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Insufficient physical activity and ultra-processed foods consumption in Brazilian adults

Atividade física insuficiente e consumo de alimentos ultraprocessados em adultos brasileiros

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ABSTRACT

To estimate the prevalence of simultaneous insufficient physical activity (IPA) and excessive consumption of ultra-processed foods (UPF), and to verify the association between IPA and dietary habits (in natura/minimally processed foods, ultra-processed foods and food consumption markers) in Brazilian adults. Cross-sectional study with data from the Vigitel Telephone Survey 2018. 51,064 adults (≥ 20 years) were studied. IPA covered three domains: leisure, commuting and work (< 150 minutes/week). The scores for in natura/minimally processed foods and UPF (number of subgroups mentioned/previous day) were calculated; ≥ 5 UPF: excessive consumption. Questions on weekly and daily frequency of food consumption were used. Prevalence ratios (PR) were estimated by Poisson regression. The simultaneity of IPA and consumption of UPF was 7.0% (95% CI: 6.50 - 7.55), higher among women (PR = 1.26; 95% CI: 1.08 - 1.47), in residents of the Southeast (PR = 1.23; 95% CI: 1.00 - 1.51) and South (PR = 1.50; 95% CI: 1.22 - 1.84), and was lower in individuals aged ≥ 40 years (40-49: PR = 0.71; 95% CI: 0.56 - 0.88; 50-59: PR = 0.46; 95% CI: 0.36 - 0.58; ≥ 60: PR = 0.45; 95% CI: 0.36 - 0.56) and with health insurance (PR = 0.84; 95% CI: 0.72 - 0.99). IPA was associated with lower consumption of in natura/minimally processed foods and higher consumption of UPF. There was lower regular consumption (≥ 5 days/week) of raw vegetables (PR = 0.82; 95% CI: 0.78 - 0.85), cooked vegetables (PR = 0.88; 95% CI: 0.84 - 0.92), fruit (PR = 0.78; 95% CI: 0.75 - 0.82) and juice (PR = 0.93; 95% CI: 0.89 - 0.97), and higher consumption of soft drinks (≥ 3 days/week: PR = 1.17; 95% CI: 1.11 - 1.23) among individuals with IPA. They also had lower consumption of raw vegetables (2 times/day: PR = 0.93; 95% CI: 0.88 - 0.98), fruit (2 times/day: PR = 0.89; 95% CI: 0.85 - 0.94; ≥ 3 times: PR = 0.84; 95% CI: 0.79 - 0.89) and juice (≥ 2 glasses/day: PR = 0.93; 95% CI: 0.89 - 0.98). An association was identified between IPA and inadequate eating habits, the subgroups most affected by both risk behaviors, which should be prioritized in health promotion and disease prevention strategies.

Keywords: Physical activity; Food consumption; Ultra-processed foods; Risk factors; Health surveys.

