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Dietary quality and self-reported diabetes in Brazilian adults: National Health Survey (2019)

Qualidade da dieta e diabetes autorreferido em adultos brasileiros: Pesquisa Nacional de Saúde (2019)

Abstract

Introduction: Knowledge of food consumption in individuals with diabetes is essential to guide comprehensive healthcare actions and encourage the improvement of the food and nutritional profile. *Objective*: Toanalyze the association between food consumption markers and the prevalence of self-reported diabetes among Brazilian adults. *Methods*: Data from 2019 Brazilian National Health Survey (n= 63,782) were analyzed. Diet was assessed based on regular consumption (≥ five times per week) of healthy and unhealthy food; and one diet quality score. Logistic regression models were stratified by gender and adjusted for demographic, socioeconomic, and lifestyle variables, considering the effect of study design and sample weights. *Results*: A higher prevalence of self-reported diabetes was observed among adults with regular consumption of beans, fruits, and better diet quality. A lower prevalence was observed among those with regular consumption of soft drinks, artificial juice, sweets, and replaced lunch with snacks. After adjustment, the regular consumption of fruit (OR= 1.41 and OR= 1.31, respectively) and the diet quality score (Men: 5th= OR= 1.72; Women: 4th= OR= 1.48; 5th= 1.70) remained directly associated with the prevalence of diabetes, for both sexes, and inversely associated with the regular consumption of artificial juice (OR = 0.70*) for men and sweets (OR= 0.64) for women.* *Conclusion*: The association of diet quality and regular consumption of fruit with self-reported diabetes prevalence may suggest that Brazilian adults with diabetes seek a better diet quality to control and take care of their health conditions.

Keywords: Diabetes Mellitus. Diet quality. Food consumption. Risk factors. Lifestyle.

Resumo

Introdução: Conhecer o consumo alimentar de indivíduos com diabetes é essencial para orientar ações integrais de atenção à saúde e estimular a melhoria do perfil alimentar e nutricional. *Objetivo*: Analisar a associação entre marcadores de consumo alimentar e a prevalência de diabetes autorreferido entre adultos brasileiros. *Métodos*: Foram analisados dados da Pesquisa Nacional de Saúde de 2019 (n= 63.782). A dieta foi avaliada com base no consumo regular (≥ cinco vezes por semana) de alimentos saudáveis e não

saudáveis; e um escore de qualidade da dieta. Os modelos de regressão logística foram estratificados por sexo e ajustados por variáveis demográficas, socioeconômicas e de estilo de vida, considerando o efeito do delineamento do estudo e os pesos amostrais. *Resultados*: Maior prevalência de diabetes autorreferido foi observada entre adultos com consumo regular de feijão, frutas e melhor qualidade da dieta. Menor prevalência foi observada entre aqueles com consumo regular de refrigerantes, suco artificial, doces e que substituíram o almoço por lanches. Após ajuste, o consumo regular de frutas (OR= 1,41 e OR= 1,31, respectivamente) e o escore de qualidade da dieta (Homens: 5º quinto= OR= 1,72; Mulheres: 4º quinto= OR= 1,48; 5º quinto= 1,70) permaneceram diretamente associados à prevalência de diabetes, para ambos os sexos, e inversamente associados ao consumo regular de suco artificial (OR= 0,70) para homens, e de doces (OR= 0,64) para mulheres. *Conclusão*: A associação da qualidade da dieta e do consumo regular de frutas com a prevalência autorreferida de diabetes pode sugerir que adultos brasileiros com diabetes buscam uma dieta de melhor qualidade para controlar e cuidar de suas condições de saúde.

Palavras-chave: Diabetes Mellitus.Qualidade da dieta.Consumo alimentar. Fatores de risco. Estilo de vida.

