ORIGINAL ARTICLE

KNOWLEDGE AND PARTICIPATION IN PUBLIC PHYSICAL ACTIVITY PROGRAMS OF BRAZILIANS WITH SELF-REPORTED DIABETES MELLITUS

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Highlights: (1) Knowledge of public programs varied according to sociodemographic characteristics. (2) Lack of interest in the activities offered was the main barrier. (3) Physical activity promotion actions should focus on more vulnerable groups.

PRE-PROOF
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KNOWLEDGE AND PARTICIPATION IN PUBLIC PHYSICAL ACTIVITY PROGRAMS OF BRAZILIANS WITH SELF-REPORTED DIABETES MELLITUS

ABSTRACT

Objective: To describe the prevalence of knowledge and participation in public physical activity programs and barriers related to non-participation in these programs by individuals with self-reported diabetes mellitus. **Methods**: Cross-sectional study with data from the National Health Survey, 2019. Pearson's chi-square test was used in the analysis. **Results:** A total of 7,088 adults with self-reported diabetes mellitus were included. The prevalence of knowledge was 28.5% (95%CI: 26.5-30.5) and, of these, 11.1% (95%CI: 8.7-14.2) reported participating in public physical activity programs. The most reported barriers were lack of interest in the activities offered (37.4%) and schedule incompatibility (23.6%). Knowledge was higher among women, individuals with higher education, those with higher household income per capita, and residents of the Southeast macro-region. **Conclusion:** A small portion of individuals with self-reported diabetes mellitus reported knowing about and participating in public physical activity programs. The prevalence of knowledge differed according to sex, education, income, and geographic macro-region. The barriers of lack of interest and lack of time were the most reported by individuals with self-reported diabetes mellitus. It is necessary to expand actions and programs to promote physical activity to prevent and control diabetes mellitus.

Keywords: Diabetes Mellitus; Exercise; Health Promotion; Cross-sectional Studies

INTRODUÇÃO

Noncommunicable chronic diseases (NCDs) are the leading causes of illness and death worldwide and were responsible for 73.6% of deaths in 2019. One of the primary chronic diseases and the fourth leading cause of death in the world was diabetes mellitus (DM)[1]. In Brazil, in 2019, the prevalence of self-reported medical diagnosis of DM was 7.7% and was higher in females, older adults, and less-educated individuals[2].

The growing prevalence of DM is primarily exacerbated by urbanization, nutritional and epidemiological transitions, population aging, lifestyle changes, and other factors[3]. DM treatment is performed through glycemic control based on the adoption of healthy lifestyle habits, including adequate and healthy diet, regular physical activity, and smoking cessation.

Pharmacological treatment can also be added to prevent microvascular and macrovascular complications associated with chronic hyperglycemia[3,4].

Physical inactivity is one of the main modifiable risk factors for NCDs[5]. It is estimated that 31.3% of adults worldwide are insufficiently active[5]. In Brazil, the recommended levels of leisure-time physical activity have not been achieved by the general population[6] and individuals with NCDs[7,8].

Bodily practices and physical activities are one of the priorities of the National Health Promotion Policy[9] and the Strategic Action Plan to Combat NCDs in Brazil (2021–2030)[10]. Among the proposed actions, promoting physical activity in community settings stands out as a strategy to expand its practice among the population and encourage healthy lifestyle habits. In Brazil, this type of intervention was institutionalized as a national program in 2011[11].

DM prevention and treatment actions should include the development of self-care activities, such as physical activity[12]. A scoping review showed that adherence to this practice among people with DM is associated with sociodemographic characteristics and personal and social barriers[13]. In addition, population-based studies have shown inequalities in gender, socioeconomic status, and environmental factors in access to leisure-time physical activity[6-8,11,12].

In this context, this study aimed to describe the prevalence of knowledge and participation in public physical activity programs and barriers related to non-participation in these programs by individuals with self-reported DM. This knowledge can improve the structuring of public health surveillance and care policies.