RESUMO

Estimar a prevalência de simultaneidade de atividade física insuficiente (AFI) e consumo excessivo de alimentos ultraprocessados (AUP), bem como verificar a associação entre AFI e hábitos alimentares (alimentos in natura/minimamente processados, ultraprocessados e marcadores de consumo alimentar) em adultos brasileiros. Estudo transversal com dados do inquérito telefônico Vigitel 2018. Foram estudados 51.064 adultos (≥ 20 anos). AFI abarcou três domínios: lazer, deslocamento, trabalho (< 150 minutos/semana). Calcularam-se os escores de alimentos in natura/minimamente processados e AUP (número de subgrupos referidos/dia anterior); ≥ 5 AUP: consumo excessivo. Foram utilizadas questões sobre a frequência semanal e diária de consumo alimentar. Estimaram-se razões de prevalência (RP) com regressão de Poisson. A simultaneidade de AFI e consumo de AUP foi de 7,0% (IC 95%: 6,50 – 7,55), maior nas mulheres (RP = 1,26; IC 95%: 1,08 – 1,47), nos residentes do Sudeste (RP = 1,23; IC 95%: 1,00 – 1,51) e Sul (RP = 1,50; IC 95%: 1,22 – 1,84), e foi menor nos indivíduos com idade ≥ 40 anos (40–49: RP = 0,71; IC 95%: 0,56 – 0,88; 50 – 59: RP = 0,46; IC 95%: 0,36 – 0,58; ≥ 60: RP = 0,45; IC 95%: 0,36 – 0,56) e com plano de saúde (RP = 0,84; IC 95%: 0,72 – 0,99). A AFI associou-se ao menor consumo de alimentos in natura/minimamente processados e ao maior consumo de AUP. Observou-se menor consumo regular (≥ 5 dias/semana) de hortaliças cruas (RP = 0,82; IC 95%: 0,78 – 0,85), cozidas (RP = 0,88; IC 95%: 0,84 – 0,92), frutas (RP = 0,78; IC 95%: 0,75 – 0,82), suco (RP = 0,93; IC 95%: 0,89 – 0,97), e maior de refrigerante (≥ 3 dias/semana: RP = 1,17; IC 95%: 1,11 – 1,23) entre os indivíduos com AFI. Estes também apresentaram menor consumo de hortaliças cruas (2 vezes/dia: RP = 0,93; IC 95%: 0,88 – 0,98), frutas (2 vezes/dia: RP = 0,89; IC 95%: 0,85 – 0,94; ≥ 3 vezes/dia: RP = 0,84; IC 95%: 0,79 – 0,89) e suco (≥ 2 copos/dia: RP = 0,93; IC 95%: 0,89 – 0,98). Identificou-se associação entre AFI e hábitos alimentares inadequados, os subgrupos mais acometidos por ambos os comportamentos de risco, que devem ser priorizados em estratégias de promoção da saúde e prevenção de agravos.

Palavras-chave: *Atividade física; Consumo alimentar; Alimentos ultraprocessados; Fatores de risco; Sistema de vigilância por inquérito telefônico.*

Introduction

Physical inactivity and unhealthy eating habits are among the most important modifiable risk factors associated with mortality and disability[1,2]. Globally, physical inactivity causes 7% to 8% of cardiovascular diseases, depression, and dementia, and around 5% of cases of type 2 diabetes. In addition, this risk factor generates an annual cost of around US$ 27 billion[3] to healthcare systems.

In the 2019 Brazilian National Health Survey (PNS), 40.3% of Brazilian adults had insufficient physical activity (IPA), that is, they did no physical activity or less than 150 minutes/week of moderate and/or high intensity physical activities, considering the domains of leisure, work and commuting to usual places, such as work, school or classes[4]. IPA was higher in women, individuals aged 40 or older, and those with low levels of education and income[4]. A systematic review of 43 articles showed that individuals with lower levels of education, income and/or professional qualifications were more likely to perform physical activity in the commuting and/or occupational domains[5].

A study that assessed data from the National Food Survey of 2008-2009 and 2017-2018 found a deterioration in the quality of eating habits of the Brazilian population, with a decrease in the consumption of rice, beans, fruits, beef, bread, and dairy products, and an increase in the consumption of sandwiches, regardless of gender, age, and income[6]. In Brazil, the contribution of ultra-processed foods (UPF) to total dietary energy intake ranged from 13.0% to 18.6% for men, and from 16.0% to 21.0% for women aged 30-69 years[6]. In 2019, 57,000 deaths were attributed to UPF consumption, representing 10.5% of premature deaths and 21.8% of preventable deaths from chronic noncommunicable diseases (NCDs)[7]. UPFs are industrial formulations of food-derived components that contain little or no whole food (sugars, fats, proteins, starches) and often have the addition of flavorings, colorings, emulsifiers, and other additives to make the final product palatable[8].

A study that analyzed the co-occurrence of risk factors for NCDs in the population living in Brazilian state capitals reported a simultaneous prevalence of unhealthy eating habits and IPA of 13.1% in adults and 32.1% in elderly people[9]. Particularly among elderly individuals, a study conducted in Florianópolis, Santa Catarina, Brazil, found an individual prevalence of IPA in leisure time and insufficient consumption of fruits and vegetables of about 70%, and the simultaneous occurrence of the two factors reaching 46.4% in women and 28.1% in men[10]. Other studies conducted with adults and elderly people showed an association between healthy food consumption and physical activity[11-15].

