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Factors associated with cardiovascular disease in the Brazilian adult population: National Health Survey, 2019

Fatores associados às doenças cardiovasculares na população adulta brasileira: Pesquisa Nacional de Saúde, 2019

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ABSTRACT: ***Objective*:** to estimate the prevalence and investigate the sociodemographic, health, and lifestyle factors associated with the self-reported diagnosis of Cardiovascular Disease (CVD) in the adult Brazilian population. ***Methods*:** Data from the National Health Survey (PNS 2019) were analyzed. The presence of CVD was self-reported through the question: "Has any doctor ever given you a diagnosis of heart disease?". Sociodemographic factors, health conditions, and lifestyle were evaluated. For data analysis, Poisson Regression with robust variance was used. ***Results*:** 5.3% (95%CI 5.04–5.57) of Brazilian adults reported CVD, of which, 29.08% (95%CI 27.04–31.21) underwent coronary artery bypass surgery or angioplasty and 8.26% (95%CI 7.09–9.6) reported severe limitation in usual activities due to CVD. The factors associated with CVD were advanced age; being male; white race/color; complete middle school and incomplete high school education; have health insurance; self-assessing health as regular or bad/very bad; self-reported hypertension, high cholesterol, and diabetes; being a former smoker; consuming fruits and vegetables as recommended; not consuming alcohol in excess; and not practicing leisure-time physical activity. ***Conclusions*:** CVD is associated with sociodemographic, health, and lifestyle factors. It is important to support public policies, programs, and goals for the reduction of cardiovascular diseases in Brazil, especially in the most vulnerable groups.

Keywords: Cardiovascular diseases. Risk factors. Health surveys. Brazil

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RESUMO: ***Objetivo:*** Estimar a prevalência e investigar os fatores sociodemográficos, de saúde e estilo de vida associados ao diagnóstico autorreferido de doença cardiovascular na população adulta brasileira. ***Métodos:*** Analisaram-se dados da Pesquisa Nacional de Saúde (2019). A presença de doença cardiovascular foi autorreferida por meio da pergunta: "Algum médico já lhe deu o diagnóstico de uma doença do coração?". Avaliaram-se fatores sociodemográficos, condições de saúde e estilo de vida. Para analisar os dados, utilizou-se a regressão de Poisson com variância robusta. ***Resultados:*** 5,3% (IC95% 5,04–5,57) dos adultos brasileiros referiram doença cardiovascular, destes, 29,08% (IC95% 27,04–31,21) realizaram cirurgia de revascularização miocárdica ou angioplastia coronariana e 8,26% (IC95% 7,09–9,60) relataram limitação intensa nas atividades habituais pela doença cardiovascular. Os fatores associados à doença cardiovascular foram idade avançada; ser do sexo masculino; raça/cor branca; ter ensino fundamental completo e médio incompleto; possuir plano de saúde; autoavaliar a saúde como regular ou ruim/muito ruim; autorrelatar hipertensão, colesterol alto e diabetes; ser ex-fumante; consumir frutas e hortaliças conforme o recomendado; não consumir álcool de forma abusiva; não praticar atividade física no lazer. ***Conclusões:*** A doença cardiovascular está associada a fatores sociodemográficos, de saúde e estilos de vida. Torna-se importante apoiar políticas públicas, programas e metas para reduzir doenças cardiovasculares no Brasil, especialmente nos grupos mais vulneráveis.

Palavras-chave: Doenças cardiovasculares. Fatores de risco. Inquéritos epidemiológicos. Brasil.

INTRODUCTION

Cardiovascular diseases (CVD) are the main cause of mortality in Brazil and worldwide, in addition to causing increased morbidity, premature mortality, disabilities, loss of quality of life, and direct and indirect costs to health[1].