INTRODUCTION

According to the World Health Organization (WHO), non-communicable chronic diseases (NCDs) are the main cause of illness and death worldwide, accounting for approximately 73.6% of deaths in 2019.[1] Diabetes mellitus (DM) is one of the main NCDs and the fourth leading cause of death.[2] This disease is characterized by a deficiency in the production or action of insulin in the body, causing chronic hyperglycemia.[3]

In 2021, according to data from the International Diabetes Federation (IDF), 10.5% of the world's adult population had DM and approximately 6.7 million deaths were recorded due to the disease.[2] In Brazil, about 15.7 million adults have the disease, making it the sixth country with the highest incidence of DM in the world and first place in South and Central America.[2] It is estimated that in the year 2045, 783 million people worldwide and 23.2 million people in Brazil will have DM, if the demographic, epidemiological, and health scenario continues.[2] Brazilian population surveys show an increase in the prevalence of DM in both sexes.[4,5]VIGITEL indicators from 2006 to 2020 suggest an average increase in cases of DM by 0.18 pp/year, with a greater increase in males.[4]

Risk factors for DM can be classified as non-modifiable (gender, age, and family history) or modifiable ones, which are risk behaviors related to lifestyle (inadequate diet, physical inactivity, sedentary behavior, smoking, and alcohol abuse).[6] The effect of behavioral factors has been aggravated by factors such as urbanization, nutritional and epidemiological transition, and population aging.[2,7-9] Thus, DM prevention and control can occur through drug interventions and adopting a healthy lifestyle, including body weight reduction, adequate and healthy food consumption, physical activity, and reduction or cessation of tobacco and alcoholic beverage consumption.[9,10]

One of the main factors associated with DM is diet, especially the consumption of ultra-processed foods, rich in sodium, saturated fats, and refined sugar. These foods contribute to weight gain, body adiposity, and chronic disease incidences, such as hypertension and cardiovascular disease.[11-13]

The adoption of healthy eating habits is an effective strategy not only for prevention but for treating the disease.[7] Guidelines such as the *Food Guide for the Brazilian Population*[14]suggestreducing body weight and preventing the disease and/or its complications, addressing the principles and *recommendations* for a healthy diet, with the consumption of healthy foods and reduction in ultra-processed foods. Therefore, this study aimed to analyze the association between food consumption markers and self-reported diabetes mellitus in Brazilian adults participants of the 2019 National Health Survey.

METHODS

Cross-sectional study with data from the National Health Survey (PNS) carried out between August 2019 and March 2020. The PNS is a national health survey carried out in partnership between the Ministry of Health and the Brazilian Institute of Geography and Statistics (IBGE).[15] The PNS has a complex sampling design and uses cluster sampling in three stages, with the primary units composed of census sectors or sets of sectors; secondary units composed of households; and the tertiary under-formed by residents over 15 years of age.[16]

Data collection took place through a questionnaire applied by a trained agent.[15] Self-reported diabetes mellitus was the dependent variable of this study, assessed by the question "Has any doctor ever given you the diagnosis of diabetes?". Women who answered "yes" to the question "Did this diabetes occur only during some period of pregnancy?" were excluded.

To assess food consumption, we analyzed the data available in the PNS database, similar to those used by SISVAN in Brazil.[17,18] Healthy consumption markers were considered: beans, vegetables and fruits, and natural juice; while unhealthy consumption markers were considered: soda, artificial juice, and sweets. This information was obtained with the question "On how many days of the week do you usually: (1) eat beans?; (2) eat at least one type of vegetable (not counting potatoes, cassava, yams or yams) such as lettuce, tomato, cabbage, carrot, chayote, eggplant, zucchini?; (3) eat fruit?; (4) drink natural fruit juice (including frozen fruit pulp)?; (5) drink juice from a box/can or powdered soft drink?; (6) drink soda?; and (7) eat sweet foods such as cookies/cookies, chocolate, gelatin, candies, and others?". The frequency of replacing lunch with snacks was evaluated based on the question "How many days a week do you usually replace your lunch meal with quick snacks such as sandwiches, snacks,

pizza, hot dogs etc?". For statistical analysis, the frequency of consumption was dichotomized into less than five times per week and greater than or equal to five times per week.

The methodological proposal by Sousa et al.[19] was used to evaluate diet quality, which considers the sum of the weekly frequency of food consumption. The healthy food scale ranges from zero (did not consume) to 7 (consumed every day) while the unhealthy food scale ranges from 7 (did not consume) to zero (consumed every day). Thus, the score could vary from zero to 56. Higher scores indicate better diet quality and for statistical analyses, the score was divided into quintiles.

Regarding sociodemographic characteristics, this study included four categorical variables for educational level (no education, primary, secondary, and some college or more). No education corresponds to people who had no education or less than one year of formal schooling; 'primary incomplete' education is those with one to eight years of completed formal education; 'primary complete' education are those with nine years of schooling, 'secondary complete' education are those who completed twelve years of schooling; and 'tertiary complete' are those who completed a college degree. Other individual characteristics were sex (female/male); age group (20-29, 30-39, 40-49, 50-59); race/skin color (white; black; brown; yellow, which included those of Asian descent; and indigenous); local of residence (urban or rural); and region of residence (South, Southeast, Midwest, Northeast, North).