This study investigates the hypothesis that IPA is associated with the consumption of unhealthy foods in the adult and elderly population, provides information about the co-occurrence of IPA and consumption of UPF, and offers a more comprehensive assessment of eating habits. Therefore, this study aimed to estimate the prevalence of concomitant IPA and excessive consumption of UPF and evaluate the association between IPA and eating habits (in natura/minimally processed foods, ultra-processed foods, and food consumption markers) in Brazilian adults.

Methods

This is a cross-sectional, population-based study that assessed data from the Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico - Vigitel, 2018*). Since 2006, Vigitel has annually monitored the frequency and distribution of the main determinants of NCDs in the adult population (≥ 18 years) living in the capitals of the 26 Brazilian states and the Federal District.

In each city, Vigitel interviews a probability sample of the adult population with a landline at home. In 2018, about 2,000 interviews were performed in each city, which allows the frequency of any risk factor to be estimated with a 95% confidence coefficient and a maximum error of two percentage points[16].

For sample selection in the first stage of sampling, a systematic draw was made, stratified by postal code, selecting at least 5,000 telephone lines in each city, followed by a new draw and organization into replicates (or sub-samples) of 200 lines each. The replicates reproduce the same proportion of lines per postal code as the original register of residential landline of the main telephone operators in the country. The second stage of sampling consisted of drawing one of the adults living in the selected household. It was performed after identifying the lines eligible for the system[16]. Refusals to participate in the monitoring system reached 4.4% of eligible lines[16]; however, there is no information available about refusals for the age group considered in this study. The average duration of the interviews conducted by Vigitel 2018 was almost 11 minutes, ranging

from 4 to 59 minutes[16].

To reduce the potential bias of not representing individuals without a landlines, Vigitel applies post-stratification weights to every respondent. The weights are calculated using the Rake method, which aims to match the sociodemographic distribution of the Vigitel survey population with the estimated distribution of the adult population of the same city and in the same year as the survey. The variables considered in the sociodemographic composition of the total population and the population with a landlines are: gender, age groups, and level of education. More details about the Vigitel sampling plan can be easily found[16].

Inclusion criteria were individuals aged 20 years or older of both genders (n = 51,064). Exclusion criteria were individuals aged 18-19 years, as this age subgroup includes adolescence[17]. IPA had three domains (leisure, commuting, and work), where the minutes spent in physical activity during leisure time, while commuting to work/school, and in occupational activities were added up to classify individuals into two categories: those who presented at least 150 minutes of physical activity per week in the three domains and those who did not present it or did not do any physical activity. The variable IPA (< 150 minutes/week) was calculated using the answers to the following questions[16]:

- Leisure: in the past three months, have you done any type of physical exercise or sport? What is the main type of physical exercise or sport that you have practiced? Do you exercise at least once a week? How many days a week do you usually practice physical exercise or sport? On the day that you practice exercise or sport, how long does the activity last?
- Commuting: do you walk or bike to and from work? How long do you walk or bike to and from work? Are you currently attending classes/school or do you take someone to classes/school? Do you walk or bike to and from this class or school? How long do you spend walking or biking to and from this class or school?
- Occupational: in the past three months, have you worked? At work, do you walk a lot? At work, do you lift weights or do other any heavy work? In a typical week, how many days do you do these activities at work? When you do these activities, how long do they usually last?

Eating habits were assessed using questions about the frequency of consumption (weekly, daily, and the day before the interview) of foods considered markers of healthy and unhealthy eating patterns. Five similar questions were chosen: "How many days a week do you eat or drink the following foods: raw vegetables, cooked vegetables, fruits, fruit juices, and soft drinks or juices cocktails?" Regular consumption of vegetables, fruits, fruit juices (5 or more days/week), and soft drinks/juice cocktails (3 or more days/week) was assessed.