MÉTODOS

This cross-sectional study was conducted using data from the 2019 National Health Survey (PNS), which is available on the homepage of the Brazilian Institute of Geography and Statistics (IBGE)[14]. The PNS first edition was in 2013, and its second edition was in 2019, with an expected sample of 108,525 households. This research aims to investigate the lifestyles of the Brazilian population concerning physical activity practice, eating habits, among others. The study population consisted of residents from households across all Brazilian macro-regions. A three-stage cluster sampling approach was adopted, comprising census tracts, households, and

residents aged 15 or older. Additional information is available in the study by Stopa *et al.* (2019)[15].

The PNS questionnaire is subdivided into three parts. The first two parts are answered by a resident of the household and cover questions about the household's characteristics and socioeconomic situation. The third part is the individual questionnaire, which is answered by a resident aged 15 or older and contains questions about the primary NCDs, lifestyles, and access to medical care.

The following questions were used to select individuals with self-reported DM: "Has a doctor ever diagnosed you with diabetes?" (yes/no) and "Did this diabetes occur only during some pregnancy period?" (yes/no). In the present study, only people aged 18 or older with self-reported DM were included (n=7,088) (Figure 1).

This study's dependent variables refer to knowledge of and participation in community programs to promote physical activity. This information was obtained through the following questions: "Are you aware of any public program to encourage physical activity in your municipality?" (yes/no); "Do you participate in this public program to encourage physical activity in your municipality?" (yes/no); "What is the main reason for not participating?" (it is not close to my home; the program's operating hours are incompatible with my work or household activities; I am not interested in the activities offered; the space is not safe/well-lit; health problems or physical disability; other).

The sociodemographic variables were sex (male/female); age group in years (18-34; 35-44; 45-59; 60 or older); skin color/race (White; Black; Brown; others, which corresponded to Yellow and Indigenous); marital status (with partner – married; without partner – widowed/single/divorced, separated or legally separated); schooling (illiterate/incomplete elementary school; complete elementary school/incomplete High School; complete High School/incomplete Higher Education; complete Higher education); household income per capita in minimum wages (MW) (up to half MW; more than half and up to 1 MW; more than 1 and up to 2 MWs; more than 2 MWs); geographic macro-region (North; Northeast; Southeast; South; Midwest).

The relative frequencies and their respective 95% confidence intervals (95%CI) were calculated for descriptive analysis. Pearson's chi-square test was used to compare the

prevalence of knowledge and participation in public physical activity programs by sociodemographic characteristics. The non-overlap of 95%CI was considered to identify significant differences in variables with more than two categories. All analyses were performed using Stata software (StataCorp, College Station, Texas, USA), version 16.0, with procedures for complex samples.

The National Research Ethics Committee of the National Health Council approved the 2019 PNS under Opinion number 3.529.376, issued on August 23, 2019. All participants signed an informed consent form before the interview.

