

ORIGINAL**Collective Health****Editor**

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Data Availability

The research data are openly available in the Instituto Brasileiro de Geografia e Estatística (IBGE) repository at <https://www.ibge.gov.br/estatisticas/sociais/saude/9160-pesquisa-nacional-de-saude.html?=&t=downloads>.

Conflict of interest

The authors declare that there are no conflicts of interest.

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Food intake and prevalence of cardiovascular diseases in the Brazilian adult population: National Health Survey 2019

Consumo alimentar e prevalência de doenças cardiovasculares na população adulta brasileira: Pesquisa Nacional de Saúde 2019

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ABSTRACT

Objective

To evaluate the association between dietary intake and the prevalence of cardiovascular diseases in the Brazilian adult population in 2019.

Methods

This is a cross-sectional study in the Brazilian adult population, with data from the 2019 National Health Survey. Food intake was investigated through the adequate frequency of food groups intake that are markers of healthy intake (fruits and vegetables, beans and fish) and the frequency of regular consumption of markers of unhealthy intake (soft drinks, artificial juices and sweets) and estimated in consumption proportion (%). The association between food intake and prevalence of cardiovascular diseases prevalence was obtained by Poisson regression with robust variance, using Stata[®] software.

Results

Among individuals who had cardiovascular diseases, 62% had adequate fruit and vegetables intake, with a prevalence of cardiovascular diseases 13% lower than those who did not have adequate intake. The prevalence of cardiovascular diseases was higher in those with adequate fish intake and lower in those with regular soft drinks intake, artificial juices and sweets. In women aged 20 to 39 years the prevalence of cardiovascular diseases was higher in those with regular artificial juices intake. In women aged 40 to 59 years the prevalence of cardiovascular diseases was lower in those with regular sweets intake.

Conclusion

These results provide information about Brazilian's population health and contribute to guide actions to promote healthy food intake, which should be based on encouraging increased consumption of fish, fruits and vegetables, and reducing consumption of sweets and artificial drinks.

Keywords: Cardiovascular diseases. Diet. Eating. Food.

RESUMO

Objetivo

Avaliar a associação entre o consumo alimentar e a prevalência de doenças cardiovasculares na população adulta brasileira em 2019.

Métodos

Trata-se de um estudo transversal com dados da Pesquisa Nacional de Saúde 2019. O consumo alimentar foi investigado através da frequência de consumo adequado dos grupos de alimentos marcadores de alimentação saudável (frutas e verduras, feijão e peixes) e frequência de consumo regular dos grupos marcadores de alimentação não saudável (refrigerantes, sucos de caixa, refresco em pó e doces) e estimado em proporção (%) de consumo. A associação entre o consumo alimentar e a prevalência de doenças cardiovasculares foi obtida pela regressão de Poisson com variância robusta, utilizando o software Stata®.

Resultados

Dentre os indivíduos que apresentaram doenças cardiovasculares, 62% apresentaram consumo alimentar adequado de frutas e verduras, com uma prevalência de doenças cardiovasculares 13% menor em relação a quem não apresentou consumo adequado. A prevalência de doenças cardiovasculares foi maior em quem apresentava consumo adequado de peixes e menor em quem apresentava consumo regular de refrigerantes, sucos artificiais e doces. Nas mulheres de 20 a 39 anos, a prevalência de doenças cardiovasculares foi maior em quem apresentava consumo regular de sucos artificiais. Nas mulheres de 40 a 59 anos, a prevalência de doenças cardiovasculares foi menor em quem apresentava consumo regular de doces.

Conclusão

Os resultados fornecem informações sobre a saúde da população brasileira e contribuem para nortear as ações de promoção da alimentação saudável.

Palavras-chave: Doenças cardiovasculares. Dieta. Ingestão de alimentos. Consumo alimentar. Alimentos.