Five questions were used to assess the daily frequency of consumption (number of times per day): "On an average day, do you eat … or how many glasses or cans of … do you usually drink?" including foods such as raw vegetables, cooked vegetables (1 time; 2 times), fruit juice (1; ≥ 2 glasses), fruits (1; 2; ≥ 3 times), soft drinks or juice cocktails (1; ≥ 2 glasses/cans). A question was also selected to assess the type of soft drink/juice cocktails consumed: "What type?" categorized as regular/both; diet/light/zero.

To assess the foods consumed the day before the interview, the following questions were asked: "Now I will list some foods and I want you to tell me if you ate any of them yesterday (from when you woke up to when you went to bed)." "I will start with natural or basic foods." And then: "Now I will list industrialized foods or products." Consumption was assessed using a screener with yes/no questions for 25 food subgroups (12 in natura/minimally processed and 13 ultra-processed foods), which were organized into two groups according to the level of processing. In natura and minimally processed foods that include vegetables, fruits, meat, eggs, cereals, root vegetables, legumes, oilseeds, and milk; and UPFs that include soft drinks, fruit drinks (boxed/canned juice and powdered soft drinks), dairy drinks, sweets, packaged snacks or cookies/crackers, sauces and ready/semi-prepared meals, margarine, sausages, and bread (sliced bread, hot dog or hamburger bun). Consumption of all food subgroups was reported as yes or no answers.

To calculate in natura/minimally processed food score, the number of food subgroups consumed the day before the interview was added up, ranging from 0 to 12. The sum for UPF subgroups was also calculated, ranging from zero to 13. The distribution of scores was then grouped into tertiles: 0 to 6, 7 to 8, and 9 or more for in natura/minimally processed foods, and 0 to 2, 3 to 4, and 5 or more for ultra-processed foods, with the last category considered as excessive consumption[18].

Based on the risk factors – presence of IPA and

excessive consumption of UPF – a variable was created considering the co-occurrence of both (yes; no). The sociodemographic variables were: gender (male; female), age group (in years: 20-29; 30-39; 40-49; 50-59; ≥ 60), education (in years of study: 0-8; 9 or more), race/skin color (White; Black/Mixed/Yellow/Indigenous), marital status (without a spouse; with a spouse), having health insurance (yes; no), and macro-region (Central-West; Northeast; North; South; Southeast). Variables related to previous medical diagnosis of hypertension (yes; no), diabetes (yes; no), and nutritional status were also selected. Nutritional status was assessed by the body mass index [BMI: weight (kg)/ height^2(m)], calculated using reported data and classified as: underweight (BMI < 18.5 kg/m^2 for adults and ≤ 22 kg/m^2 for the elderly), healthy weight (BMI ≥ 18.5 kg/m^2 and < 25 kg/m^2 for adults and > 22 kg/m^2 and < 27 kg/m^2 for the elderly) and overweight (BMI ≥ 25 kg/m^2 for adults and ≥ 27 kg/m^2 for the elderly)[19].

Statistical analysis and ethical aspects

First, the point and interval prevalence rates of IPA, excessive UPF consumption, and the simultaneity of these risk factors were estimated according to sociodemographic characteristics. Next, the prevalence of consumption of in natura and minimally processed foods and UPF the day before the interview was estimated, according to the presence of IPA. Then, associations between regular and daily food consumption, type of soft drink/ juice cocktails, and presence of IPA (yes; no) were analyzed using the Pearson's chi-squared test (Rao-Scott). Differences between the prevalence of regular and daily food consumption, type of soft drink/ juice cocktails, and co-occurrence of IPA and excessive UPF consumption were assessed by the prevalence ratios adjusted for gender, age, and level of education using Poisson regression. All tests considered a significance level of 5% and the analyses were performed in Stata 15.1, using the svy command, which takes into account post-stratification weights to better represent the population.

The Vigitel survey was approved by the National Ethics Committee for Research with Human Beings of the Ministry of Health, under report nº 355.590 of June 26, 2013. The signing of an informed consent form was replaced with the subject's verbal consent over the telephone.

Results

In total, 51,064 adults (≥ 20 years) were evaluated, mean age of 43.7 years (95% CI: 43.42 – 43.97). Regarding the sociodemographic characteristics of the study population, most participants were female (54.5%), aged 40 or over (54.3%), had 9 years or more of education (68.7%), and 54.1% had no health insurance (Table 1). Among these adults, 25.8% (95% CI: 25.0 2– 26.52) and 8.0% (95% CI: 7.5 – 38.41) reported hypertension and diabetes, respectively, while 57.5% (95% CI: 56.53 – 58.39) were overweight or obese (data not shown in table).