According to estimates from the Global Burden of Disease (GBD) study, globally, the prevalent cases of CVD increased significantly between 1990 and 2019, from 271 million to 523 million, respectively[2]. There was also an increase in the number of deaths from CVD from 12.1 million in 1990 to 18.6 million in 2019. In addition, global trends for years lived with disability (YLD) are growing, having doubled over these years, from 17.7 to 34.4 million[2]. In Brazil, the scenario is similar, CVD has been the leading cause of death since the 1990s[3]. There was an increase in mortality, from 270,000 in 1990 to 400,000 deaths in 2019, which corresponds to 48% of the total deaths[3]. These diseases are also the leading causes of disability-adjusted life years (DALY) lost. In 1990, they caused 7,006,214 DALYs, and in 2019, there was an increase to 8,861,401 (27% of the total DALY)[3].

The increase in CVD is related to the aging of the population and classic risk factors such as high blood pressure, diabetes, dyslipidemia, obesity, sedentary lifestyle, smoking, inadequate diet, stress, and family history[1]. Furthermore, sociodemographic, ethnic, cultural, dietary, and behavioral issues are strong predictors of causality, morbidity, and premature mortality and may also explain the differences in CVD burden among populations and their trends over the years[1].

To prevent CVD, it is necessary to strengthen protection and health promotion measures, especially those that promote healthy lifestyle habits, access to measures for primary and secondary prevention of CVD, associated with the treatment of cardiovascular events[1]. In addition, monitoring, surveillance of risk factors, and integrated actions should be priorities to face these diseases, as they allow, based on evidence, the development of more cost-effective strategies[4]. The importance of social and economic policies is also highlighted, with a view to reducing inequalities and guaranteeing universal and equal access to health actions and services[5,6].

A study carried out in Brazil, in 2013, showed a higher occurrence of CVD in females, aged people, people with hypertension, diabetes, dyslipidemia, overweight, obesity, and unhealthy behaviors such as smoking and physical inactivity[7]. However, there has been a trend toward an increase in the prevalence of CVD[8] and changes in the behavior of some risk factors[6,8]. A study showed that, between 2006 and 2014, there was a reduction in smokers and an increase in obesity, consumption of fruits and vegetables, physical activity, and alcohol use. However, as of 2015, the scenario changed, with a reduction in the consumption of fruits and vegetables, stability in the practice of physical activity and an increase in alcohol abuse[6]. It should be noted that, from mid-2014, there were economic and political crises in Brazil and austerity policies were implemented, such as the approval of Constitutional Amendment No. 95 (EC95)[9], which resulted in a decrease in investments in social and health policies, increased inequalities, in addition to reducing the supply of health goods and services, worsening comorbidities and impacting on mortality rates[10-13].

In this sense, it is necessary to monitor the prevalence of CVD and their risk factors in Brazilian adults, especially in a scenario of political, economic, and social instability. Therefore, the present study aimed to estimate the prevalence and investigate the sociodemographic, health, and lifestyle factors associated with self-reported diagnosis of CVD in the adult Brazilian population.

METHODS

Cross-sectional study with data from the 2019 National Health Survey (*Pesquisa Nacional de Saúde* – PNS), which is a population-based survey, representative of the Brazilian population, carried out by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE) in partnership with the Ministry of Health (MoH)[14].

The PNS questionnaire was divided into three parts:

1. Household information;
2. Information from all residents; and
3. Information about a randomly selected individual.

The 2019 PNS target population consisted of individuals aged 15 years old or older, residing in permanent private households. The sample consisted of three-stage clusters, with

the census tracts being the primary unit, the households the secondary, and one resident aged 15 years old or older the tertiary. Households and residents were selected by simple random sampling. The minimum size defined for the sample was 108,525 households, and the final sample had 94,114 households with an interview carried out, with a response rate of 93.6%[14]. For the analysis of the present study, individuals under 18 years of age were excluded, totaling 88,531 individuals. Further details on the PNS methodology can be found in previous publications[14,15].

The diagnosis of CVD was self-reported and evaluated by the question: "Has a doctor ever given you the diagnosis of a heart disease, such as a heart attack, angina, heart failure or any other?". Individuals who answered "YES" to this question were considered as having CVD.

For individuals who reported a diagnosis of CVD, the following conditions were evaluated: age at first diagnosis of CVD; performing saphenous bypass surgery or catheterization with stent placement or angioplasty; degree of limitation in usual activities due to heart disease; care for CVD (diet; regular physical activity; regular use of medication; regular follow-up with a health professional).