INTRODUCTION

The consumption of in natura foods, such as fruits, vegetables, and beans, is recognized as a significant marker of healthy dietary patterns and, consequently, offers protection against various diseases. A primary line of evidence supporting this association lies in the presence of micronutrients and bioactive compounds or phytochemicals [1]. Furthermore, the consumption of this food group supports local food cultures practices and promotes a sustainable food system, encompassing social and environmental dimensions by mitigating the impact of food production and distribution [2]. Conversely, elevated consumption of sodium and sugars has been linked to an increased risk of Noncommunicable Chronic Diseases (NCDs), attributed to mechanisms such as elevated blood pressure, increased glycemia, insulin resistance, increased energy intake, and weight gain [3-5].

NCDs arise from a confluence of genetic, physiological, environmental, and behavioral factors and are typically long-lasting. This group includes cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes [6]. Cardiovascular Diseases (CVDs) account for the highest percentage of premature mortality in the countries of the Americas, followed by cancer [7,8], and can manifest in chronic or acute forms [9,10].

Unplanned urbanization and unhealthy lifestyle choices, including imbalanced diets, physical inactivity, tobacco and alcohol consumption, and population aging, are identified as major risk

factors for the occurrence of these diseases. A systematic analysis from the Global Burden of Disease study [6] identified high sodium intake, low whole grain intake, and low fruit intake as the leading dietary risk factors for NCD-related mortality and morbidity globally [6]. In Brazil, the 2019 *Pesquisa Nacional de Saúde* (PNS, National Survey of Health) revealed a higher prevalence of CVDs among men, individuals aged 60 years and older, those with low educational attainment, individuals of white ethnicity, those with an income of 3 to 5 minimum salaries (monthly), and residents of the Southern region of the country [11].

Given the substantial influence of adequate nutrition on the development and progression of CVDs [5,12,13], the objective of this article is to analyze the association between dietary consumption and the prevalence of CVDs in Brazilian adults using data from a population-based study conducted in 2019, and to identify associated factors (demographic, socioeconomic, lifestyle, and health-related).

Understanding this association is relevant for the broad planning of population-based prevention strategies aimed at reducing risk factors for CVDs. The study hypothesizes that the consumption of fruits and vegetables, beans, and fish is either not associated with or is associated with a lower prevalence of CVDs, whereas the consumption of soft drinks, processed juices, and sweets is associated with a higher prevalence of CVDs.

METHODS

This cross-sectional study was conducted using data from the 2019 PNS, collected between August 26, 2019, and March 13, 2020. The study targeted the Brazilian adult population aged 20 to 59 years.

The PNS population comprised individuals aged 15 years or older, residing in private permanent households across the entire national territory, excluding areas with special characteristics, such as military bases and bunkhouses, Indigenous villages, hospitals, rural settlements, *quilombola* communities, among others [14]. The sample was selected using a three-stage cluster sampling method, with stratification of the Primary Sampling Units (PSUs). Census tracts were the primary units, households the second-stage units, and residents aged 15 years or older the third-stage units [14]. Sample expansion was performed using expansion factors or sampling weights for PSUs, households, all residents, and the selected resident who answered the questionnaire. The planned sample comprised 108,525 households, and the final sample included 94,114 households with completed interviews, with a response rate of 93.6% [14].

Dietary data were obtained from responses to the 2019 PNS questionnaires available on the Instituto Brasileiro de Geografia e Estatística (IBGE, Brazilian Institute of Geography and Statistics) website (Module P – Lifestyle) [14]. Data on dietary habits of individuals were collected, considering the frequency of consumption (weekly and daily). The food groups analyzed were: Recommended fruit and vegetable intake (5 or more days/week), recommended bean consumption (5 or more days/week), recommended fish consumption (at least 1 day/week), regular soft drink intake (5 or more days/week), regular intake of processed juices (5 or more days/week), regular intake of sweet foods (5 or more days/week), regular replacement of lunch with snacks (5 or more days/week), and perceived excessive salt intake (high or very high salt consumption). Dietary intake was assessed based on the frequency of adequate intake for fruits and vegetables, beans, and fish, and regular intake for soft drinks, artificial juices, sweets, lunch replacement with snacks, and high salt consumption, expressed as proportion (%).