Additionally, lifestyle-related risk behaviors were assessed. Tobacco use was obtained with the question: "Do you currently smoke any tobacco product?", in which those who answered "yes, daily" and "yes, less than daily" were considered smokers[15,16]. Consumption of alcoholic beverages was obtained with the question "How often do you usually consume an alcoholic beverage?". The answers "less than once a month" and "once or more a month" were considered as "yes" and the answer "I never drink" was considered "no".[15,16]

Physical activity was measured with the question "In the last three months, have you practiced any type of physical exercise or sport?", categorized as "yes" and "no".[15,16] Sedentary behavior was evaluated considering daily time spent watching television and using screens such as cell phones/smartphones and tablets daily. Sedentary behavior was obtained by the questions "On average, how many hours a day do you usually spend watching television?" and "In a day, how many hours of your free time (excluding work) do you usually use a computer, tablet or cell phone for leisure, such as: using social networks, watching the news, videos, playing games, etc.?". Responses were grouped and categorized as less than 3 hours a day and 3 hours or more a day.[15,16]

Ethical aspects

Participation in the PNS was voluntary, the confidentiality of information was guaranteed, and the research was approved by the National Research Ethics Committee (CONEP) of the National Health Council (CNS) in August 2019. The database and modules of the 2019 PNS questionnaires are available for public use.

Data analysis

Data analysis was performed using the Statistical Package for Social Sciences – SPSS, version 19 (IBM SPSS Statistics) software, considering the effect of study design and sample weights through the Complex Sample module. The analysis described were presented in terms of prevalence and 95% confidence intervals (95%CI) of the analyzed variables. Logistic regression models were used, obtaining the Odds Ratio (OR) and 95%CI, to analyze the association of food consumption markers with the prevalence of self-reported diabetes, considering two adjustment models. The first model included demographic and socioeconomic variables. The second added variables related to lifestyle-related risk behaviors.

RESULTS

A total of 63,782 individuals, aged between 20 and 59 years old, were evaluated. Participants were 52.2%female; 28.2% aged between 30 and 39 years old; 39.4% completed high school; 45.4% self-declared color of brown skin; 86.4% lived in urban areas; and 42.7% lived in the Southeast Region (Table 1). The prevalence of self-reported diabetes mellitus was 5.2% (95%CI= 4.9; 5.5), greater among women (4.8%) compared to men (4.1%). Diabetes prevalence was directly associated with increased age

group (20-29 years = 0.6%; 30-39 years = 2.0%; 40-49 years = 4.7%; 50-59 years = 11.4%), inversely associated with the increase in education level (no education= 8.2%; incomplete elementary school= 7.2%; complete elementary school= 4.0%; high school complete= 3.4%; higher education complete= 2.7%),greater among individuals residing in urban areas (4.6%) and residents of the Southeast region (4.9%) (Table 1).

Table 1. Population distribution (% and 95% Confidence Interval) according to demographic and socioeconomic characteristics in Brazilian adults (N= 63,782). National Health Survey (PNS) 2019