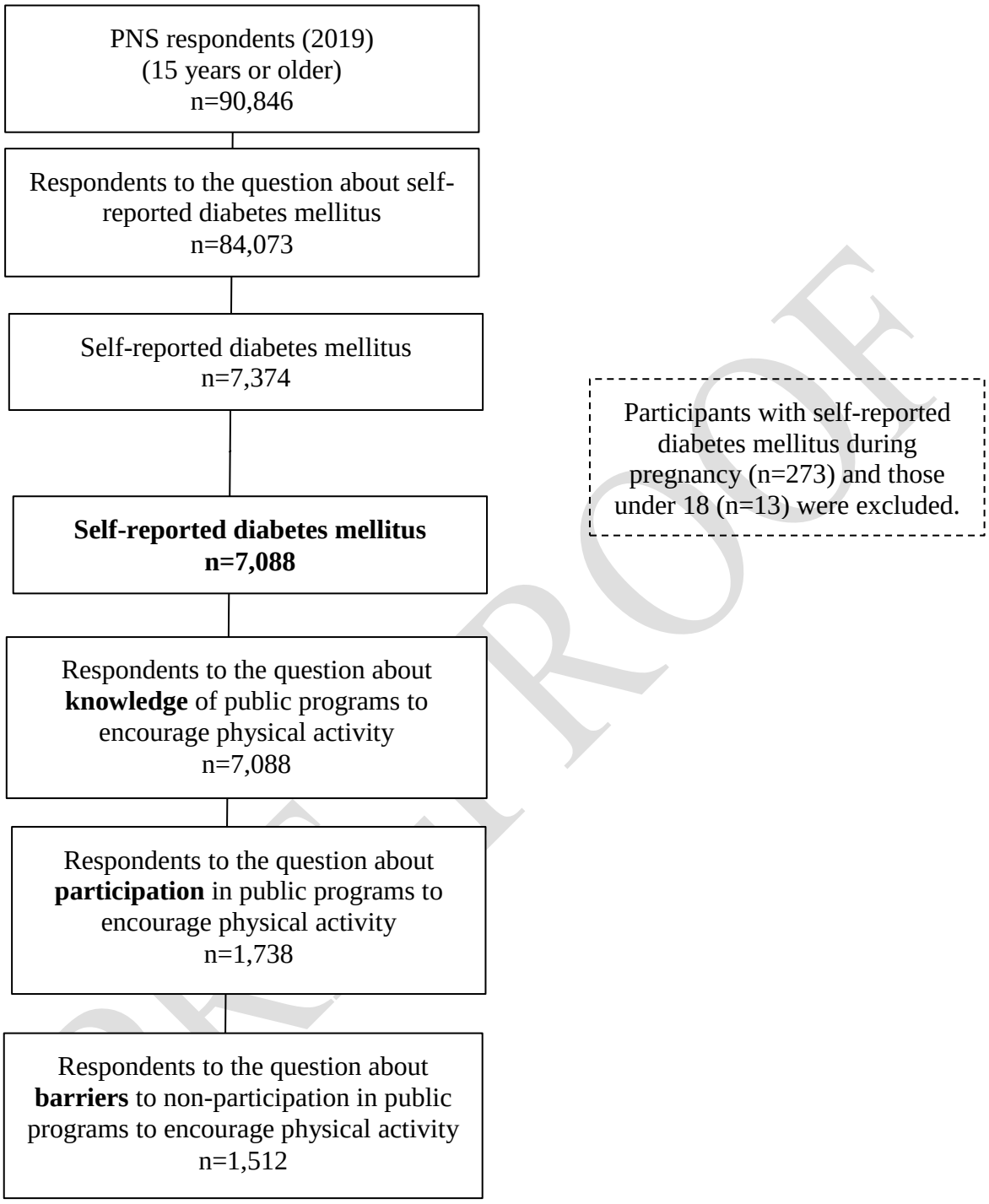

Figure 1 - Flowchart of the study sample. National Health Survey (PNS), 2019.

Source: Prepared by the authors.

RESULTADOS

The study included 7,088 individuals aged 18 or older with self-reported DM. Most were female (58.1%), aged 60 or older (56.5%), Black or Brown (52.8%), with a partner (52.3%), illiterate/incomplete elementary school (58.0%), and a household income per capita of more than half to 2 MWs (61.7%). Most of the sample was from the Southeast macro-region (47.8%) (Table 1).

Regarding knowledge about public programs to encourage physical activity, 28.5% (95%CI: 26.5-30.5) stated that they knew of some program in their municipality and, of these, 11.1% (95%CI: 8.7-14.2) participated in these programs (data not shown in the table).

The main barriers to non-participation in these programs were a lack of interest in the activities offered (37.4%), followed by the program's operating hours incompatible with work or household activities (23.6%), and health problems or physical disability (22.0%). Significant differences in the prevalence of some barriers were observed between the sexes. Lack of interest in the activities offered was more frequent among men, while lack of safety/illumination of spaces and other reasons were more frequently reported by women (Figure 2).

Table 1 - Frequency distribution of sociodemographic variables in individuals aged 18 or older with self-reported diabetes mellitus. National Health Survey (PNS), 2019 (n=7,088).