A category termed Cardiovascular Diseases (CVD) was created, which included self-reported medical diagnoses of at least one of the following: Hypertension (SAH), Heart Disease (HD - myocardial infarction, angina, heart failure), and/or stroke [14]. Data regarding CVD prevalence were expressed as percentages (%).

Demographic variables analyzed included major regions (North, Northeast, Southeast, South, and Midwest) and place of residence (urban and rural areas); sociodemographic variables included sex (male and female), age group (20-39 and 40-59 years), age (continuous), educational attainment (no education and incomplete primary education, complete primary and incomplete secondary education, complete secondary and incomplete higher education, and complete higher education), and race/skin color (White, Black, and Yellow/Indigenous), with the Black category comprising individuals self-identified as Black or brown [15]; pre-existing conditions included self-reported medical diagnoses of diabetes and dyslipidemia; and lifestyle variables included physical inactivity, tobacco use, and alcohol consumption [14].

Physical activity was classified using the indicator: adequate physical activity during leisure time (individuals aged 18 or older who engaged in 75 or more minutes/week of vigorous physical activity or 150 or more minutes/week of light or moderate physical activity) [14]. This was later categorized as physical inactivity. Smoking was classified using the indicator: current use of tobacco products (individuals aged 18 or older who smoked cigarettes or other tobacco products that produce or do not produce smoke, or smokeless tobacco products) [14]. Alcohol consumption was classified using the indicator: regular alcohol consumption (individuals aged 18 or older who consumed alcohol on 5 or more days per week) [14].

Food consumption and CVD prevalence among the Brazilian population were described as proportions (%) according to demographic, socioeconomic, lifestyle, and health characteristics. Exploratory data analysis procedures were used, including relative frequencies for categorical variables, and means and standard deviations for continuous variables. Associations between food consumption percentages and CVD prevalence were analyzed using Prevalence Ratios (PR) obtained by Poisson regression with robust variance.

A significance level of $p < 0.05$ was adopted for all analyses. Bivariate analyses were performed to obtain crude PRs and 95% confidence intervals (95% CI). For multivariate analyses, variables with $p < 0.2$ or close to this value in the crude analyses were included in the model, and some variables were later removed to achieve the best model fit [16]. The Yellow/Indigenous category was excluded from the adjusted multivariate model due to the small number of observations. Statistical analyses were performed using Stata[®] version 14.0, accounting for complex sampling. The "svyset" command was used to define sample expansion, considering PSUs, strata (geographical and urban/rural situation), and the weight of the selected resident [17].

This study was approved by the *Comitê de Ética em Pesquisa* (CEP, Research Ethics Committee) of the School of Medicine at the Universidade Federal Fluminense (UFF, Fluminense Federal University) (*Certificado de Apresentação de Apreciação Ética* [CAAE, Certificate of Presentation for Ethical Appreciation]: 58122322.6.0000.5243, approval no. 5.412.444).

RESULTS

This study included 62,474 individuals of both sexes. Table 1 presents the prevalence and crude Prevalence Ratios (PR) of sociodemographic, health, and lifestyle characteristics of the individuals according to the presence of CVD. Male individuals exhibited a lower prevalence of CVD (39%),

while the Black race/skin color showed the highest prevalence of CVD (56%), although this was not statistically significant. The age group of 40 to 59 years presented the highest prevalence of CVD (81%), and for each one-year increase in age, the prevalence of CVD increased by 6%.