With regard to associated factors, the following factors were evaluated:

a. Sociodemographic characteristics:
   - Gender: male and female;
   - Age range: 18 to 24, 25 to 39, 40 to 59 and 60 or more;
   - Education: no education and complete elementary school, complete elementary/middle school and incomplete high school, complete high school and incomplete higher education, and complete higher education;
   - Race/color: White, Brown, Black, and others (Yellow and Indigenous);
   - Income in minimum wages (MW): up to 1 MW, 1 to 3 MW, 3 to 5 MW, and 5 or more MW;
   - Regions: North, Northeast, Southeast, South, and Midwest;
   - Health insurance: yes or no.

b. Health status:
   - Self-evaluation of health status: good/very good, regular, and bad/very bad;
   - Self-reported diagnosis of hypertension: yes, no;
   - Self-reported diagnosis of diabetes: yes, no;
   - Self-reported diagnosis of high cholesterol: yes, no;
   - Nutritional status: eutrophic (body mass index – BMI <25 kg/m^2); overweight (BMI between 25 and 29 kg/m^2); obesity (BMI $\geq$30kg/m^2)[16]. BMI was calculated based on reported weight and height.

c. Lifestyle:
   - Smoking: non-smokers, former smokers, and smokers;
   - Abusive consumption of alcoholic beverages: yes, no. The consumption of five or more doses on a single occasion was considered abusive[14];

- Recommended intake of fruits and vegetables (FV): yes, no. The consumption of FV at least 25 times a week was considered recommended, with a minimum consumption of five fruits (including juice) and five vegetables[14];
- Ultra-processed foods intake: yes or no. "Yes" was defined as the reported consumption, on the day prior to the interview, of at least five groups of the following processed foods: soft drinks; fruit juice in a box or can or powdered soft drink; chocolate drink or flavored yogurt; tortilla chips or savory biscuits/crackers; sweet or stuffed biscuit/cookie or package cake; ice cream, chocolate, jello, flan or other industrialized dessert; hot dog, sausage, bologna or ham; loaf, hot dog or hamburger bread; margarine, mayonnaise, ketchup or other industrialized sauces; instant noodles, tortilla soup, frozen lasagna or other ready-made industrialized frozen dish[14];
- High salt intake: yes, no. It was considered high when the individuals answered "very high" or "high" to the question: "Considering freshly prepared and industrialized foods, how would you rate your intake?";
- Sufficient leisure-time physical activity (LPA): yes; no. Individuals who reported practicing at least 150 minutes per week of light or moderate intensity physical activity or 75 minutes per week of vigorous physical activity during leisure time were considered active[17].

To describe the data, proportions and 95% confidence intervals (95%CI) were calculated. In the verification of possible factors associated with CVD, the prevalence ratio (PR), obtained through Poisson regression with robust variance, was used as a measure of association. Variables with a p-value <0.20 in the crude analyses were included in the multivariate model. In the final model, factors associated with variables with a value of $p \leq 0.05$ were considered.

All analyzes were performed by the Data Analysis and Statistical Software (Stata), version 14, using the survey module that considers post-stratification weights.

The PNS 2019 was approved by the National Research Ethics Committee (*Comissão Nacional de Ética em Pesquisa* – CONEP) of the MoH, under opinion number 3.529.376. Adult participation in the research was voluntary and information confidentiality was guaranteed[14]. The PNS 2019 data are available for public access and use in the IBGE repository (https://www.ibge.gov.br/estatisticas/sociais/saude/9160-pesquisa-nacional-de-saude.html?=&t=download0s).

RESULTS

88,531 individuals over 18 years of age were evaluated. Of these, 5.3% (95%CI 5.0–5.6) reported a medical diagnosis of CVD. The mean age at first medical diagnosis of CVD was 46.7 years (95%CI 45.6–47.9). Among adults who reported CVD, 29.1% (95%CI 27.0–31.2)

had undergone bypass surgery or angioplasty and 8.3% (95%CI 7.1–9.6) reported severe limitation in usual activities by CVD. With regard to health care given to CVD, 43.7% reported dieting, 26.2% practicing LPA, 69.1% using medication, and 69.9% having regular follow-up with a health professional (Supplementary material 1).