Characteristics	Total % (95%CI)	Self-reported Diabetes % (95%CI)	
		Yes	No
Total		5.2 (4.9; 5.5)	94.8 (94.5; 95.1)
Sex			
Male	47.8 (47.1; 48.5)	4.1 (3.7; 4.5)	95.9 (95.5; 96.3)
Female	52.2 (51.5; 52.9)	4.8 (4.5; 5.3)	95.2 (94.7; 95.5)
Age group (years)			
20 – 29	24.4 (23.7; 25.1)	0.6 (0.4; 0.8)	99.4 (99.2; 99.6)
30 – 39	28.2 (27.6; 28.8)	2.0 (1.7; 2.4)	98.0 (97.6; 98.3)
40 – 49	24.4 (23.8; 25.0)	4.7 (4.1; 5.4)	95.3 (94.6; 95.9)
50 – 59	23.0 (22.4; 23.5)	11.4 (10.5; 12.3)	88.6 (87.7; 89.5)
Educational level			
No education	3.2 (3.0; 3.5)	8.2 (6.7; 9.9)	91.8 (90.1; 93.3)
Primary incomplete	24.5 (23.9; 25.2)	7.2 (6.6; 8.0)	92.8 (92.0; 93.4)
Primary complete	14.8 (14.3; 15.3)	4.0 (3.4; 4.7)	96.0 (95.3; 96.6)
Secondary complete	39.5 (38.7; 40.2)	3.4 (3.0; 3.8)	96.6 (96.2; 97.0)
Tertiary complete	18.0 (17.2; 18.7)	2.7 (2.3; 3.2)	97.3 (96.8; 97.7)
Race/skin color			
White	41.5 (40.7; 42.3)	4.4 (4.0; 4.9)	95.6 (95.1; 96.0)
Black	11.8 (11.4; 12.3)	4.6 (4.0; 5.4)	95.4 (94.6; 96.0)
Yellow	0.8 (0.7; 1.0)	7.0 (3.3; 14.1)	93.0 (85.9; 96.7)
Brown	45.4 (44.6; 46.1)	4.4 (4.0; 4.8)	95.6 (95.2; 96.0)
Indigenous	0.5 (0.4; 0.6)	5.6 (3.1; 9.6)	94.4 (90.4; 96.9)
Local of residence			
Urban	86.4 (85.9; 86.8)	4.6 (4.3; 4.9)	95.4 (95.1; 95.7)
Rural	13.6 (13.2; 14.1)	3.7 (3.2; 4.2)	96.3 (95.8; 96.8)
Region of residence			
North	8.2 (7.9; 8.6)	3.4 (2.9; 3.9)	96.6 (96.1; 97.1)
Northeast	26.7 (26.0; 27.4)	4.1 (3.7; 4.4)	95.9 (95.6; 96.3)
Southeast	42.7 (41.6; 43.7)	4.9 (4.5; 5.5)	95.1 (94.5; 95.5)
South	14.5 (14.0; 15.1)	4.7 (4.1; 5.5)	95.3 (94.5; 95.9)
Midwest	7.9 (7.6; 8.3)	3.9 (3.4; 4.5)	96.1 (95.5; 96.6)

Regarding food consumption markers, the prevalence of self-reported DM was significantly higher among adults who regularly consumed beans (4.7 vs 3.9%) and fruits (5.6 vs 3.7%) and there was an increase directly associated with the fifths of the diet quality score (1st = 2.8%; 2nd = 3.6%; 3rd = 4.5%; 4th = 5.4%; 5th = 6.9%). On the other hand, it was lower among those with

regular consumption of artificial juice (3.4 vs 4.6%), and sweets (2.9 vs 4.7%), and who replaced lunch with snacks (2.7 vs 4. 5%) (Table 2).

Table 2. Population distribution (% and 95% Confidence Interval) according to food consumption markers in the previous seven days among Brazilian adults (N= 63,782). National Health Survey (PNS) 2019.