Regarding educational attainment, a gradient was observed: the lower the education levels, the higher the prevalence of CVD. The Southeast region exhibited the highest CVD prevalence (49%). Residents of urban areas also had a higher prevalence of CVD compared to rural residents (6%). In terms of health variables, individuals with diabetes and dyslipidemia showed higher CVD

Table 1 – Prevalence of cardiovascular disease in the Brazilian adult population according to sociodemographic, health, and lifestyle characteristics (PNS, 2019) (N=62,474).

Variables	Cardiovascular Disease			
	Prevalence (%)	p-value	Crude PR ¹ (95% CI)	p-value
Total	20		-	
Sex				
Female		0.00*		0.00*
Male	39		0.77 (0.74; 0.79)	
Race/Skin color				
White		0.29		
Black	56		1.03 (1.00; 1.07)	0.07
Yellow/Indigenous	1		0.98 (0.85; 1.12)	0.75
Age Range				
20-39 years		0.00*		
40-59 years	81		-	
Age	48	0.00*	1.06 (1.06; 1.06)	0.00*
Educational Attainment				
Complete Higher Education		0.07		
Complete Secondary and Incomplete Higher Education	36		0.97 (0.92; 1.01)	0.16
Complete Primary and Incomplete Secondary Education	39		1.32 (1.26; 1.38)	0.00*
No schooling and Incomplete Primary Education	10		2.11 (1.99; 2.23)	0.00*
Major Regions				
North		0.08		
Northeast	24		1.21 (1.15; 1.26)	0.00*
Southeast	49		1.36 (1.29; 1.43)	0.00*
South	14		1.26 (1.19; 1.34)	0.00*
Midwest	8		1.22 (1.15; 1.30)	0.00*
Place of Residence				
Rural		0.97		0.01*
Urban	87		1.06 (1.02; 1.10)	
Diabetes				
No		0.00*		0.00*
Yes	19		3.03 (2.93; 3.14)	
Dyslipidemia				
No		0.00*		0.00*
Yes	29		2.58 (2.50; 2.66)	
Physical Inactivity				
No		0.29		0.00*
Yes	29		0.77 (0.74; 0.80)	
Smoking				
No		0.40		0,98
Yes	16		1.00 (0.95; 1.05)	
Alcohol Consumption				
No		0.38		0.00*
Yes	8		1.31 (1.17; 1.46)	

Note: *p-value <5%. Chi-squared test. ¹PR: Prevalence Ratio.

prevalence. Among lifestyle variables, CVD was more prevalent in those engaging in physical activity and with excessive alcohol consumption.

Table 2 displays the prevalence and crude PR of food consumption variables among the study participants. Among individuals with CVD, 62% reported adequate fruit and vegetable consumption, with a 13% lower prevalence of CVD compared to those with inadequate consumption. The prevalence of CVD was lower in individuals with regular consumption of soft drinks, processed juices, and sweets.

Table 2 – Food intake of the Brazilian adult population according to the presence of cardiovascular disease (PNS, 2019) (N=62,474).

Variables	Cardiovascular Disease			
	Prevalence (%)	<i>p</i> -value	Crude PR ¹ (95% CI)	<i>p</i> -value
Adequate Consumption				
Fruits and Vegetables				
No		0.01*		0.00*
Yes	62		0.87 (0.84; 0.90)	
Beans				
No		0.60		0.45
Yes	30		0.99 (0.96; 1.02)	
Fish				
No		0.72		0.21
Yes	57		1.02 (0.99; 1.05)	
Regular Consumption				
Soft Drinks				
No		0.50		0.00*
Yes	11		0.79 (0.74; 0.84)	
Processed Juices				
No		0.38		0.00*
Yes	11		0.91 (0.86; 0.95)	
Sweets				
No		0.70		0.00*
Yes	14		0.83 (0.79; 0.87)	
Lunch Replacement				
No		0.69		0.20
Yes	2		0.92 (0.82; 1.04)	
Excess Salt				
No		0.96		0.39
Yes	14		0.98 (0.93; 1.03)	

Note: **p*-value <5%. Chi-squared test; ¹PR: Prevalence Ratio.

