           | Women                     |                           |
|                                           | 1 item                                         | 2-3 items                 | 1 item                    | 2-3 items                 |
|                                           | OR (95%CI) <sup>a,b</sup>                      | OR (95%CI) <sup>a,b</sup> | OR (95%CI) <sup>a,b</sup> | OR (95%CI) <sup>a,b</sup> |
| Psychological                             |                                                |                           |                           |                           |
| No violence                               | Ref                                            | Ref                       | Ref                       | Ref                       |
| Violence by intimate partner <sup>c</sup> | 0.81 (0.57; 1.14)                              | 0.70 (0.50; 0.97)         | 0.90 (0.72; 1.13)         | 0.85 (0.70; 1.04)         |
| Violence by others <sup>d</sup>           | 0.85 (0.72; 1.01)                              | 0.82 (0.70; 0.97)         | 1.00 (0.85; 1.17)         | 0.91 (0.78; 1.06)         |
| Physical                                  |                                                |                           |                           |                           |
| No violence                               | Ref                                            | Ref.                      | Ref                       | Ref.                      |
| Violence by intimate partner <sup>c</sup> | 0.65 (0.34; 1.24)                              | 0.45 (0.25; 0.79)         | 1.02 (0.76; 1.36)         | 0.93 (0.69; 1.27)         |
| Violence by others <sup>d</sup>           | 0.70 (0.53; 0.94)                              | 0.74 (0.57; 0.97)         | 1.12 (0.80; 1.56)         | 0.76 (0.55; 1.06)         |

OR: Odds ratio; CI: confidence interval. <sup>a</sup> Analyses adjusted for age, race/ethnicity, marital status, educational level, and *per capita* household income. <sup>b</sup> These results display the odds ratio of each category according to the base outcome (no item of the dietary marker of food consumption). <sup>c</sup> Intimate partner violence refers to spouse or partner; ex-spouse or ex-partner; boyfriend/girlfriend. <sup>d</sup> Violence by others included violence perpetrated by known or unknown person.

Source: Authors.

**Table 3.** Adjusted associations between psychological and physical interpersonal violence and unhealthy food consumption according to sex – Brazilian National Health Survey 2019.

| Exposure<br>to interpersonal violence     | Regular consumption of unhealthy dietary markers |                           |                           |                           |
|-------------------------------------------|--------------------------------------------------|---------------------------|---------------------------|---------------------------|
|                                           | Men                                              |                           | Women                     |                           |
|                                           | 1 item                                           | 2-3 items                 | 1 item                    | 2-3 items                 |
|                                           | OR (95%CI) <sup>a,b</sup>                        | OR (95%CI) <sup>a,b</sup> | OR (95%CI) <sup>a,b</sup> | OR (95%CI) <sup>a,b</sup> |
| Psychological                             |                                                  |                           |                           |                           |
| No violence                               | Ref                                              | Ref                       | Ref                       | Ref                       |
| Violence by intimate partner <sup>c</sup> | 1.37 (1.02; 1.84)                                | 2.23 (1.48; 3.35)         | 1.23 (1.01; 1.50)         | 1.34 (1.02; 1.75)         |
| Violence by others <sup>d</sup>           | 1.32 (1.15; 1.51)                                | 1.46 (1.20; 1.79)         | 1.21 (1.07; 1.37)         | 1.30 (1.06; 1.60)         |
| Physical                                  |                                                  |                           |                           |                           |
| No violence                               | Ref                                              | Ref.                      | Ref                       | Ref.                      |
| Violence by intimate partner <sup>c</sup> | 1.46 (0.89; 2.41)                                | 1.95 (0.91; 4.18)         | 1.29 (0.92; 1.82)         | 1.90 (1.30; 2.77)         |
| Violence by others <sup>d</sup>           | 1.09 (0.88; 1.36)                                | 1.65 (1.18; 2.31)         | 1.23 (0.93; 1.64)         | 2.28 (1.52; 3.43)         |

OR: Odds ratio; CI: confidence interval. <sup>a</sup> Analyses adjusted for age, race/ethnicity, marital status, educational level, and *per capita* household income. <sup>b</sup> These results display the odds ratio of each category according to the base outcome (no item of the dietary marker of food consumption). <sup>c</sup> Intimate partner violence refers to spouse or partner; ex-spouse or ex-partner; boyfriend/girlfriend. <sup>d</sup> Violence by others included violence perpetrated by known or unknown person.

Source: Authors.