Variables	%	95%CI
Sex		
Male	41.9	39.9-43.9
Female	58.1	56.0-60.1
Age group (years)		
18-34	3.4	2.7-4.3
35-44	8.3	7.2-9.5
45-59	31.8	30.0-33.7
60 or older	56.5	54.5-58.5
Skin color/race		
White	45.1	43.1-47.1
Black	11.6	10.6-12.9
Brown	41.2	39.3-43.2
Others (Yellow and Indigenous)	2.1	1.5-2.8
Marital status		
With partner	52.3	50.3-54.2
Without partner	47.7	45.8-49.7
Schooling		
Illiterate/incomplete elementary school	58.0	56.0-60.0
Complete elementary school/incomplete High School	11.7	10.4-13.2
Complete High School/incomplete Higher Education	20.7	19.1-22.5
Complete Higher Education	9.6	8.5-10.7
Household income per capita		
Up to half MW	16.2	14.9-17.6
More than half and up to 1 MW	31.7	29.9-33.5
More than 1 and up to 2 MWs	30.0	28.2-31.8
More than 2 MWs	22.1	20.4-24.0
Geographic macro-region		
North	5.6	5.0-6.1
Northeast	24.6	23.2-26.0
Southeast	47.8	45.8-49.8
South	15.0	13.8-16.3
Midwest	7.0	6.3-7.8

95%CI – 95% confidence interval; MW – minimum wage.
Source: Prepared by the authors.

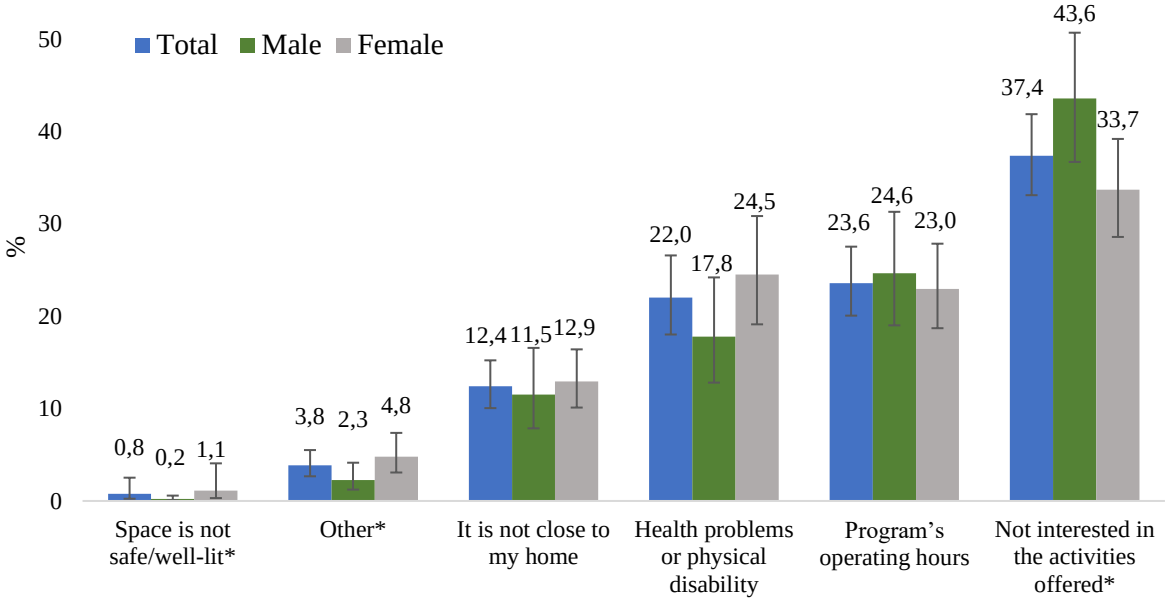

Figure 2 - Main barriers reported by individuals aged 18 or older with self-reported diabetes mellitus for not participating in public programs to encourage physical activity, stratified by gender. National Health Survey (PNS), 2019 (n=1,512).

*Statistically significant difference between sexes ($p<0.05$).

Source: Prepared by the authors.

The prevalence of knowledge of public programs to encourage physical activity among individuals with self-reported DM was higher among females, individuals with higher education, household income per capita greater than 1 MW, and residents of the Southeast macro-region (no 95%CI overlap). Knowledge about these programs did not differ regarding age group, skin color/race, or marital status (Table 2).