Table 3 shows the adjusted PR for food consumption variables, sociodemographic, health, and lifestyle characteristics of the study participants according to the presence of CVD. The prevalence of CVD was higher in those with adequate fish consumption. Among sociodemographic and lifestyle variables, the prevalence of CVD was lower in males and in physically inactive individuals. The prevalence of CVD was higher in the Black race/skin color (PR=1.14), in the Southeast region (PR=1.18), in individuals with diabetes (PR=1.74) and dyslipidemia (PR=1.74), and with increasing age.

Table 4 presents the adjusted PR stratified by sex and age group for the study variables according to the presence of CVD. Among women aged 20 to 39 years, a higher prevalence of CVD was observed in those with regular consumption of artificial juices. Higher CVD prevalence was also associated with Black race/ethnicity, diabetes, dyslipidemia, and excessive alcohol consumption. The prevalence of CVD was lower in the Black race/ethnicity and higher in those with diabetes, dyslipidemia, and excessive alcohol consumption.

Table 3 – Adjusted Poisson Regression of food intake, sociodemographic, health, and lifestyle characteristics of the Brazilian adult population according to the presence of cardiovascular disease (PNS, 2019) (N=62,474).

Variables	Cardiovascular Disease	
	Adjusted PR ¹ (95% CI)	p-value
Adequate Consumption		
Fruits and Vegetables		
No		
Yes	1.03 (1.00; 1.07)	0,07
Fish		
No		
Yes	1.07 (1.03; 1.10)	0.00*
Sex		
Female		
Male	0.80 (0.78; 0.83)	0.00*
Race/Skin color		
White		
Black	1.14 (1.10; 1.18)	0.00*
Age	1.05 (1.05; 1.05)	0.00*
Major Regions		
North		
Northeast	1.10 (1.05; 1.15)	0.00*
Southeast	1.18 (1.12; 1.24)	0.00*
South	1.15 (1.09; 1.23)	0.00*
Midwest	1.12 (1.06; 1.19)	0.00*
Diabetes		
No		
Yes	1.74 (1.67; 1.81)	0.00*
Dyslipidemia		
No		
Yes	1.74 (1.68; 1.79)	0.00*
Physical Inactivity		
No		
Yes	0.88 (0.85; 0.91)	0.00*

Note: * $p < 0.001$. ¹Adjusted PR for adequate consumption of fruits and vegetables, adequate consumption of fish, sex, race/color, age, major regions, diabetes, dyslipidemia, and physical inactivity.

Table 4 – Adjusted and stratified Poisson regression by sex and age range of food intake, sociodemographic, health, and lifestyle characteristics of the Brazilian adult population according to the presence of cardiovascular disease (PNS, 2019) (N=62,474).

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Variables	Cardiovascular Disease			
	Male		Female	
	Adjusted PR ¹ (95% CI)	p-value	Adjusted PR ¹ (95% CI)	p-value
Age Range – 20-39 years				
Adequate Consumption				
Fruits and Vegetables				
No				
Yes	1.00 (0.80; 1.24)	0.99	1.11 (0.89; 1.38)	0.37
Regular Consumption				
Soft Drinks				
No				
Yes	1.04 (0.82; 1.33)	0.73	0.92 (0.68; 1.25)	0.60
Processed Juices				
No				
Yes	0.93 (0.71; 1.22)	0.59	1.35 (1.05; 1.73)	0.02*