## Discussion

The study results indicate that both psychological and physical interpersonal violence are risk factors for inadequate consumption of dietary markers, albeit with discernible variations between sexes. Men who have experienced interpersonal violence not only exhibit a lower regular consumption of healthy food but also have an augmented intake of unhealthy food items, thus experiencing a dual negative impact of violence in their consumption pattern. On the other

hand, although women victims do not have a lower consumption of healthy foods; they consume more unhealthy food than those who did not report interpersonal victimization.

In this study, psychological and physical interpersonal violence, irrespective of the perpetrator's identity (whether known, unknown, or an intimate partner), led to a decline in the consumption of healthy foods only in men. The literature investigating the link between experiencing interpersonal violence and food consumption is relatively recent and limited in



**Table 4.** Relationship between psychological and physical interpersonal violence and each marker of healthy and unhealthy food by sex – Brazilian National Health Survey 2019.

| Exposure to interpersonal violence        | Regular consumption of individual healthy dietary markers   |                   |                   |                        |                   |                   |
|-------------------------------------------|-------------------------------------------------------------|-------------------|-------------------|------------------------|-------------------|-------------------|
|                                           | Men                                                         |                   |                   | Women                  |                   |                   |
|                                           | Beans                                                       | Vegetables        | Fruits            | Beans                  | Vegetables        | Fruits            |
|                                           | OR (95%CI) <sup>a</sup>                                     |                   |                   |                        |                   |                   |
| Psychological                             |                                                             |                   |                   |                        |                   |                   |
| No violence                               | Ref.                                                        | Ref.              | Ref.              | Ref.                   | Ref.              | Ref.              |
| Violence by intimate partner <sup>b</sup> | 0.91 (0.69; 1.18)                                           | 0.92 (0.72; 1.18) | 0.80 (0.61; 1.06) | 0.93 (0.79; 1.10)      | 0.93 (0.79; 1.09) | 0.94 (0.80; 1.11) |
| Violence by others <sup>c</sup>           | 0.88 (0.79; 0.99)                                           | 0.88 (0.79; 0.99) | 1.04 (0.92; 1.18) | 0.84 (0.76; 0.93)      | 1.08 (0.97; 1.20) | 0.91 (0.82; 1.01) |
| Physical                                  |                                                             |                   |                   |                        |                   |                   |
| No violence                               | Ref.                                                        | Ref.              | Ref.              | Ref.                   | Ref.              | Ref.              |
| Violence by intimate partner <sup>b</sup> | 0.68 (0.42; 1.08)                                           | 0.60 (0.40; 0.92) | 0.79 (0.53; 1.18) | 1.05 (0.81; 1.37)      | 0.85 (0.66; 1.09) | 1.14 (0.87; 1.50) |
| Violence by others <sup>c</sup>           | 0.77 (0.62; 0.95)                                           | 0.94 (0.7; 1.14)  | 1.03 (0.84; 1.28) | 0.85 (0.67; 1.09)      | 0.84 (0.65; 1.08) | 0.79 (0.61; 1.04) |
| Exposure to interpersonal violence        | Regular consumption of individual unhealthy dietary markers |                   |                   |                        |                   |                   |
|                                           | Men                                                         |                   |                   | Women                  |                   |                   |
|                                           | Artificial fruit juice                                      | Soft drinks       | Sweets            | Artificial fruit juice | Soft drinks       | Sweets            |
|                                           | OR (95%CI) <sup>a</sup>                                     |                   |                   |                        |                   |                   |
| Psychological                             |                                                             |                   |                   |                        |                   |                   |
| No violence                               | Ref.                                                        | Ref.              | Ref.              | Ref.                   | Ref.              | Ref.              |
| Violence by intimate partner <sup>b</sup> | 1.53 (1.11; 2.11)                                           | 1.80 (1.30; 2.48) | 1.37 (0.99; 1.91) | 1.22 (0.97; 1.54)      | 1.42 (1.04; 1.94) | 1.11 (0.93; 1.34) |
| Violence by others <sup>c</sup>           | 1.06 (0.91; 1.24)                                           | 1.25 (1.06; 1.48) | 1.55 (1.32; 1.82) | 1.07 (0.92; 1.24)      | 1.18 (0.97; 1.44) | 1.32 (1.15; 1.51) |
| Physical                                  |                                                             |                   |                   |                        |                   |                   |
| No violence                               | Ref.                                                        | Ref.              | Ref.              | Ref.                   | Ref.              | Ref.              |
| Violence by intimate partner <sup>b</sup> | 1.54 (0.92; 2.57)                                           | 1.52 (0.86; 2.68) | 1.35 (0.75; 2.43) | 1.37 (1.02; 1.85)      | 1.99 (1.23; 3.23) | 1.18 (0.88; 1.59) |
| Violence by others <sup>c</sup>           | 1.04 (0.80; 1.35)                                           | 1.46 (1.12; 1.91) | 1.35 (1.04; 1.75) | 1.32 (0.94; 1.86)      | 1.84 (1.28; 2.64) | 1.56 (1.15; 2.12) |