The prevalence of IPA was 44.5% (95% CI: 43.59 – 45.45) and for excessive consumption of UPF, 17.0% (95% CI: 16.19 – 17.80). The prevalence of co–occurrence of risk factors was 7.0% (95% CI: 6.50 – 7.55) for the total adult population, significantly higher among women (PR = 1.26; 95% CI: 1.08 – 1.47), among those living in the Southeast (PR = 1.23; 95% CI: 1.00 – 1.51) and South (PR = 1.50; 95% CI: 1.22 – 1.84) regions of the country, and lower among individuals aged ≥ 40 years (40–49 years: PR = 0.71; 95% CI: 0.56 – 0.88; 50–59 years: PR = 0.46; 95% CI: 0.36 – 0.58; ≥ 60 years: PR = 0.45; 95% CI: 0.36 – 0.56), and those who had health insurance (PR = 0.84; 95% CI: 0.72 – 0.99) (Table 1).

Table 2 shows that IPA was associated with lower consumption of in natura/minimally processed foods and higher consumption of UPF, reported on the day before the interview. Among insufficiently active individuals, consumption of 7 to 8 or 9 to 12 in natura/ minimally processed foods was lower by 16.0% and 27.0%, respectively. On the other hand, consumption of 3 or more UPFs was around 10% higher than the prevalence observed among physically active individuals.

Table 3 shows that IPA was associated with lower regular consumption (≥ 5 days/week) of raw vegetables (PR = 0.82; 95% CI: 0.78 – 0.85), cooked vegetables (PR = 0.88; 95% CI: 0.84 – 0.92), fruits (PR = 0.78; 95% CI: 0.75 – 0.82), and fruit juice (PR = 0.93; 95% CI: 0.89 – 0.97), and with higher regular consumption (≥ 3 days/week) of soft drinks/ juice cocktails (PR = 1.17; 95% CI: 1.11 – 1.23), when compared to physically active individuals.

Individuals who performed IPA had lower daily consumption of raw vegetables (2 times, PR = 0.93; 95% CI: 0.88 – 0.98), and fruits (2 times, PR = 0.89; 95% CI: 0.85 – 0.94; ≥ 3 times/day, PR = 0.84; 95% CI: 0.79 – 0.89), and fruit juice (≥ 2 glasses, PR = 0.93; 95% CI: 0.89 – 0.98) (Table 4).

Discussion

The results of this study showed the co-occurrence of

Table 1 – Prevalence of co-occurrence of insufficient physical activity and excessive consumption of ultra-processed foods in adults (≥ 20 years), according to sociodemographic characteristics. Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel), Brazil, 2018.