Table 4 – Adjusted and stratified Poisson regression by sex and age range of food intake, sociodemographic, health, and lifestyle characteristics of the Brazilian adult population according to the presence of cardiovascular disease (PNS, 2019) (N=62,474).
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Variables	Cardiovascular Disease			
	Male		Female	
	Adjusted PR ¹ (95% CI)	p-value	Adjusted PR ¹ (95% CI)	p-value
Age Range – 20-39 years				
Adequate Consumption				
Sweets				
No				
Yes	0.80 (0.60; 1.05)	0.11	0.90 (0.69; 1.16)	0.40
Race/Skin color				
White				
Black	0.83 (0.69; 1.0)	0.04*	1.37 (1.11; 1.69)	0.00*
Diabetes				
No				
Yes	3.00 (1.94; 4.63)	0.00*	2.35 (1.57; 3.52)	0.00*
Dyslipidemia				
No				
Yes	3.29 (2.64; 4.10)	0.00*	2.24 (1.74; 2.87)	0.00*
Alcohol Consumption				
No				
Yes	1.58 (1.13; 2.21)	0.01*	1.61 (1.02; 2.54)	0.04*
Age Range – 40-59 years				
Adequate Consumption				
Fruits and Vegetables				
No				
Yes	1.01 (0.92; 1.12)	0.77	1.10 (0.98; 1.23)	0.09
Regular Consumption				
Soft Drinks				
No				
Yes	1.05 (0.90; 1.23)	0.51	0.90 (0.71; 1.13)	0.35
Processed Juices				
No				
Yes	1.01 (0.87; 1.18)	0.86	0.90 (0.74; 1.11)	0.33
Sweets				
No				
Yes	0.87 (0.75; 1.01)	0.08	0.79 (0.65; 0.97)	0.02*
Race/Skin color				
White				
Black	1.02 (0.93; 1.11)	0.68	1.23 (1.10; 1.38)	0.00*
Diabetes				
No				
Yes	2.03 (1.82; 2.25)	0.00*	1.83 (1.59; 2.11)	0.00*
Dyslipidemia				
No				
Yes	1.77 (1.61; 1.94)	0.00*	1.65 (1.48; 1.85)	0.00*
Alcohol Consumption				
No				
Yes	1.16 (1.03; 1.32)	0.02*	0.74 (0.52; 1.05)	0.09

Note: *p<0.001. ¹Adjusted PR for adequate consumption of fruits and vegetables, regular consumption of soft drinks, artificial juices, sweets, race/color, diabetes, dyslipidemia, and alcohol consumption.

Among female individuals aged 40 to 59 years, the prevalence of CVD was lower in those with regular consumption of sweets and higher in the Black race/skin color, diabetes, and dyslipidemia. Among male individuals aged 40 to 59 years, the prevalence of CVD was higher in the following variables: diabetes, dyslipidemia, and excessive alcohol consumption.

DISCUSSION

This study analyzed the association between the dietary intake of the Brazilian population in 2019 and the prevalence of CVDs, stratified by sociodemographic, health, and lifestyle characteristics.

A higher prevalence of CVDs was observed among individuals who reported consuming fish at least once a week, a finding contrary to expectations. A systematic review investigating fish consumption and cardiovascular health indicated that non-fried fish intake was associated with a reduced risk of CVD [18]. Similarly, a meta-analysis reported an inverse relationship between fish consumption and the risk of CVD mortality [19]. The unexpected results of the present study could be attributed to its cross-sectional design and a possible reverse causality, where individuals with CVD might have altered their consumption of foods considered cardioprotective, such as fish, as a consequence of their condition. Furthermore, the lack of detailed information on fish preparation methods might have influenced the study's outcome, as fried fish consumption could elevate CVD prevalence.

Data from individuals selected in this study demonstrated that the prevalence of CVD in those who had adequate dietary intake of fruits and vegetables was 62% and 30% in those who had adequate consumption of beans. Data from the 2017-2018 *Pesquisa de Orçamentos Familiares* (POF, Consumer Expenditure Survey) show a reduction in the consumption of rice and beans by the Brazilian population, as well as a reduction in fruit consumption [14]. On the other hand, the prevalence of CVD was a little over 10% in those who consumed soft drinks, processed juices, sweets and replaced lunch with snacks.