OR: odds ratio; CI: confidence interval. <sup>a</sup> Analyses adjusted for age race/ethnicity, marital status, educational level, and *per capita* household income. <sup>b</sup> Intimate partner violence refers to spouse or partner; ex-spouse or ex-partner; boyfriend/girlfriend. <sup>c</sup> Violence by others included violence perpetrated by known or unknown person.

Source: Authors.

scope<sup>26-33</sup>. These studies primarily focused on child abuse, and the outcome focused on children and adolescents. Only two studies have found an association between child abuse and lower consumption of healthy foods<sup>31,32</sup>, one of which is specifically in the adult population<sup>32</sup>. It is important to note that, in this study, the effect of interpersonal violence perpetrated by others on reducing healthy consumption was observed only in male victims. It is also pointed out that the literature shows that this type of violence is more related to young men<sup>2</sup>.

Despite the lower consumption of healthy dietary markers of male victims of psychological and physical interpersonal violence, beans and vegetables emerged as the specific food items affected. In an attempt to elucidate the mechanisms underlying these findings, some explanatory aspects related to the sex difference in food preparation and consumption can be considered. Beans and vegetables necessitate considerable pre-preparation time involving cleaning and cooking processes before eating. Men are not typically the primary individuals

responsible for food provisioning within the household, as cultural norms often assign these tasks to women in Brazil<sup>34,35</sup>. We can postulate that male victims of interpersonal violence tend to spend more time away from home and may not take on household responsibilities, including food purchase and preparation, which can lead to a reduction in consumption of these items.

Another aspect that should be considered is that some men consider healthy food as feminine foods<sup>36,37</sup>. It is plausible that men who are victims of violence try to reaffirm their masculinity (i.e., taking the perspective of power) by moving away from any symbolism seen as weak, and may remove these items from their menu. In addition, male victims of interpersonal violence often tend to rely on consuming meals outside the home, which typically offer fewer healthy food options compared to those prepared within a domestic setting<sup>38</sup>. All these aspects can potentially contribute to a reduction in healthy food consumption in this group. The absence of these associations among women may be attributed to their tendency to spend more time at home, which in turn leads to the consumption of food items that require longer preparation times<sup>39,40</sup>. Another possibility is that women are more sensitive to media indications regarding the benefits that a balanced diet can bring to their health<sup>40</sup>.

In our study, both men and women who experienced psychological interpersonal violence, regardless of the perpetrator, exhibited an increased frequency of consuming unhealthy foods. As previously mentioned, the literature lacks comprehensive research on the relationship between violence experienced during adulthood and food consumption in this life stage. It is worth noting that the only study that investigates the negative consequences of interpersonal violence on adult eating preferences has specifically examined the connection between child abuse and food consumption<sup>32</sup>. In this particular study, the authors found that adults who had been victims of child abuse had poorer diets, characterized by higher consumption of unhealthy food.

However, our findings align with the results drawn from previous studies exploring the relationship between other types of interpersonal violence and food consumption across other age groups<sup>26-28,31</sup>. Abajobir *et al.*<sup>26</sup> evaluated the association between physical, emotional, and sexual violence abuse and neglect, and dietary fat consumption among younger adults. According

to these authors, any type of violence was associated with higher fat intake. In the study of Duke and Borowsky<sup>27</sup> emotional, physical, and sexual child abuse reduced fruit and increased fast-food consumption among adolescents. Jackson and Vaughn<sup>28</sup> evaluated the association between emotional and physical child abuse and obesogenic food consumption among children. The findings showed that emotional abuse was associated with the consumption of soft drinks and physical abuse was associated with eating several ultra-processed foods, such as soft drinks, salty snacks, and sweets during childhood. The study by Marques *et al.*<sup>20</sup> also indicated that adolescents' victims of violence had lower consumption of *in natura* food (fruits, vegetables, and beans) and higher consumption of ultra-processed food (salt biscuits, snacks, or processed meat; sweets; and soft drinks). Notably, the mentioned studies examined diverse forms of violence and their implication during both childhood and adolescence. None of them, however, specifically targeted the adult population encompassed by the present study.

