

Physical Activity Before and During The COVID-19 Pandemic in Piauí: Population-based Study

Prática de Atividade Física Antes e Durante a Pandemia de COVID-19: Estudo de Base Populacional
Actividad Física Antes y Durante la Pandemia de COVID-19 en Piauí: Estudio Poblacional

RESUMO

Objetivo: Analisar a prevalência e fatores associados da prática de atividade física antes e durante a pandemia de covid-19 no Piauí. **Métodos:** Estudo transversal de base populacional, realizado no estado do Piauí em 2022. Realizaram-se entrevistas domiciliares com aplicação de questionário eletrônico, avaliando-se a prática de atividade física antes e durante a pandemia. Foram calculadas prevalências e intervalos de confiança de 95%. **Resultados:** Antes da pandemia, 50,4% dos adultos faziam atividade física suficiente; durante a pandemia, a prevalência foi de 39,2%. Sexo, faixa etária, escolaridade, uso de tabaco, renda familiar, possuir plano de saúde e ter comorbidades/condições crônicas foram associados significativamente à prática de atividade física. **Conclusões:** A prática de atividade física diminuiu durante a pandemia no estado e esteve relacionada com fatores sociodemográficos, comportamentais e clínicos.

DESCRIPTORIOS: Pandemia COVID-19; Adultos; Estilo de Vida Sedentário; Inatividade física; Inquéritos Epidemiológicos.

ABSTRACT

Objective: To analyze prevalence and associated factors of physical activity before and during the COVID-19 pandemic in the state of Piauí, Brazil. **Methods:** This was a population-based cross-sectional study conducted in the state of Piauí in 2022. Household interviews were carried out using an electronic questionnaire to assess physical activity before and during the pandemic. Prevalence estimates and 95% confidence intervals were calculated. **Results:** Before the pandemic, 50.4% of adults engaged in sufficient physical activity; during the pandemic, this prevalence decreased to 39.2%. Sex, age group, educational level, tobacco use, family income, having private health insurance, and the presence of comorbidities/chronic conditions were significantly associated with physical activity. **Conclusions:** Physical activity decreased during the pandemic in the state and was associated with sociodemographic, behavioral, and clinical factors.

DESCRIPTORS: COVID-19 Pandemic; Adults; Sedentary Lifestyle; Physical Inactivity; Health Surveys.

RESUMEN

Objetivo: Analizar prevalencia y factores asociados a la práctica de actividad física antes y durante la pandemia de COVID-19 en estado de Piauí. **Métodos:** Estudio transversal de base poblacional realizado en estado de Piauí, 2022. Se realizaron entrevistas domiciliarias mediante la aplicación de un cuestionario electrónico para evaluar la práctica de actividad física antes y durante la pandemia. Se calcularon prevalencias e intervalos de confianza del 95%. **Resultados:** Antes de la pandemia, el 50,4% de los adultos realizaba suficiente actividad física; durante la pandemia, la prevalencia disminuyó al 39,2%. El sexo, el grupo de edad, el nivel educativo, el consumo de tabaco, el ingreso familiar, la posesión de seguro de salud y la presencia de comorbilidades o enfermedades crónicas se asociaron significativamente con la práctica de actividad física. **Conclusiones:** La práctica de actividad física disminuyó durante la pandemia en el estado y estuvo relacionada con factores sociodemográficos, conductuales y clínicos.

DESCRIPTORIOS: Pandemia de COVID-19; Adultos; Estilo de Vida Sedentario; Inactividad Física; Encuestas de Salud.

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INTRODUCTION

Physical activity is defined as behavior involving voluntary body movements that result in energy expenditure above the resting level. This expenditure occurs during social interactions and interactions with the environment and can take place during leisure time, commuting, work or study, and household chores¹. The World Health Organization (WHO) states that, in adults, physical activity provides numerous health benefits, including improved mental health, quality of life, and well-being. Furthermore, it contributes to the prevention and treatment of chronic non-communicable diseases, such as heart disease, stroke, diabetes, and cancer, and helps prevent hypertension and obesity².

The WHO's Global Action Plan on Physical Activity 2018–2030 sets a target of reducing the prevalence of physical inactivity by 15% by 2030 through the implementation of policies and actions aimed at promoting physical activity in various settings³. Combating a sedentary lifestyle is an important strategy for reducing morbidity and mortality in the popula-

tion, since being physically active is one of the main recommendations for maintaining and improving quality of life⁴. However, during the COVID-19 pandemic, social restriction measures altered people's daily lives and compromised the maintenance of this healthy behavior.