An inverse association was also noted between the regular consumption of soft drinks, processed juices, and sweets and CVD prevalence. This could be explained by the less frequent consumption of these items among individuals already diagnosed with CVD, who might be adhering to disease-specific diets and guidelines, or due to a possible reverse causality. A study using the 2013 *Pesquisa Nacional de Saúde* (PNS, National Survey of Health) assessed markers of unhealthy foods related to NCDs (saturated fats and sugars) and identified a risk profile in the Brazilian population, with a high prevalence (above 20%) of unhealthy food consumption [20].

In this study, stratified analyses by sex and age group revealed a direct association between processed juice consumption and CVD prevalence in women and those aged 20 to 39 years. A review of prospective studies observed an increased risk of developing cardiovascular complications and mortality with the consumption of sugar-sweetened and artificially sweetened beverages, although without establishing causality [18]. Another systematic review and meta-analysis found that habitual consumption of sugar-sweetened beverages was associated with CVD morbidity and mortality in a dose-response manner [21]. The proposed mechanism involves excessive energy intake, reduced satiety, and increased hunger, contributing to weight gain and an elevated risk of diseases such as obesity [18,22].

An inverse association was also observed between the consumption of sweet foods and CVD prevalence in women aged 40 to 59 years, possibly resulting from dietary changes following a CVD diagnosis. The consumption of added sugar has doubled in Brazil, particularly through soft drinks and biscuits, exceeding the maximum limit recommended by the World Health Organization (WHO) by over 60% [23]. In 2015, WHO revised its sugar intake recommendations, advising a reduction to less than 10% of Total Energy Value (VET) due to its association with weight gain [24].

Regarding sociodemographic characteristics, a lower prevalence of CVD was found among men. This could be attributed to women's greater tendency to seek healthcare services, leading to

increased access to diagnosis. Data from the 2019 PNS indicated that nearly 70% of primary healthcare users are women and 60% are Black individuals [25]. However, other studies have reported a higher prevalence of CVD in men, potentially due to their higher rates of risk factors such as smoking, excessive alcohol consumption, inadequate diet, and SAH [11,25,26]. It is important to note the higher male mortality rates from infectious and degenerative diseases, as well as external causes like accidents, which may lead to men dying before women [27,28].

A higher prevalence of CVD was observed in Black individuals, reinforcing existing literature on racial disparities [27]. Stratification by sex and age revealed an even higher prevalence among Black women across all age groups, highlighting the intersectionality of sex and race/skin color as factors contributing to greater vulnerability. A US study found an association between race/skin color and sex and the incidence of Acute Coronary Events (ACE), identifying a higher risk of fatal ACE in Black individuals compared to White individuals, linked to a greater burden of risk factors. This association varied by sex, with Black women exhibiting a higher risk [29]. Another U.S. study examining ischemic heart disease mortality found that young Black women had a higher risk of mortality, attributed to a higher prevalence of risk factors like obesity, SAH, and diabetes, as well as adverse socioeconomic conditions, stress, and other contributing factors [30].

A direct association was found between age and CVD prevalence, with the 40 to 59 age group exhibiting the highest prevalence. This expected result aligns with existing literature, due to factors such as aging and longer exposure to behavioral risk factors for these diseases over the lifespan [11,31]. Beyond the inherent biological changes of aging, diseases in this age group result from the cumulative effects of detrimental factors throughout life, stemming from genetic interactions and lifestyle habits [32].

The higher prevalence of CVD in urban regions of Brazil observed in this study underscores the risks associated with contemporary lifestyles within the context of post-industrialization and urbanization, coupled with demographic and epidemiological transitions. These shifts have led to changes in dietary patterns and an increase in other risk factors for chronic diseases, such as alcohol consumption, smoking, and physical inactivity [33,34]. A study in a Latin American city found that individuals residing in neighborhoods with poorer socioeconomic conditions had a higher likelihood of CVD, highlighting inequalities in healthcare access [35].