Table 1 shows the prevalence of CVD according to sociodemographic characteristics, health conditions, and lifestyle. There was a higher prevalence of CVD among women (5.6%); people over 60 years of age (13.1%); individuals with low education (7.8%); white color/race (6.1%); who receive from 3 to 5 MW (6.1%); residents of the Southern Region (6.8%). As for health and behavioral characteristics, the highest prevalence of CVD was among those who have health insurance (6.2%); self-evaluation their health as bad or very bad (17.1%); people with hypertension (13.6%), diabetes (15.4%), high cholesterol (13.4%), obesity (7.0%); former smokers (7.9%); with recommended consumption of fruits and vegetables (7.2%); who do not abuse alcohol intake (5.9%); who do not have high salt intake (5.4%); who are not physically active at leisure (6.1%).

In the multivariate model, it was observed that the highest prevalence of CVD is associated with 60 years of age or more (PR=2.8; 95%CI 1.8–4.4); complete middle school to incomplete high school (PR=1.2; 95%CI 1.0–1.4); having health insurance (PR=1.4; 95%CI 1.2–1.6); self-evaluated health as regular (PR=2.0; 95%CI 1.8–2.3) or bad/very bad (PR=3.1; 95%CI 2.7–3.6); hypertension (PR=2.3; 95%CI 2.0–2.5), high cholesterol (PR=1.7; 95%CI 1.5–1.9) and diabetes (PR=1.2; 95%CI 1 ,1–1.3); consumption of fruits and vegetables (PR=1.2; 95%CI 1.1–1.4); being a former smoker (PR=1.2; 95%CI 1.1–1.3). On the other hand, being female (PR=0.8; 95%CI 0.7–0.9), of brown (PR=0.8; 95%CI 0.7–0.9) or black race/color (PR=0.8; 95%CI 0.7-0.9), abusive use of alcohol (RP=0.7; 95%CI 0.6-0.9), and practice of LPA (PR=0.8; 95%CI 0.7–0.9) were associated with a lower prevalence of CVD (Table 2).

DISCUSSION

This study identified that approximately 1 in 20 Brazilian adults had CVD, showing that self-reported diagnosis of the disease was frequent in the country. About a third had undergone coronary artery bypass graft surgery and/or coronary angioplasty and about a tenth reported severe limitation. Factors positively associated with CVD were: advanced age; complete middle school and incomplete high school education; health insurance; self-rating health as regular or bad/very bad; self-reported hypertension, high cholesterol, and diabetes; being a former-smoker; consuming fruits and vegetables as recommended. On the other hand, the lowest prevalence of CVD were among women, those of brown and black color/race; those who consume alcohol abusively and practice LPA.

In the present study, in the bivariate analysis, women had a higher prevalence of CVD, however, in the multivariate model, there was a higher prevalence of CVD in men. Although some studies show higher prevalence of CVD in women[18,19], most studies point to higher risk factors, such as smoking, inadequate diet[20-22], measured hypertension[23], among men,

Table 1. Prevalence and crude prevalence ratio for cardiovascular diseases, according to sociodemographic characteristics, clinical conditions and lifestyles, National Health Survey, Brazil, 2019.

Characteristics	Self-reported CVD				
	%	95%CI	PR	95%CI	p-value
Total	5.3	5.0–5.6			
Gender					
Male	4.9	4.6–5.3	1.00		
Female	5.6	5.3–6.0	1.13	1.3–1.3	0.010
Age range years					
18 to 24	1.4	0.9–2.2	1.00		
25 to 39	1.9	1.6–2.3	1.40	0.9–2.2	0.160
40 to 59	4.8	4.4–5.2	3.40	2.2–5.3	<0.001
60 or more	13.1	12.4–13.9	9.40	6.1–14.6	<0.001
Education					
Illiterate and incomplete elementary/middle school	7.8	7.4–8.3	1.00		
Complete Middle school and incomplete high school	4.8	4.2–5.5	0.60	0.5–0.7	<0.001
Complete high school and incomplete higher degree	3.5	3.1–3.9	0.40	0.4–0.5	<0.001
Complete Higher degree	4.3	3.7–4.8	0.50	0.5–0.6	<0.001
Race/color					
White	6.1	5.7–6.6	1.00		
Black	4.8	4.2–5.5	0.80	0.7–0.9	<0.001
Brown	4.6	4.3–5.0	0.80	0.7–0.8	0.002
Others, yellow/indigenous	5.2	3.2–8.3	0.90	0.5–1.4	0.500
Income					
Up to 1 minimum wage	4.9	4.6–5.1	1.00		
1 to 3 minimum wages	5.6	5.2–6.0	1.10	1.0–1.3	0.020
3 to 5 minimum wages	6.1	5.1–7.3	1.20	1.0–1.5	0.040
5 or more minimum wages	5.8	4.9–6.8	1.30	1.0–1.4	0.080