Social distancing was the most widely implemented measure by authorities and the most effective in preventing the spread of the disease and flattening the coronavirus transmission curve⁵. It is believed that, in addition to the effects of vaccination, adherence to physical activity guidelines was strongly associated with a reduced risk of severe COVID-19 cases among infected adults⁶. However, with the closure of some establishments (such as gyms) and the ban on team sports to prevent crowds and disease transmission, the population found it more difficult to remain physically active. Encouraging people to stay at home was a significant measure, but it may also have had negative effects on healthy behaviors, such as a decrease in physical activity⁷.

Studies show that the prevalence of physical inactivity increased among Brazilian adults during the

COVID-19 pandemic⁸. In this context, the objective of this study was to analyze physical activity levels before and during the COVID-19 pandemic in the state of Piauí and the associated factors.

METHOD

A cross-sectional study using a population-based household survey, based on the age-stratified seroepidemiological investigation protocol for SARS-CoV-2 infection (EpiCOVID-Piauí).

The study was conducted in the state of Piauí from March to November 2022. A two-domain sampling plan was used, with the first domain consisting of the municipality of Teresina (capital of Piauí) and the second comprising municipalities in the state's interior (23 municipalities). Municipalities were selected at random, followed by census tracts, blocks, and finally, households.

The sample size for each domain was calculated using the OpenEpi® software via the equation: $n = [EDFF * Np(1-p)] / [(d^2 / Z^2 1-\alpha/2 * (N-1) + p * (1-p)]$, where N = population size of each domain; p = prevalence of infected individuals estimated at 50%;

EDFF = cluster design effect equal to 2.0; d = tolerable error of 4.5%; and Z = standard score of the normal distribution equal to 1.96 (corresponding to a 95% confidence level). The minimum number of individuals per domain was 950, totaling 1,900 individuals to comprise the sample. This study included adults aged 18 years or older who resided in urban or rural areas, resulting in a sample of 1,806 individuals out of a total of 2,104 people interviewed.

Data were collected through interviews using an electronic questionnaire with closed-ended questions, via the EpiCollect app. The dependent variable was physical activity, based on the following questions: 1. “BEFORE the pandemic (before March 2020), did you engage in at least 30 minutes of physical exercise or sports (running outdoors, running on a treadmill, aerobic exercise, soccer, basketball, jumping rope, cycling) at least 5 times a week?” with the following response options: yes; no; 2. “During the pandemic (since March 2020), have you been engaging in at least 30 minutes of physical exercise or sports (running outdoors, running on a treadmill, aerobic exercise, soccer, basketball, jumping rope, cycling) at least 5 times a week?”: yes; no.

The independent variables used were sociodemographic characteristics (gender, age group, income, race/skin color, education level, marital status, alcohol use, tobacco use, receipt of government benefits) and clinical characteristics (health insurance, chronic conditions/comorbidities, heart disease, and COVID-19 symptoms in the past 15 days).

The *rake* method was used to construct the weights after stratification by region (primary and internal), so that the distribution of the sample after weighting would be identical to that of the population⁹. To this end, estimates of the resident population by sex, age group, and highest level of ed-

ucation of households were used, based on data from the fourth quarter of the Continuous National Household Sample Survey (PNAD Contínua) since 2022, conducted by the IBGE¹⁰. Prevalences and their respective 95% confidence intervals were calculated, and to assess the association between the independent variables and the outcomes of interest, Pearson's chi-square test was used, with a significance level of 5%. The data were tabulated in Excel, and analyses were performed using Stata version 16.1, employing the *survey* module, which accommodates the parameters of the complex sampling design and sample weighting.

In accordance with the recommendations of Resolution 466/2012, the study protocol was approved by the UFPI Research Ethics Committee (Opinion No. 4,644,991, dated April 12, 2021). All individuals selected for the sample were informed about the study's objectives, risks, and benefits. They were asked to sign the informed

consent form (ICF), and participant confidentiality was maintained during and after the study.