Regarding lifestyle-related factors, this study demonstrated a lower prevalence of CVD in physically inactive individuals, which could also be a result of reverse causality, given current recommendations promoting a healthy lifestyle with regular physical activity as crucial for preventing new cardiovascular events [36]. A randomized clinical trial in the city of Recife (state of Pernambuco – Brazil), assigned individuals with a history of CVD to a behavioral change program including physical activity and healthy eating, observing improvements in blood pressure among hypertensive individuals, a strong predictor of cardiovascular events [37].

In this study, the prevalence of CVD was 31% higher for individuals who reported consuming alcohol on 5 or more days per week. Multivariate and stratified analyses also showed a direct association between regular alcohol consumption and CVD prevalence, with this prevalence being higher in the 20 to 39 age group, regardless of sex. In the 40 to 59 age group, regular alcohol consumption was also directly associated with CVD prevalence, but only in men.

Alcohol is a risk factor for various diseases, including CVDs, certain cancers, and liver problems [38]. The 2013 PNS investigated abusive alcohol consumption, defined as consuming 5 or more doses for men and 4 or more doses for women on one occasion, finding a prevalence of 13.7%. This prevalence was significantly higher in men (21.6%) compared to women (6.6%) – a difference of

3.3 times [39]. Data from the 2019 survey *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone) – indicated an increase in this percentage to 18.8%, remaining higher in men (25.3%) than in women (13.3%), suggesting an increase in alcohol consumption among the Brazilian population in recent years [40].

Another finding was the significant increase in CVD prevalence among individuals with comorbidities. This result was expected, as diabetes and dyslipidemia are considered classic risk factors for CVDs, given that excessive consumption of sugars and dietary fats, especially saturated and trans fats, can contribute to arterial obstruction, elevated blood pressure, and elevated blood glucose – conditions frequently present in individuals with diabetes and dyslipidemia [3,9,41].

The prevalence of CVD exhibited an inverse association with the level of education in a gradient manner; lower education levels were associated with a higher prevalence of CVD. Another socioeconomic variable used in this study was race/skin color. The relationship between CVD mortality and socioeconomic indicators such as education and race/skin color is well-established. These variables are linked to income, which in turn influences access to healthcare resources like medications and complementary exams, information, and better living conditions [42-44]. It is crucial to reflect on the social determination of the health-disease process and structural racism as a means of perpetuating health inequalities, denying access to healthcare services and/or quality care to the Black population [45].

Among the strengths of this study are the data derived from a frequently conducted national survey with a complex and representative sample of the Brazilian population. Furthermore, it was possible to examine data on the consumption of healthy and unhealthy markers, health status, lifestyle factors, and sociodemographic factors, and to adjust the model to minimize the effect of other variables on the outcome. Limitations include the inability to establish cause-and-effect relationships, potentially leading to reverse causality. Additionally, possible interactions between exposure variables might have altered the expected effect of some results. Selective survival, i.e., the loss of more severely ill individuals due to death, could also represent a bias, as could the exclusion of certain population groups from the PNS study sample. The inability to analyze data on Body Mass Index (BMI), given that obesity can be a confounding factor and is a risk factor for the outcome, might have also weakened the study. Moreover, the data were obtained from a Food Frequency Questionnaire for some food markers and not the quantity consumed in grams, which can be considered a limitation, especially for alcohol consumption.

CONCLUSION

This study offers valuable insights for informing the planning of cardiovascular disease prevention strategies by identifying population profiles that warrant greater attention within the field of public health.

Interventions aimed at reducing modifiable risk behaviors, particularly excessive alcohol consumption and processed juice intake, are necessary. It is important to direct health promotion and disease prevention efforts towards Black women and residents of urban areas, as well as to enhance the monitoring of individuals with dyslipidemia and diabetes. Consideration should be given to the social determination of the health-disease process through the lens of race/skin color and sex intersectionality.

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