Parameter	n (%)	Prevalence of IPA and excessive consumption of UPFs % (95% CI)	p value[a]	Prevalence ratio $_{adjusted}$[b] (95% CI)
Gender				
Male	18,344 (45.5)	6.3 (5.58 – 7.16)	0.021	1.00
Female	32,720 (54.5)	7.6 (6.90 – 8.31)		1.26 (1.08 – 1.47)
Age group (years)				
20 to 29	5,896 (22.6)	9.6 (8.24 – 11.18)	< 0.001	1.00
30 to 39	6,607 (23.1)	8.1 (6.93 – 9.45)		0.83 (0.67 – 1.03)
40 to 49	7,716 (18.5)	7.0 (5.97 – 8.29)		0.71 (0.56 – 0.88)
50 to 59	9,864 (16.9)	4.6 (3.82 – 5.55)		0.46 (0.36 – 0.58)
60 and older	20,981 (18.9)	4.7 (4.09 – 5.32)		0.45 (0.36 – 0.56)
Level of education (years)				
0 to 8	14,483 (31.3)	6.1 (5.26 – 7.13)	0.033	1.00
9 or more	36,581 (68.7)	7.4 (6.79 – 8.07)		0.93 (0.76 – 1.13)
Ethnicity/skin color				
White	22,258 (45.0)	7.3 (6.55 – 8.21)	0.833	1.00
Black/Mixed/Yellow/Indigenous	24,046 (55.0)	7.2 (6.49 – 8.02)		0.91 (0.78 – 1.07)
Marital status				
No spouse	24,546 (50.1)	7.6 (6.87 – 8.43)	0.024	1.00
With spouse	26,248 (49.9)	6.4 (5.73 – 7.16)		0.99 (0.84 – 1.16)
Health insurance				
No	22,860 (54.1)	7.5 (6.77 – 8.33)	0.035	1.00
Yes	27,929 (45.9)	6.4 (5.75 – 7.13)		0.84 (0.72 – 0.99)
Macro region				
Central-West	7,925 (11.6)	6.2 (5.37 – 7.23)	0.001	1.00
Northeast	17,838 (25.1)	5.8 (5.22 – 6.37)		0.91 (0.76 – 1.09)
North	11,271 (10.2)	7.5 (6.48 – 8.70)		1.16 (0.94 – 1.43)
Southeast	8,027 (45.0)	7.4 (6.45 – 8.55)		1.23 (1.00 – 1.51)[c]
South	6,003 (8.1)	8.9 (7.76 – 10.28)		1.50 (1.22 – 1.84)
Total	51,064	7.0 (6.50 – 7.55)		

n (%) = Absolute frequency and weighted relative frequency; IPA = insufficient physical activity; UPF = ultra-processed foods (excessive consumption, ≥ 5 items); % (95% CI) = Prevalence and 95% confidence interval; a p-value from Pearson's chi-squared test (Rao-Scott); b Adjusted for gender, age, and level of education; c p = 0.045.

risk factors – IPA and excessive consumption of UPFs – reached 7.0% in the adult population of all 27 Brazilian state capitals (26 states plus the Federal District). It was higher among women and residents of the Southeast and South regions, and lower among individuals aged ≥ 40 years and those who had health insurance. An inverse association was observed between consumption of in natura/minimally processed foods and IPA, and a direct association with consumption of UPF. IPA was also associated with inadequate eating habits, characterized by lower consumption of vegetables, fruits, and fruit juice, and higher consumption of soft drinks and juice cocktails.

Regarding the co-occurrence of risk factors, population-based studies conducted in Campinas, São Paulo, found better diet quality among adult women (20-59 years old) and among elderly individuals who practiced physical activity during leisure time[12,13]. Cacau et al.[11], when assessing data from 14,779 participants in the Longitudinal Study of Adult Health (ELSA-Brazil), found higher mean scores in the Cardiovascular Health Diet Index (CHDI) in physically active and very physically active individuals, when compared to insufficiently active individuals. The CHDI assesses 11 components, including fruits, vegetables, fish, red

Table 2 – Prevalence of consumption of in natura and minimally processed foods and ultra-processed foods the day before the interview, according to insufficient physical activity in adults (≥ 20 years). Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel), Brazil, 2018.

Food consumption score (number of items/day before interview)	Insufficient physical activity (%)		Prevalence ratio $_{unadjusted}$ (95% CI)	Prevalence ratio $_{adjusted}$ [a] (95% CI)
	No	Yes		
In natura and minimally processed foods	p < 0.001[b]			
0 to 6	38.8	48.2	1.00	1.00
7 to 8	38.7	35.1	0.84 (0.81 – 0.88)	0.84 (0.80 – 0.88)
9 to 12	22.4	16.7	0.75 (0.70 – 0.79)	0.73 (0.68 – 0.77)
Ultra–processed foods	p = 0.009[b]			
0 to 2	50.9	51.5	1.00	1.00
3 to 4	31.1	32.8	1.02 (0.98 – 1.07)	1.12 (1.07 – 1.17)
5 to 13	18.0	15.7	0.92 (0.86 – 0.99)	1.10 (1.03 – 1.18)

a Prevalence ratio adjusted for age, gender, and level of education; 95% CI = 95% confidence interval; b p-value from Pearson's chi-squared test (Rao-Scott).