Participation in public programs to encourage physical activity among individuals with self-reported DM was not significantly different for any sociodemographic variable assessed (Table 3).

Table 2 - Prevalence of **knowledge** of public programs to encourage physical activity by sociodemographic variable in individuals aged 18 or older with self-reported diabetes mellitus. National Health Survey (PNS), 2019 (n=7,088).

Variables	Prevalence (%)	95%CI	P-value*
Sex			
Male	25.0	22.3-27.8	**0.002**
Female	31.0	28.4-33.7	
Age group (years)			
18-34	32.1	22.3-43.7	0.246
35-44	31.8	25.5-38.7	
45-59	30.3	26.5-34.5	
60 or older	26.7	24.4-29.2	
Skin color/race			
White	29.2	26.4-32.3	0.622
Black	25.6	21.2-30.6	
Brown	28.2	25.1-31.4	
Others (Yellow and Indigenous)	33.7	19.2-52.1	
Marital status			
With partner	29.7	26.8-32.7	0.205
Without partner	27.1	24.7-29.8	
Schooling			
Illiterate/incomplete elementary school	25.6	23.0-28.3	**0.001**
Complete elementary school/incomplete High School	31.4	26.0-37.3	
Complete High School/incomplete Higher Education	31.1	27.1-35.3	
Complete Higher Education	36.6	31.0-42.6	
Household income per capita			
Up to half MW	23.1	19.4-27.3	**0.005**
More than half and up to 1 MW	25.8	22.7-29.2	
More than 1 and up to 2 MWs	32.1	28.5-36.0	
More than 2 MWs	31.2	26.8-36.0	
Geographic macro-region			
North	20.1	16.4-24.5	**<0.001**
Northeast	22.0	19.8-24.4	
Southeast	34.7	31.2-38.4	
South	25.9	22.3-29.9	
Midwest	20.8	17.0-25.2	

95%CI – 95% confidence interval; MW – minimum wage.
*Pearson's Chi-square test.
Bold: Statistically significant difference ($p<0.05$).
Source: Prepared by the authors.

Table 3 - Prevalence of **participation** in public programs to encourage physical activity by sociodemographic variable in individuals aged 18 or older with self-reported diabetes mellitus. National Health Survey (PNS), 2019 (n=1,738).

Variables	Prevalence (%)	95%CI	P-value*
Sex			
Male	9.5	6.4-14.0	0.340
Female	12.0	8.9-16.2	
Age group (years)			
18-34	9.7	4.0-21.6	0.323
35-44	10.5	5.2-20.0	
45-59	8.5	9.3-18.0	
60 or older	13.1	8.7-14.2	
Skin color/race			
White	10.9	7.8-15.0	0.958
Black	11.0	7.3-16.2	
Brown	11.2	7.0-17.4	
Others (Yellow and Indigenous)	14.4	4.7-36.5	
Marital status			
With partner	11.7	8.0-16.8	0.614
Without partner	10.4	7.9-13.6	
Schooling			
Illiterate/incomplete elementary school	10.5	6.9-15.5	0.704
Complete elementary school/incomplete High School	9.5	6.0-14.7	
Complete High School/incomplete Higher Education	12.0	7.8-18.1	
Complete Higher Education	14.1	8.2-23.0	
Household income per capita			
Up to half MW	8.6	4.9-14.4	0.518
More than half and up to 1 MW	9.8	7.0-13.7	
More than 1 and up to 2 MWs	13.5	8.5-20.7	
More than 2 MWs	10.8	6.5-17.3	
Geographic macro-region			
North	14.5	8.3-24.1	0.428
Northeast	12.0	9.1-15.7	
Southeast	10.0	6.4-15.3	
South	11.4	7.5-17.0	
Midwest	17.1	11.2-25.1	

95%CI – 95% confidence interval; MW – minimum wage.
*Pearson's Chi-square test.
Source: Prepared by the authors.