Several explanatory hypotheses can provide insight into this overconsumption of unhealthy foods. First, emotions can play a role in food choice and consumption<sup>41,42</sup>, as evidenced by the concept of "comfort food" or "emotional eating"<sup>29,43,44</sup>. In response to negative emotions, certain individuals tend to increase their consumption of pleasurable food sources, primarily consisting of highly palatable and energy density options, often categorized as unhealthy or ultra-processed foods. Second, the impact on mental health may lead to modifications in diet<sup>45-48</sup>. The literature suggests that our temporary psychological state or mood can affect our food choices, increasing "comfort food" consumption, for example. Finally, chronic stress can stimulate the production of "alert hormones" such as adrenaline, noradrenaline, growth hormone, and cortisol. As suggested by the literature, these hormones may influence unhealthy food consumption through the craving for high-fat and high-sugar foods<sup>8,49</sup>.

Divergent results were obtained when examining physical interpersonal violence across the sexes. Specifically, female victims of this type of violence, irrespective of the perpetrator, showed a higher regular consumption of unhealthy foods. In contrast, only male victims of physical violence perpetrated by others demonstrated an increase in their food consumption of such foods. The aforementioned explanations to justify the reduced consumption of healthy

food markers are equally applicable in elucidating these findings. It is noteworthy to underscore that physical intimate partner violence impacts solely the unhealthy consumption of food among women. It is highlighted that women are more frequently subjected to this form of violence than men<sup>50</sup>. When analyzing the relationship between interpersonal violence and the food consumption of each marker of unhealthy food, it is crucial to emphasize that there was an increase in the consumption of all three food items for both sexes.

The interpretation of the study findings should consider its limitations and strengths. In terms of limitations, the cross-sectional design does not allow us to establish the temporality between exposure to interpersonal violence and food consumption, thereby difficulting our ability to claim that interpersonal violence preceded dietary outcomes. To overcome this problem, further longitudinal studies are needed, which would provide valuable insights into temporal relationships. It is also important to note that the detection of interpersonal victimization, although based on items adapted from previous frequently used questionnaires, was not grounded on a validated scale. Utilizing measurement instruments that have been thoroughly validated is of utmost importance for accurately classifying individuals, especially when studying complex constructs such as violence. Perhaps, this limitation could be responsible for the relatively low prevalence of interpersonal violence found here. Another limitation pertains to the absence of inquiries regarding the severity and chronicity of victimization, rendering it challenging to elucidate the effects of recurrent and more severe violence on diet. Another limitation restriction is that when focusing only on the most severe violent episode to identify the perpetrator, it is not possible to definitively assert that individuals who report experiencing interpersonal violence from an unknown person, for instance, have not experienced also intimate partner violence during the previous

twelve months. Another potential limitation in this study refers to the number of dietary markers used to estimate the consumption of healthy and unhealthy food (three food items for each category). Specifically, the small number of dietary markers, particularly for unhealthy foods, poses a possible limitation, as it may not adequately capture the habitual consumption of individuals concerning such types of food. To reduce this possible problem, the healthy and unhealthy dietary markers included *in natura*/minimally processed and ultra-processed foods, respectively, a valid classification of foods based on the NOVA food classification system groups<sup>9</sup>.

Regarding the positive aspects, the originality of the research question and the population of study can be highlighted. To the best of our knowledge, this study represents the initial investigation into the relationship between the occurrence of interpersonal violence during adulthood and dietary patterns within this particular life circle. We reinforce the importance of further studies to understand this intricate relationship, as well as studies assessing the impact of polyvictimization on food consumption. Notably, it encompassed a large (n: 88,531) nationally representative sample from Brazil thus enhancing the generalizability of our findings. The fact that the study was developed in a middle-income country, where the scarcity of studies focusing on the negative consequences of violence on food consumption is even more striking, enhances the relevance of the study findings.

Finally, this study reveals the complex relationship between interpersonal violence and food consumption, indicating the importance of considering both types of violence (psychological and physical) in understanding the consumption of healthy and unhealthy food among male and female adults. Efforts to address and mitigate the impact of interpersonal violence on food consumption should take into account sex-specific differences and the diverse types of violence experienced.

## Collaborations

ES Marques, Pozza L e Buffarini R: formal analysis. All authors: conception and design, supervision, validation, visualization, writing review and editing, critical review, and approval of the version to be published.

## Data availability statement

The data sources used in the research are indicated in the body of the article.

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