RESULTS

Of the 1,806 individuals who participated in the survey, the majority were female (53.6%), aged 18 to 39 (49.1%), of mixed-race or brown skin color (62.3%), had completed high school (38.7%), were not in a marital relationship (54.5%), and lived in rural areas (62.4%). Most reported a household income of up to two minimum wages (64.2%), received some form of government assistance (55.8%), consumed alcohol up to once a week (66.8%), and did not smoke (91.7%). Regarding clinical and n data, most participants did not have health insurance (73.5%), did not report heart disease (94.5%), and stated they had not experienced COVID-19 symptoms in the past 15 days (54.5%) (Table 1).

Table 1. Sociodemographic and clinical characteristics of the study population. Piauí, 2022 (N = 1,806).

Variables	n	%*
Total	1.806	100,0
Region		
Capital	864	37,6
Inland	942	62,4
Gender		
Female	1.161	53,6
Male	645	46,4
Age group (in years)		
18–39	649	49,1
40–59	648	32,5
≥60	509	18,4
Race/skin color		
White	366	21,5
Black	279	16,1
Brown	1.123	62,2
Education		
No education/Elementary school	697	29,7
High school	710	38,7

High	399	31,6
Marital partnership		
No	945	54,5
Yes	861	45,5
Alcohol use ¹		
Up to 1 day	1.206	66,8
2 days or more	254	14,1
Tobacco use		
No	1.627	91,7
Yes	179	8,3
Income (in minimum wages) ²		
Up to 2	1.160	64,2
More than 2	593	32,8
Government benefits		
No	757	44,2
Yes	1.049	55,8
Health insurance		
No	1.379	73,5
Yes	427	26,5
Chronic conditions/comorbidities		
None	880	54,1
One or more	926	45,9
COVID-19 symptoms		
Asymptomatic	939	54,5
Mild symptoms	427	22,9
Sintomático	440	22,6

*Percentage weighted according to a complex sampling plan.

1 Did not respond: 346 (19.1%); 2 Did not respond: 53 (2.9%).

Table 2 shows that, before the COVID-19 pandemic, 50.4% of adults engaged in sufficient physical activity; during the pandemic, this percentage dropped to 39.2%. This prevalence was higher among men (54.8%) than among women (46.5%). During the pandemic, although there was a decrease in both sexes, men maintained a higher rate of physical activity (43.5%) than women (35.5%). There was a decrease in physical activity among young adults (ages 18–39) (before the pandemic: 52.0% / during: 41.3%) and among people aged 60 and older, whose rate fell from 47.0% to 34.0%.

Physical activity was significantly more frequent among individuals with a college degree, with a prevalence of 62.3% before and 52.3% during the pandemic, compared to those with less education (36.4% and 24.8%, respectively; $p < 0.001$). Similarly, non-smokers had higher prevalence rates of physical activity both before (51.8% vs. 34.1%) and during the pandemic (40.4% vs. 23.7%) compared to smokers ($p \leq 0.006$). Regarding household income, those with an income greater than or equal to two minimum wages saw a decrease in physical activity from 54.8% before the pandemic to 43.4% during the pandemic (Table 2).

Table 2. Physical activity among adults before and during the COVID-19 pandemic, by sociodemographic characteristics. Piauí, 2022.

Variables	Physical activity before				Physical activity during			
	n	%*	95% CI ¹	p-value	n	%*	95% CI ¹	p-value
Total	849	50,4	(46,9-53,8)		631	39,2	(35,4-43,0)	
Region								
Capital	420	52,3	(47,4-57,2)	0,362	298	38,8	(34,5-43,3)	0,869
Interior	429	49,2	(44,5-53,9)		333	39,4	(34,1-45,0)	
Gender								
Female	513	46,5	(42,0-51,1)	0,028	372	35,5	(31,8-39,3)	0,013
Male	336	54,8	(49,2-60,3)		259	43,5	(37,6-49,5)	
Age group (in years)								
18–39	310	52,0	(46,9-56,0)	<0,001	237	41,3	(35,5-47,3)	0,178
40–59	306	49,9	(45,0-54,8)		225	39,0	(34,2-44,0)	
≥60	233	47,0	(40,6-53,5)		169	34,0	(28,7-39,7)	