Characteristics	Total % (95%CI)	Self-reported Diabetes	
		Yes	No
		% (95% CI)	
Regular consumption of beans			
< 5 days	32.1 (31.4; 32.9)	3.9 (3.5; 4.3)	96.1 (95.6; 96.5)
≥ 5 days	67.9 (67.1; 68.6)	4.7 (4.4; 5.1)	95.3 (94.9; 95.6)
Regular consumption of vegetable			
< 5 days	46.4 (45.7; 47.2)	4.1 (3.7; 4.5)	95.9 (95.5; 96.3)
≥ 5 days	53.6 (52.8; 54.3)	4.8 (4.4; 5.2)	95.2 (94.8; 95.6)
Regular consumption of fruits			
< 5 days	58.3 (57.6; 59.0)	3.7 (3.4; 4.0)	96.3 (96.0; 96.6)
≥ 5 days	41.7 (41.0; 42.4)	5.6 (5.1; 6.1)	94.4 (93.9; 94.9)
Regular consumption natural juice			
< 5 days	79.1 (78.5; 79.6)	4.4 (4.1; 4.7)	95.6 (95.3; 95.9)
≥ 5 days	20.9 (20.4; 21.5)	4.6 (4.1; 5.2)	95.4 (94.8; 95.9)
Regular consumption of soft drinks			
< 5 days	90.1 (89.7; 90.5)	4.6 (4.3; 4.9)	95.4 (95.1; 95.7)
≥ 5 days	9.9 (9.5; 10.3)	3.4 (2.4; 4.8)	96.6 (95.2; 97.6)
Regular consumption of artificial juice			
< 5 days	86.1 (85.6; 86.6)	4.6 (4.4; 4.9)	95.4 (95.1; 95.6)
≥ 5 days	13.9 (13.4; 14.4)	3.4 (2.8; 4.2)	96.6 (95.8; 97.2)
Regular consumption of sweets			
< 5 days	85.2 (84.6; 85.7)	4.7 (4.5; 5.1)	95.3 (94.9; 95.5)
≥ 5 days	14.8 (14.3; 15.4)	2.9 (2.3; 3.6)	97.1 (96.4; 97.7)
Lunch replacement with snacks			
< 5 days	97.8 (97.5; 98.0)	4.5 (4.2; 4.8)	95.5 (95.2; 95.8)
≥ 5 days	2.2 (2.0; 2.5)	2.7 (1.8; 4.0)	97.3 (96.0; 98.2)
Diet quality score (quintile)			
1	25.3 (24.7; 26.0)	2.8 (2.3; 3.3)	97.2 (96.7; 97.7)
2	17.8 (17.3; 18.4)	3.6 (3.0; 4.3)	96.4 (95.7; 97.0)
3	23.5 (22.9; 24.0)	4.5 (4.0; 5.1)	95.5 (94.9; 96.0)
4	15.7 (15.3; 16.2)	5.4 (4.7; 6.1)	94.6 (93.8; 95.3)
5	17.7 (17.1; 18.2)	6.9 (6.2; 7.7)	93.1 (92.3; 93.8)

Regarding risk behaviors related to lifestyle, a higher prevalence of self-reported DM was observed among those who did not practice physical activity (5.0%) compared to those who practiced (3.8%); did not consume alcoholic beverages (5. 4%) compared to those who consumed (3.4%);watched TV for 3 hours or more a day (5.6%) compared to those who watched less than 3 hours (4.2%); and those who used screens, such as tablets and smartphones, for less than 3 hours a day (5.1%), compared to those who used screens for 3 hours or more (2.6%) (Table 3).

Table 3. Population distribution (% and 95% Confidence Interval) according to lifestyle-related risk behaviors in Brazilian adults (N= 63,782). National Health Survey (PNS) 2019.

Characteristics	Total % (IC 95%)	Self-reported Diabetes	
		Yes	No
		% (IC 95%)	
Physical activity practice			
Yes	44.7 (43.9; 45.4)	3.8 (3.4; 4.2)	96.2 (95.8; 96.6)
No	55.3 (54.6; 56.1)	5.0 (4.7; 5.4)	95.0 (94.6; 95.3)
Smoking			
No	86.9 (86.4; 87.3)	4.4 (4.2; 4.7)	95.6 (95.3; 95.8)
Yes	13.1 (12.7; 13.6)	4.6 (3.8; 5.5)	95.4 (94.5; 96.2)
Alcohol consumption			
No	53.4 (52.7; 54.2)	5.4 (5.0; 5.8)	94.6 (94.2; 95.0)
Yes	46.6 (45.8; 47.3)	3.4 (3.0; 3.8)	96.6 (96.2; 97.0)
Time spends watching TV			
< 3 hours/day	80.4 (79.8; 81.0)	4.2 (3.9; 4.5)	95.8 (95.5; 96.1)
≥ 3 hours/day	19.6 (19.0; 20.2)	5.6 (4.9; 6.3)	94.4 (93.7; 95.1)
Time spent on screen (smartphones, and others)			
< 3 hours/day	74.9 (74.2; 75.6)	5.1 (4.8; 5.4)	94.9 (94.6; 95.2)
≥ 3 hours/day	25.1 (24.4; 25.8)	2.6 (2.2; 3.1)	97.4 (96.9; 97.8)

In the adjusted logistic regression models, the prevalence of self-reported DM remained directly associated, for both genders, with regular consumption of fruit (OR= 1.41 and OR= 1.31, respectively) and with the diet quality index (Men: 5th= OR= 1.72; Women: 4th= OR= 1.48; 5th= 1.70), and inversely associated with regular consumption of artificial juice (OR = 0.70) for men and sweets (OR= 0.64) for women (Table 4).