Continue...

Table 1. Continuation.

Characteristics	Self-reported CVD				
	%	95%CI	PR	95%CI	p-value
Region					
North	3.3	2.8–3.8	1.00		
Northeast	4.1	3.8–4.4	1.20	1.0–1.5	0.015
Southeast	6.0	5.5–6.6	1.80	1.5–2.2	<0.001
South	6.8	6.2–7.4	2.10	1.7–2.5	<0.001
Midwest	4.8	4.2–5.4	1.40	1.2–1.8	<0.001
Health insurance					
No	4.9	4.7–5.4	1.00		
Yes	6.2	5.7–6.8	1.30	1.1–1.4	<0.001
Health status					
Good/very good	2.8	2.6–3.0	1.00		
Regular	8.8	8.2–9.4	3.20	2.9–3.5	<0.001
Bad/very bad	17.1	15.6–18.8	6.10	5.4–6.9	<0.001
Hypertension					
No	2.7	2.5–2.9	1.00		
Yes	13.6	12.8–14.4	5.00	4.6–5.5	<0.001
Diabetes					
No	4.5	4.2–4.7	1.00		
Yes	15.4	14.1–16.9	3.50	3.1–3.9	<0.001
High cholesterol					
No	3.9	3.7–4.2	1.00		
Yes	13.4	12.4–14.5	3.40	3.1–3.8	<0.001
Nutritional status					
Eutrophic	4.6	4.2–5.0	1.00		
Overweight	5.3	4.9–5.7	1.20	1.0–1.3	0.020
Obesity	7.0	6.4–7.8	1.50	1.4–1.8	<0.001
Smoking					
Non-smoker	4.3	4.0–4.6	1.00		
Former smoker	7.9	7.4–8.5	1.85	1.7–2.0	<0.001
Smoker	4.6	4.0–5.3	1.07	0.9–1.3	0.410

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Table 1. Continuation.

Characteristics	Self-reported CVD				
	%	95%CI	PR	95%CI	p-value
Recommended fruits and vegetables intake					
No	5.0	4.7–5.3	1.00		
Yes	7.2	6.5–8.1	1.40	1.3–1.6	<0.001
Ultra-processed foods intake					
No	5.2	4.9–5.5	1.00		
Yes	5.7	5.2–6.2	1.1	1.0–1.2	0.110
Excessive alcohol intake					
No	5.9	5.6–6.2	1.00		
Yes	2.5	2.1–3.0	0.4	0.4–0.5	<0.001
High salt intake					
No	5.4	5.1–5.7	1.00		
Yes	4.5	3.9–5.2	0.8	0.7–1.0	0.020
Physically active during leisure time					
No	6.1	5.8–6.5	1.00		
Yes	3.4	3.1–3.8	0.6	0.5–0.6	<0.001

CVD: cardiovascular diseases; PR: prevalence ratio.

which has been explained by behavioral and cultural issues and greater access to health services, health care and adherence to promotion and prevention practices among women[24-26]. Furthermore, the mortality rate, loss of healthy years of life, and disability due to CVD are higher among men[3,18,27]. Thus, higher prevalence of CVD among men is considered consistent with the literature.