Table 3 – Prevalence of weekly food consumption among adults (≥ 20 years), according to insufficient physical activity. Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel), Brazil, 2018.

Regular food consumption	Insufficient physical activity (%)			Prevalence ratio $_{unadjusted}$ (95% CI)	Prevalence ratio $_{adjusted}$ [a] (95% CI)
	Total	No	Yes		
≥ 5 days/week					
Raw vegetables (p< 0.001)[b]	38.6	42.2	34.1	0.82 (0.78 – 0.86)	0.82 (0.78 – 0.85)
Cooked vegetables (p = 0.001)[b]	26.0	27.2	24.4	0.92 (0.87 – 0.97)	0.88 (0.84 – 0.92)
Fruits (p< 0.001)[b]	49.3	51.6	46.5	0.89 (0.86 – 0.93)	0.78 (0.75 – 0.82)
Fruit juice (p = 0.001)[b]	27.8	28.9	26.3	0.93 (0.89 – 0.97)	0.93 (0.89 – 0.97)
≥ 3 days/week					
Soft drink/ juice cocktails (p = 0.775)[b]	24.9	24.8	25.1	1.01 (0.96 – 1.06)	1.17 (1.11 – 1.23)

a Prevalence ratio adjusted for age, gender, and level of education; 95% CI = 95% confidence interval; b p-value from Pearson's chi-squared test (Rao-Scott).

Table 4 – Prevalence of daily food consumption among adults (≥ 20 years), according to insufficient physical activity. Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel), Brazil, 2018.

Consumption/type of food	Number of times per day	Insufficient physical activity (%)			Prevalence ratio $_{unadjusted}$ (95% CI)	Prevalence ratio $_{adjusted}$ [a] (95% CI)
		Total	No	Yes		
Raw vegetables (p = 0.001)[b]	Twice	26.3	27.6	24.5	0.91 (0.86 – 0.96)	0.93 (0.88 – 0.98)
Cooked vegetables (p = 0.257)[b]	Twice	32.2	32.7	31.6	0.97 (0.92 – 1.02)	0.99 (0.95 – 1.04)
Fruits (p < 0.001)[b]	Twice	34.1	34.8	33.1	0.92 (0.88 – 0.97)	0.89 (0.85 – 0.94)
	≥ 3 times	17.8	19.0	16.3	0.87 (0.81 – 0.92)	0.84 (0.79 – 0.89)
Fruit juice (p < 0.001)[b]	≥ 2 glasses	54.6	57.9	50.2	0.84 (0.80 – 0.88)	0.93 (0.89 – 0.98)
Soft drink (p = 0.003)[b]	≥ 2 glasses	56.8	58.6	54.6	0.91 (0.86 – 0.97)	1.04 (0.98 – 1.10)
Type of soft drink (p = 0.021)[b]	Diet	10.0	9.3	11.0	1.11 (1.02 – 1.20)	0.98 (0.90 – 1.06)

a Prevalence ratio adjusted for age, gender, and level of education; 95% CI = 95% confidence interval; b p-value from Pearson's chi-squared test (Rao-Scott).

meat, and UPFs, and higher scores indicate better compliance with dietary recommendations for cardiovascular health[11].

This study found that almost half of the insufficiently active adults reported consumption of three or more UPFs the day before the interview, showing that strategic interventions to promote physical activity and healthy eating habits are even more relevant, given the new scenario that emerged with COVID-19. Although this study was conducted before the pandemic, a study assessing data of individuals aged 18 and older from the ConVid virtual health survey, found a sig-

nificant decrease in the practice of sufficient physical activity and regular consumption of vegetables, and an increase in UPF consumption during this period[20].

Our study also found a significant association between higher consumption of UPF and IPA. In a cross-sectional study conducted in the United Kingdom, Rauber et al.[21] found no association between UPF consumption and physical activity, although they assessed UPF consumption differently (average contribution to total calories in the diet). In Belo Horizonte, Minas Gerais, Gomes et al.[15] reported a higher likelihood of unhealthy eating habits among individuals who did not practice recommended physical activity in leisure time (OR = 1.58; 95% CI: 1.33 - 1.88).