Race/skin color								
White	170	49,8	(43,3-56,3)	0,888	143	42,6	(36,2-49,3)	0,462
Black	132	52,0	(43,9-59,9)		89	38,8	(31,6-46,5)	
Brown	528	49,8	(45,0-54,6)		385	37,7	(32,6-43,1)	
Education Level								
No/	257	36,4	(31,7-41,3)	<0,001	175	24,8	(20,9-29,1)	<0,001
Elementary	348	51,3	(46,4-56,2)		257	39,5	(34,6-44,5)	
Median	244	62,3	(56,1-68,2)		199	52,3	(45,8-58,8)	
Upper								
Marital partnership	447	52,0	(46,9-57,1)	0,275	342	41,7	(36,4-47,1)	0,080
No	402	48,4	(44,2-52,7)		289	36,2	(32,1-40,6)	
Yes								
Alcohol use	568	49,7	(46,0-53,4)	0,574	554	38,9	(35,3-42,7)	0,731
Up to 1 day	109	46,9	(38,2-52,6)		77	40,4	(31,7-49,8)	
2 days or more								
Tobacco use	796	51,8	(48,1-55,6)	0,001	601	40,4	(36,4-44,6)	0,006
No	53	34,1	(25,4-44,1)		30	23,7	(15,6-43,1)	
Yes								
Household income (in minimum wages)	506	47,4	(42,7-52,2)	0,038	371	36,5	(31,9-41,4)	0,036
Up to 2	318	54,8	(49,8-59,7)		242	43,4	(38,6-48,3)	
More than 2								
Government benefit	377	53,2	(48,2-58,2)	0,096	308	44,0	(38,7-49,5)	0,055
No	472	48,1	(43,9-52,3)		323	35,3	(30,6-40,3)	

*Percentage weighted according to a complex sampling plan. ¹ 95% CI: 95% confidence intervals.

Having health insurance (before: 60.4%; during: 36.4%) and having comorbidities/chronic conditions (before: 48.3%; during: 33.9%) were statistically significantly associated with physical activity (Table 3).

Table 3. Physical activity among adults before and during the COVID-19 pandemic, by clinical characteristics. Piauí, 2022.

Variables	Physical activity before				Physical activity during			
	n	%*	95% CI ¹	p-value	n	%*	95% CI ¹	p-value
Total	849	50,4	(46,9-53,8)		631	39,2	(35,4-43,0)	
Health insurance								
No	596	46,7	(43,1-50,4)	0,001	439	36,4	(32,0-40,5)	0,001
Yes	255	60,4	(53,0-67,4)		192	46,8	(40,5-53,2)	
Chronic conditions/comorbidities								
None	431	52,1	(47,6-56,6)	0,254	338	43,7	(39,2-48,2)	0,002
One or more	418	48,3	(43,3-53,4)		293	33,9	(28,9-39,2)	
COVID-19 symptoms								
Asymptomatic	463	53,5	(48,8-58,1)	0,075	348	41,2	(36,0-46,5)	0,055
Oligosymptomatic	190	46,5	(40,4-52,8)		155	39,9	(34,6-45,4)	
Symptomatic	196	46,7	(40,8-52,7)		128	33,7	(28,1-39,8)	

*Weighted percentage according to a complex sampling plan. ¹ 95% CI: 95% confidence intervals.

DISCUSSION

The prevalence of sufficient physical activity decreased from 50.4% before the COVID-19 pandemic to 39.2% during the pandemic. Men maintained higher prevalence rates of physical activity in both periods compared to women, although a reduction was observed across all age groups. Physical activity was significantly more frequent among individuals with higher levels of education, nonsmokers, those with higher household income, and recipients of government assistance programs. Additionally, having health insurance and not having comorbidities were associated with higher prevalence of physical activity, highlighting the impact of sociodemographic, economic, and health factors on maintaining this behavior during the pandemic.

The results of this study showed variations in physical activity behavior among participants before and during the COVID-19 pandemic restrictions. More people became physically inactive, and this may be one of the negative effects caused by fear and increased restrictions on movement in public places. The more severe restrictions during the pandemic caused significant changes in people's lifestyles, leading them to spend more time at home and resulting in increased sedentary time and a decrease in physical activity¹¹.

The present study has some limitations that should be taken into account. These include reporting bias, which may be influenced by memory lapses, the need for approval, and fear of criticism related to physical activity. Furthermore, the results were not adjusted for other potential confounding variables that may also be relevant, such as screen time and diet.