As in other studies[2,7,28], this study identified higher prevalence of CVD with increasing age, with greater magnitude in the age group aged 60 years old or more. The association between advancing age and progressive increase in CVD is supported in the literature, especially by the inherent alterations of senescence[29,30]. In addition, the progression of longevity can also provide longer exposure to risk factors such as pollution, smoking, unhealthy diet, and sedentary lifestyle[31], which may contribute to the development of CVD[32]. Furthermore, aged people use health services more often, which can contribute to the diagnosis of CVD[25,33,34].

The lower prevalence of CVD in black and brown people remained in line with the results of studies with PNS data from 2013[7]. Although they have been presented as a protective factor, it is important to highlight the existence of ethnic-racial disparities in cardiovascular health[35], in which black individuals have higher mortality risk than white ones[36]. In

Table 2. Multivariate model of factors associated with cardiovascular diseases, National Health Survey, Brazil, 2019.

Characteristics	PR	95%CI	p-value
Gender			
Male	1.00		
Female	0.80	0.7–0.9	<0.001
Age range years			
18 to 24	1.00		
25 to 39	1.20	0.7–1.9	0.500
40 to 59	1.70	1.1–2.6	0.020
60 years or more	2.80	1.8–4.4	<0.001
Race/color			
White	1.00		
Brown	0.80	0.7–0.9	<0.001
Black	0.80	0.7–0.9	0.010
Education			
Illiterate and incomplete elementary/middle school	1.00		
Complete middle school and incomplete high school	1.20	1.0–1.4	0.045
Complete high school and incomplete higher degree	1.00	0.9–1.2	0.758
Complete higher degree	1.10	0.9–1.3	0.512
Health insurance			
No	1.00		
Yes	1.40	1.2–1.6	<0.001
Health status			
Good/very good	1.00		
Regular	2.00	1.8–2.3	<0.001
Bad/very bad	3.10	2.7–3.6	<0.001
Hypertension			
No	1.00		
Yes	2.30	2.0–2.5	<0.001
High cholesterol			
No	1.00		
Yes	1.70	1.5–1.9	<0.001

Continue...

Table 2. Continuation.

Characteristics	PR	95%CI	p-value
Diabetes			
No	1.00		
Yes	1.20	1.1–1.3	0.010
Smoking			
Non-smoker	1.00		
Former smoker	1.20	1.1–1.3	<0.001
Smoker	1.00	0.9–1.2	0.770
Recommended fruits and vegetables intake			
No	1.00		
Yes	1.20	1.1–1.4	0.002
Alcohol intake			
No	1.00		
Yes	0.70	0.6–0.9	<0.001
Leisure physical activity			
No	1.00		
Yes	0.80	0.7–0.9	<0.001

PR: prevalence ratio.

Brazil, socioeconomic and cultural disparities can lead to differences in risk factors according to race/color[20]. A study identified the highest occurrence of cardiovascular risk factors in blacks and browns, such as hypertension, worse dietary patterns, and physical inactivity[20]. Thus, the possible explanations for the results of the present study are due to the greater access of the white population to health services, providing more opportunities for CVD diagnoses[25] and more use of therapeutic procedures to define the presence of CVD, and also due to the effect of the bias of survival, with the occurrence of fatal events in blacks and browns, reinforcing the importance of studies in the country to elucidate this issue in most vulnerable populations.

Although improvements in the access to the Unified Health System (*Sistema Único de Saúde* – SUS) have taken place throughout Brazil, in this study, individuals with health insurance had a higher prevalence of CVD. It is known that the use of the service is determined by a need perceived by the user, arising from their health situation or prior knowledge of the disease[37]. Thus, the data described here may reflect the greater ease of access to medical diagnosis by the population with health insurance. It is noteworthy that, in the PNS carried out in 2013, individuals without health insurance, with or without chronic non-communicable

diseases (NCDs), also had a lower prevalence of use of services, hospitalization, and medical consultation[37,38]. These findings reinforce the need for investments in the SUS, to remedy these differences in social segments of the population[37].