Table 4. Association (Odds Ratio and 95% Confidence Interval) of food consumption markers and self-reported diabetes among Brazilian adults (N= 63,782). National Health Survey (PNS) 2019.

Markers of food consumption	Men		Women	
	Model 1	Model 2	Model 1	Model 2
Regular consumption of beans				
<5 days	1	1	1	1
≥ 5 days	0.99 (0.79; 1.23)	0.97 (0.78; 1.21)	1.16 (0.97; 1.38)	1.13 (0.94; 1.34)
Regular consumption of vegetables				
<5 days	1	1	1	1
≥ 5 days	0.95 (0.77; 1.17)	0.96 (0.78; 1.18)	1.02 (0.85; 1.23)	1.06 (0.88; 1.27)
Regular consumption of fruits				
<5 days	1	1	1	1
≥ 5 days	1.41 (1.14; 1.74)	1.41 (1.15; 1.73)	1.28 (1.07; 1.53)	1.31 (1.10; 1.56)
Regular consumption of natural juice				
<5 days	1	1	1	1
≥ 5 days	1.18 (0.92; 1.50)	1.16 (0.91; 1.48)	0.99 (0.83; 1.19)	0.99 (0.82; 1.19)
Regular consumption of soft drinks				
<5 days	1	1	1	1
≥ 5 days	0.87 (0.57; 1.33)	0.86 (0.56; 1.32)	1.23 (0.72; 2.11)	1.24 (0.70; 2.18)
Regular consumption of artificial juice				
<5 days	1	1	1	1
≥ 5 days	0.70 (0.51; 0.98)	0.70 (0.50; 0.97)	1.04 (0.79; 1.36)	1.02 (0.77; 1.34)

Table 4. Association (Odds Ratio and 95% Confidence Interval) of food consumption markers and self-reported diabetes among Brazilian adults (N= 63,782). National Health Survey (PNS) 2019. (Cont)

Markers of food consumption	Men		Women	
	Model 1	Model 2	Model 1	Model 2
Regular consumption of sweets				
<5 days	1	1	1	1
≥ 5 days	0.88 (0.62; 1.27)	0.87 (0.60; 1.25)	0.64 (0.49; 0.84)	0.64 (0.48; 0.84)
Lunch replacement with snacks				
<5 days	1	1	1	1
≥ 5 days	0.82 (0.43; 1.56)	0.84 (0.44; 1.60)	0.96 (0.53; 1.75)	0.99 (0.54; 1.79)
Diet quality score (quintile)				
1	1	1	1	1
2	1.07 (0.73; 1.56)	1.08 (0.75; 1.58)	1.07 (0.79; 1.45)	1.09 (0.80; 1.48)
3	1.10 (0.79; 1.54)	1.12 (0.81; 1.55)	1.21 (0.91; 1.61)	1.24 (0.94; 1.64)
4	1.26 (0.89; 1.78)	1.29 (0.91; 1.82)	1.42 (1.04; 1.93)	1.48 (1.08; 2.02)
5	1.69 (1.22; 2.33)	1.72 (1.25; 2.36)	1.62 (1.24; 2.12)	1.70 (1.29; 2.25)

Regular consumption: consumption on 5 or more days in the week before to the interview.
Model 1: adjusted for demographic and socioeconomic variables (age group, educational level, local of residence, and geographic region); Model 2: adjusted for demographic and socioeconomic variables and lifestyle-related risk behaviors (practice of physical activity, consumption of alcoholic beverages, time spent watching TV and screen time).

DISCUSSION

In this study, the prevalence of self-reported diabetes mellitus was directly associated with better diet quality and healthy food consumption markers and inversely associated with unhealthy food consumption markers.

Food consumption is one of the modifiable risk factors of DM. Knowledge of food consumption in individuals with DM is essential to guide comprehensive healthcare actions and encourage the improvement of the food and nutritional profile of this population group. The results of this study suggest that Brazilian adults with DM consume greater amounts of healthy food, such as fruits and beans, and less unhealthy food, such as soft drinks and candy.

This hypothesis can be supported by other results observed in the PNS. Comparing the 2013 and 2019 editions, there was an increase in the proportion of people with diabetes who received medical care, from 73.2% to 79.1%.[20] Additionally, the most frequent physician recommendations for the treatment of DM in the 2019 PNS were: maintaining a healthy diet (94.9%), avoiding the consumption of sugar, sugary drinks, and sweets (92.8%), maintaining adequate weight (92.1%), reducing consumption of pasta and bread (88.7%), and practicing regular physical activity (84.9%).[15] Therefore, it can be assumed that these guidelines reflect greater awareness of better eating habits among people with DM.