Similar results were observed in a study that demonstrated that the level of physical activity during the pandemic decreased compared to

the previous period¹². The virtual health survey "ConVid, Behavior Survey," conducted by the Oswaldo Cruz Foundation (Fiocruz), analyzed 45,161 individuals residing in Brazil during the COVID-19 pandemic¹³ and reported similar findings: the prevalence of physical activity was higher among men (33.0%) than among women (27.6%) prior to the pandemic, with a decrease observed in both sexes during the pandemic. Pandemic restrictions or safety guidelines often resulted in a shift from working outside the home to working from home. This was cited as a barrier to physical activity, except among older adults, most of whom were retired¹⁴.

There is an increased risk of physical inactivity associated with the transition to working from home¹⁵, since, for most of the pandemic, working from home—when possible—was mandatory or recommended in most countries. In this context, although social isolation was a key prevention strategy, these measures had negative impacts on people's behavior, leading to changes in physical and mental health¹⁶. For some, the uncertainty, worry, and stress caused by the pandemic may have affected their motivation to exercise and maintain a regular physical activity routine. In addition, fear of falling ill oneself or seeing family members fall ill, uncertainty regarding the decisions and strategies adopted by authorities to control the pandemic, and financial circumstances were factors that may have negatively impacted people's health^{17,18}.

According to socioeconomic data from the study, those with an income greater than or equal to two minimum wages reported reduced levels of physical activity. A systematic review aimed at analyzing the relationship between levels of physical activity and socioeconomic conditions among adults and older adults indicated that

the population in the lowest economic class was more likely to be physically inactive compared to those in higher economic classes. This was likely due to limited availability of time or accessible options for engaging in regular physical activity, since individuals with greater financial stability tend to experience less financial stress and have more flexibility to dedicate time to physical activity, compared to those who had to focus on work or other priorities to make ends meet¹⁹.

Given this, income may have impacted physical activity during the pandemic through access to resources, spatial conditions, available time, and psychological impacts related to economic security. These factors may have contributed to disparities in the continuity and intensity of physical activity among different socioeconomic groups during this challenging period, given that having space at home, free time, strong motivation, and being free from work and family responsibilities are some of the factors that facilitate regular exercise²⁰.

Another factor found to be significantly associated with physical activity was smoking. A higher prevalence of smoking, lower income, and the presence of cardiovascular disease were correlated with a greater number of barriers to exercise⁴. The observed relationship between smoking and reduced physical activity may be associated with the harmful effects of this social habit. Smokers are more likely to have low levels of physical activity, long-standing limiting conditions, diagnosed chronic lung diseases, and clinically significant depressive symptoms²¹.

The WHO has set key targets to reduce mortality from chronic non-communicable diseases (CNCDs) by 25%. Among these targets is the reduction of risk factors such as tobacco, alcohol, salt, and physical inactivity²². Physical inactivity is associated with the development of CNCDs,

increasing mortality rates, the risk of hospitalizations, and psychosocial problems²³. The first measure to prevent the spread of the virus—quarantine—was associated with increased morbidity related to cardiovascular diseases. During this period, individuals exhibited more sedentary behaviors, adopted dietary habits characterized by an increasing consumption of processed foods (high in sodium and sugars), increased tobacco use, and often reduced their physical activity⁽²⁴⁾.

Participants with COVID-19 symptoms showed a greater reduction in physical activity during the pandemic. As a general rule, the most common symptoms of COVID-19 are fever, dry cough, dyspnea, fa-

tigue, myalgia, cognitive impairment, anxiety, and shortness of breath. In addition, cardiovascular conditions and central nervous system complications may also manifest in some cases. Symptoms such as fatigue, dyspnea, myalgia, and respiratory impairment can limit exercise, especially those requiring greater aerobic effort²⁴.

CONCLUSION

In this context, the lack of engagement in physical activity before and during the pandemic is associated with factors that include sociodemographic, socioeconomic, and health-related conditions. Furthermore, the pandemic period brought about drastic

changes in people's routines and lifestyles, making the decline in physical activity levels even more alarming, as the population faced constant challenges in balancing their health in various ways. Therefore, it is essential to promote a more frequent and focused discussion on the importance of adopting healthy habits, including lifestyle changes—especially with regard to physical activity—while taking into account diverse individual circumstances.

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