DISCUSSION

The study revealed low knowledge and participation in public programs promoting physical activity among individuals with self-reported DM. The prevalence of knowledge was higher among women, more educated individuals, those with a higher household income per capita, and residents of the Southeast macro-region. The three main barriers to non-participation in these programs by Brazilians with self-reported DM were a lack of interest in the activities offered, the program's operating hours incompatible with work or household activities, and health problems or physical disability.

Most of the research participants were female, aged 60 or older, Black or Brown, had a partner, were illiterate or had an incomplete elementary school, had a household income per capita between more than half and up to 2 MWs, and resided in the Southeast macro-region. This sample profile can be attributed to women's more frequent search for health services, which enables a greater diagnosis of the disease than in men, in addition to hormonal changes during menopause and consequent increase in body weight and abdominal fat, factors that predispose to the development of DM[16]. In turn, increasing age is associated with a higher frequency of DM due to pathophysiological mechanisms resulting from aging, physical inactivity, inadequate diet, increased obesity, and greater opportunity for diagnosis[2]. Regarding marital status, unlike our study, a recent narrative review indicated that there is some evidence that being married, in itself, exerts a small protective effect on the risk of developing type 2 DM. This result may be related to higher stress levels among those who live alone, as well as lower adoption of a healthy lifestyle and social support[17].

The highest prevalence of DM among those with lower education and income was observed in studies conducted using data from the PNS[2,18]. The authors affirm that more educated people with higher income have greater access to health services, health literacy, and healthier eating habits, which generates a protective effect against this disease[2,18]. Previous research analyzing spatial clusters of type 2 DM among participants in the Brazilian Longitudinal Study of Adult Health (ELSA-Brazil) in Belo Horizonte and Salvador identified that residents in clusters with a high prevalence of type 2 DM were more likely to report Brown or Black skin color and a lower schooling level[19]. In turn, the higher frequency of respondents in the Southeast macro-region may be due to the higher Human Development Index of this

geographic macro-region of the country, which has greater investment in structure, service, and requests for tests, assistance, and care, contributing to greater diagnosis of the disease in the resident population[20,21].

Knowledge about public physical activity programs was higher among women, individuals with a complete Higher education, those with a household income per capita greater than 1 MW, and residents of the Southeast macro-region. This result was similar to that found by Ferreira *et al.* (2019)[11] in a study conducted with Brazilian adults participating in the first PNS edition. Although leisure-time physical activity is greater among men, as documented in the literature[22], as it is a public physical activity program linked to health services, women are expected to have greater knowledge because they seek medical assistance and other health services more frequently[23].

In the present study, knowledge about these programs was associated with higher socioeconomic status, as indicated by the higher prevalence of knowledge among participants with higher education and income levels, which may be related to social and health inequalities. A study that also analyzed data from the PNS showed a higher frequency of public physical activity facilities (squares, parks, closed streets, and beaches) near homes among individuals in the highest quintiles of income and education[24]. It is widely reported in the literature that individuals with a higher socioeconomic level have better working conditions, a healthier lifestyle, greater access to health services, and a greater understanding of the importance of physical exercise practice[25-27].

In our study, 28.5% of individuals with self-reported DM reported knowing about public programs to promote physical activity in their municipality and, of these, only 11.1% participated in the programs, a result slightly higher than that observed among Brazilian adults, in which 20.0% knew about them and, of these, 9.7% participated[11]. A study by Silva *et al.* (2021)[8] found that adherence to physical activity is more likely when health professionals recommend it. It is worth noting that the recommendations must be made by all health professionals for greater adherence, which, in practice, does not occur, as 80% of the recommendations are made only by doctors[8]. In this sense, advice from the team at PHC units (UBS) is necessary to increase knowledge and participation in public physical activity programs and their benefits in the prevention and control of NCDs.

In addition to recommendations from health professionals, access to public programs and adequate structures for physical activity is necessary for different population groups. Even with investment from the National Health Promotion Policy, which encourages physical activity by creating programs such as the Health Academy and expanding qualified locations for physical activity practice, the bureaucracy and the available budget pose challenges to the implementation of programs and actions[28,29].