The current study showed that individuals with bad/very bad self-rated health had a higher prevalence of CVD. The data found in this research corroborate previous studies in which most individuals with CVD reported a worse perception of their health status[7,39]. The poor self-rated health indicator is a strong predictor of morbidity and mortality and worse health outcomes[40]. It is noteworthy that this indicator produces a self-classification of the individual and also shows their understanding and perception of the disease, considering signs and symptoms, severity, risks, disabilities, and impacts on their physical, mental, and social well-being[41]. Studies show a positive association between self-assessment and regular and poor self-perception with CVD[42,43]. Thus, individuals with CVD had 2.5 times the chance of evaluating their health status as bad[42]; those with angina, 2.17 times; with heart failure the chance was 5.21 times; and with acute myocardial infarction, 5.77 times[43].

Self-reported clinical conditions, such as hypertension, diabetes, and high cholesterol, were presented in this study as risk factors for the diagnosis of CVD. The presence of these risk factors causes deleterious effects on the cardiovascular system, with negative impacts on health, reinforcing the multiple causality of CVD[44-47]. In hypertension, the risk attributable to a progressive increase in blood pressure is approximately 60% for stroke and 50% for coronary artery disease (CAD)[45,47]. In diabetes, there is an increased risk of mortality from CVD, and the most common cardiovascular manifestations include heart failure, peripheral arterial disease, and CAD[44]. Dyslipidemia, on the other hand, has an increased risk of atherosclerotic CVD[46]. In this context, it is imperative to contain modifiable risk factors with the implementation of interventions, such as access to early pharmacological and non-pharmacological treatments[29,48]. The importance of preventing these comorbidities is highlighted, not only to improve the living conditions of individuals, but also to reduce the global burden of NCDs in the population[29].

Regarding the lifestyle of the Brazilian population, evidence indicates a proportional increase in CVD due to the growth of the four main risk factors, which include tobacco use, unhealthy diet, physical inactivity, and excessive consumption of alcohol[47]. Although the prevalence of smoking in Brazil has reduced in recent decades, there is still a high burden of disease associated with this risk factor[21,49]. In the current study, there is a possible explanation for the higher prevalence and positive association between former smokers and CVD, which is related to the fact that these people have stopped smoking due to the medical diagnosis of CVD, adhering to changes in behavior due to received guidance on the harmful effects of smoking[1], configuring a reverse causality effect. This same effect possibly occurred in relation to the positive association of CVD with alcohol use and in those individuals who had recommended consumption of FV, suggesting a possible change in lifestyle, with an improvement in the dietary pattern and a decrease in alcohol consumption after diagnosis of the disease. This can also demonstrate a greater understanding of the disease and its risks, as well as the importance of adopting healthy habits by the participants to prevent worse clinical outcomes[1].

An important result of this study was the positive effect of LPA as a protective factor for CVD. Regular physical activity is inversely associated with mortality from all causes (including cardiovascular ones), configures a protective factor for NCDs and contributes to improving quality of life, physical and mental well-being, in addition to helping with weight control[1,22].

Some limitations of the study should be considered, such as the impossibility of establishing a causal relationship, as this is a cross-sectional study. Although the investigation of CVD, which includes cardiac and cerebrovascular pathologies, is frequent in the literature, the present study analyzed only heart diseases. Another point that deserves to be highlighted is the fact that the 2019 PNS collects self-reported information, which may be subject to information bias, generating less accurate estimates. However, it is highlighted that the PNS presents great methodological rigor, and the generalization of the results is safe for national estimates. Furthermore, theoretical criteria were used for the analyses, along with robust statistical methods.

Despite the limitations presented, this study advances in findings on factors associated with CVD with robust survey data and national representativeness in a period after the economic austerity policies. In this sense, it is also relevant as an analysis prior to the COVID-19 pandemic, which will serve as a basis for comparing future studies.

The results showed that the prevalence of CVD was approximately 5% of the Brazilian adult population. CVD was associated with sociodemographic factors (male gender, older age, white race/color, average education level and health insurance), health status (self-assessed health as regular or bad/very bad and diagnosis of hypertension, high cholesterol, and diabetes) and lifestyle (former-smoker, consumption of fruits and vegetables, alcohol use, and physical inactivity). This information can support public policies, programs, and goals to reduce CVD in Brazil, especially in the most vulnerable groups.

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