These results may also be due to changes in the dietary profile of the Brazilian population that indicate a slight inclination towards improving eating habits, such as the reduction in soft drink consumption ranging from 30.9% in 2007 to 15.2% in 2020 (average reduction of -1.27 pp/year) observed in the evolution of VIGITEL indicators.[21] Barros et al.,[22] assessing risk behaviors with data from the 2013 and 2019 PNS, found a reduction in excessive consumption of sweetened beverages (23.2 vs 21.2%) and insufficient consumption of fruits (61.6 vs 58.8%).

Rodrigues et al.,[23] analyzing the data obtained from the National Food Surveys in the years 2008-2009 and 2017-2018, found that traditional foods of the Brazilian dietary pattern, such as rice, beans, coffee, bread, vegetables, and beef, remained the basis of the Brazilian diet. However, ultra-processed foods, such as sweet/stuffed biscuits, savory biscuits, and soft drinks, were also on the list of the 20 most consumed foods by the Brazilian population in both editions.

This epidemiological scenario of health and nutrition of the Brazilian population is due to the implementation of public policies and social programs in health and food in recent decades, including the National Food and Nutrition Policy,[24] which provided the Brazilian population with greater access to health, food, and nutrition services. In addition, the use of instruments, such as the *Food Guide for the Brazilian Population*,[14] can be considered a promoting factor for improvements in the quality of food of the Brazilian population. The *Food Guide* has been considered innovative in guiding healthy eating practices and contributing to health promotion.[25,26]

Thus, the importance of public policies that seek to maintain healthy eating habits is emphasized, encouraging Food and Nutrition Education (FNE) actions. FNE promotion aimed at people with diabetes is a fundamental tool for understanding the disease and encouraging healthy food consumption, which provides better self-care and improvement of the anthropometric profile of these individuals.[27] In Brazil, in 2012, the Marco de Referência de Educação Alimentar e Nutricional para as Políticas Públicas[28] [Food and Nutrition Education Reference Framework for Public Policies] was published, representing an important theoretical reference in the food and nutrition agenda. It outlines the paths for critical education in FNE actions and serves as a strategy to guarantee actions in different care scenarios to ensure the Human Right to Adequate Food.

Regarding the results observed in the present study for the association of risk behaviors related to lifestyle and the prevalence of DM, it must be highlighted that the adoption of a healthy lifestyle, based on regular physical activity, reduction or cessation of alcohol consumption, and cessation of tobacco use, as well as a healthy and balanced diet, have configured a strategy for both prevention and non-pharmacological treatment that helps DM control.[10,29,30]

The results of the present study and the supposed hypothesis must be analyzed with caution, considering the cross-sectional design of the study is unable to infer causality, as well as the use of self-reported information. However, another study with Brazilian adults and elderly also observed healthier food consumption and healthy eating habits among people with diabetes.[31] Furthermore, self-reported DM may be associated with an underestimate of observed prevalence. Based on data from the International Diabetes Federation, Ogurtsova et al.[32] estimated that, in 2021, approximately one in two adults (20-79 years) with diabetes was undiagnosed (44.7%; 239.7 million worldwide). In Brazil, based on data from 2013 PNS, Malta et al.[33] observed that the prevalence of DM defined by glycated hemoglobin ≥ 6.5% or use of medication was 12% higher than the value achieved through self-report.

Strengths of the present study are the nationally representative sample of Brazilian adults, and the use of assessment instruments widely used in surveys in Brazil. Thus, we hope that this study can help support the proposal of more public health care policies related to NCDs, especially DM.

CONCLUSION

The prevalence of self-reported diabetes in Brazilian adults participating in the 2019 PNS was directly associated with better diet quality and healthy food consumption markers, and inversely associated with unhealthy food consumption markers, suggesting that these individuals may possibly seek a better diet quality to control and take care of their health conditions.

Knowing and evaluating the food consumption of individuals with CNCDs, including DM, is of paramount importance, since changing both eating habits and lifestyle can prevent the risk of complications from the disease and, in some cases, favor the reduction of drug treatment. Health professionals should encourage the awareness of these individuals through health education actions to improve their lifestyle.

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Contributors

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