A previous study evaluating Brazilian adults found that men engaged in more physical activity than women, and this engagement was associated with higher levels of education and income[22]. According to authors, individuals with lower socioeconomic status have less access to public spaces suitable for physical activity practice[22]. Forechi *et al.* (2018)[7] report that individuals with DM are more likely to engage in physical activity when they know the benefits of this activity and its effects on preventing NCDs.

No differences were observed in the prevalence of participation in public programs to promote physical activity by sociodemographic characteristics. This result differs from that observed in studies with Brazilian adults[11] and seniors[30]. Among adults, participation was higher in those aged 60 or older, females, non-whites, and individuals belonging to the lowest income quartile[11]. Among older adults, the highest participation was observed in those aged 60-69, women, married individuals, and residents in the South and Southeast regions[30]. A possible explanation for the finding of the present study is that the analyzed sample comprised individuals with the same health condition[30] who share similar sociodemographic characteristics. A study involving users of programs and interventions to promote physical activity in the PHC units (UBS) in Pernambuco found that the main reasons reported for participating in these programs were to improve health, prevent diseases, and lose weight[31].

The main barriers to non-participation in public programs promoting physical activity were a lack of interest in the activities offered and the program's operating hours incompatible with work or household activities. This result aligns with that found in a study of Brazilian adults[11]. The type of activity offered, and the program's operating hours define the profile of users. Notably, the workday can contribute to lower motivation to engage in leisure-time physical activity due to fatigue, excessive workload, and school and family commitments, leaving little time left for physical activity[11]. Moreover, the lack of interest is related to the

activities the program offers, which are typically limited to walking and gymnastics, with no variety of activities to increase adherence[31]. In this context, it is necessary to expand the operating hours of public physical activity programs and increase the diversity of activities offered.

Other barriers were identified, including health problems or physical disability, distance from home, and lack of safety and lighting in space. A systematic review of perceived barriers to leisure-time physical activity in the Brazilian population identified the main barriers as a lack of motivation and time among adults and a lack of motivation and diagnosis of illness or physical limitation among older adults[32]. Barriers related to health problems or physical disability are directly associated with the aging process. However, participation in public programs to promote physical activity is associated with improved nutritional status, and knowledge about its benefits is a factor that increases adherence, thereby enhancing the quality of life for these individuals[33].

As in the present study, a scoping review of studies published between 2019 and 2021 revealed that barriers to physical activity are associated with the characteristics of the built environment[34]. Such barriers include the lack of accessibility and inadequate facility conditions (e.g., insufficient security and public lighting)[34]. Access to well-lit neighborhoods makes individuals feel safer, allowing them to use walking as a transportation means and engage in outdoor activities[34]. In addition, the expanded range of activities offered in the neighborhood increases the practice of physical activity, and proximity reduces the need for travel, facilitating access[35-37].

A limitation of this study may be information bias since the data on diagnosis, knowledge, and participation were self-reported by the respondents. Additionally, self-reported morbidity data rely on access to health services for diagnosis. Therefore, individuals who use the services more frequently have a greater opportunity for a medical diagnosis of DM. Among the study's strengths, we highlight the analysis of data from the PNS, which has national coverage and, therefore, our findings have greater potential for generalization.

CONCLUSION

Only a small proportion of Brazilians with self-reported DM reported knowing about and participating in public physical activity programs in their municipality. The prevalence of knowledge was higher among women, people with higher schooling levels and household income, and residents of the Southeast macro-region. The main barriers reported for not participating in these programs were lack of interest, incompatible schedules, health problems or physical disability, and lack of adequate structure.

To expand actions to promote body practices and physical activity, it is essential to promote intersectoral coordination to consolidate physical activity programs as a component of care in Primary Health Care and in the community context. It is also essential to strengthen active and sustainable mobility initiatives and expand access to quality public spaces with adequate infrastructure for physical activity practice. Furthermore, promotional actions must consider gender and socioeconomic inequalities, structuring education and communication strategies that value social, cultural, and regional specificities and encouraging the provision of public programs that promote physical activity equitably.

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