In our study, the isolated prevalence of IPA reached 44.5% among adults. Between 2001 and 2016, the prevalence of IPA remained stable worldwide (28.5% to 27.5%, respectively) in the population aged 18 and older[22]. In Brazil, data from Vigitel show the frequency of IPA remained stable from 2013 to 2020, ranging from 49.4% to 47.2%[23]. Although information from the Vigitel system (2006-2016) showed an upward trend in the practice of physical activity during leisure time, and for the domains of commuting and work, the trend remained stable[24]. Regarding food consumption, in this study, 17.0% of adults reported excessive consumption of UPF (scores equal to or greater than five subgroups consumed the previous day), with a prevalence of 18.2% (95% CI: 17.4 - 19.0) in the population aged ≥ 18 years living in the 27 capitals of Brazil (26 states plus the Federal District)[25]. It should be noted that both risk behaviors (7.0%) have different effects when considered simultaneously, affecting more frequently women, young people (20 to 29 years old), people without health insurance, and those living in the Southeast and South regions. In a cross-sectional study conducted with university students at a private institution in Brasília, Brazil, 44.2% of the individuals showed a low level of physical activity (< 150 minutes/week) and this behavior was associated with lower regular consumption (≥ 5 times/week) of fruits, vegetables, and legumes, and higher consumption of soft drinks and high-fat meats[14]. These findings are consistent with those of our study, which found lower consumption of healthy foods and higher consumption of unhealthy foods among insufficiently active individuals.

Considering the results of our study, in order to increase population access to physical activity and the adoption of healthy eating habits in Brazil, enforcement of existing policies for primary health care should be intensified – in particular, the Health Gym Program (*Programa Academia da Saúde*), which aims to encourage the practice of guided physical exercise and healthy lifestyles through the creation of public spaces in communities[26-29], and the Dietary Guidelines for the Brazilian population (*Guia Alimentar para a População Brasileira*), which addresses the principles and recommendations for appropriate healthy eating habits[26-28,30].

This study has some limitations, such as possible memory bias (mainly due to the lack of regularity in food consumption) and information in the responses related to healthy lifestyle habits. In this sense, physical activity may be overestimated and UPF consumption may be underestimated, especially among adults. It is also important to consider the differences between adults and elderly individuals in terms of physical activity, although this study considered the population aged ≥ 20 years. The cross-sectional nature of our study, which is characterized by the simultaneous measurement of exposure and outcome, does not allow the observed associations to be considered as causal. Regarding sample restriction to individuals with a landline, Vigitel assigns a post-stratification weight to every respondent, allowing statistical inference of the results for the adult population in each city[16].

This study identified the main population subgroups with both modifiable risk behaviors, which should be a cause of concern for health promotion and prevention strategies. Modifiable risk factors should be considered together when implementing interventions to change lifestyle habits that promote benefits to the health and well-being of the population. For this reason, health professionals should adopt a broader approach with patients and consider the co-occurrence of modifiable risk factors aiming to reduce and delay the occurrence of NCDs.

This study also revealed that IPA was associated with inadequate eating habits, such as less frequent consumption of vegetables, fruits, fruit juices, and other in natura and minimally processed foods, and more frequent consumption of soft drinks/ juice cocktails and other UPFs. In terms of public administration, it is important to intensify the implementation of policies that encourage the practice of physical activity and the adoption of healthy eating habits. The subgroups most affected by both risk behaviors should be prioritized in health promotion and disease prevention strategies.

Conflict of interest

The authors have no conflicts of interest to declare.

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Contribution of authors

Ruiz AMP: Methodology, data analysis, design of data presentation, writing of the original manuscript, approval of the final version of the manuscript. Assumpção D: Conceptualization, methodology, data analysis, data curation, supervision, design of data presentation, writing of the original manuscript, text revision and editing, approval of the final version of the manuscript. Fialho PMM: Methodology, writing the original manuscript, approval of the final version of the manuscript. Francisco PMSB: Conceptualization, methodology, data curation, supervision, design of data presentation, writing of the original manuscript, text revision and editing, approval of the final version of the manuscript.

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Availability of research data and other materials

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