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Factors associated with perceived changes in physical activity and sedentary behavior in the Brazilian university community during the COVID-19 pandemic

Fatores associados às mudanças percebidas na atividade física e comportamento sedentário na comunidade universitária brasileira durante a pandemia da covid-19

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ABSTRACT

Objective: This study aimed to identify the prevalence and factors associated with perceived changes in physical activity (PA) and sedentary behavior (SB) during the COVID-19 pandemic within the university community. Methods: It is an observational, cross-sectional, multicenter study conducted with the academic community of higher education institutions in Brazil. A structured and validated questionnaire was utilized, and multinomial logistic regression was applied with a 95% confidence interval. Results: A total of 4,809 individuals participated (65.8% women and 74.0% students). It was observed that 44.6% (n = 2,136) perceived a reduction in PA, and 74.2% (n = 3,549) perceived an increase in SB. Women aged 40 and over and men in social isolation were less likely to be active (31.0% and 43.0%, respectively). Women with a good (OR = 3.33; 95% CI: 2.22 - 4.99) or fair health perception (OR = 1.98; 95% CI: 1.30 - 3.04) and men with a good health perception (OR = 2.38; 95% CI: 1.35 - 4.20) were more likely to be active. The likelihood of higher SB was lower among women with a good health perception (58.0%) or aged 30–39 (34.0%) or 40+ (50.0%), and among men with a good health perception (61.0%) or aged 30–39 (42.0%) or 40+ (54.0%). Increased SB likelihood was higher among women in isolation (OR = 1.71; 95% CI: 1.25 - 2.34), isolated for two or more months (OR = 1.43; 95% CI: 1.10 - 1.85), or with a room per capita ratio of 1.20 (OR = 1.51; 95% CI: 1.13 - 2.01); and among men in isolation (OR = 1.61; 95% CI: 1.10 - 2.34), isolated for two or more months (OR = 1.42; 95% CI: 1.02 - 1.96), and living in the Northeast (OR = 2.34; 95% CI: 1.20 - 4.57) or Southeast (OR = 2.96; 95% CI: 1.47 - 5.96) regions of Brazil. Conclusion: The pandemic led to a perceived increase in SB and a decrease in PA, especially among older women, those in isolation, and those with limited living space, as well as among men in isolation.

Keywords: Adult; Exercise; Physical inactivity; Pandemics; Universities.

RESUMO

Objetivo: Este estudo teve como objetivo identificar a prevalência e fatores associados às mudanças percebidas na prática de atividade física (AF) e comportamento sedentário (CS) durante a pandemia da covid-19 na comunidade universitária. Métodos: Estudo observacional, multicêntrico, do tipo transversal, realizado com a comunidade acadêmica de Instituições de Ensino Superior do Brasil. Utilizou-se um questionário estruturado e validado. Foi aplicada regressão logística multinomial assumindo intervalo de confiança de 95%. Resultados: Participaram 4809 indivíduos (65,8% mulheres; 74% estudantes). Observou-se que 44,6% (n = 2.136) perceberam redução da AF, e 74,2% (n = 3.549) perceberam aumento do CS. Mulheres com 40 anos ou mais e homens em distanciamento apresentaram menores chances de serem ativos (31% e 43%, respectivamente). Apresentaram mais chances em serem ativos as mulheres com boa percepção de saúde (OR = 3,33; IC 95%: 2,22 - 4,99) ou regular (OR = 1,98; IC 95%: 1,30 - 3,04), e homens com boa percepção de saúde (OR = 2,38; IC 95%: 1,35 - 4,20). As chances de maior CS foram menores nas mulheres com boa percepção de saúde (58%), idade entre 30-39 anos (34%) ou 40 anos ou mais (50%), e nos homens com boa percepção de saúde (61%), idade entre 30-39 anos (42%) ou 40 anos ou mais (54%). Apresentaram mais chances de maior CS as mulheres que estavam em distanciamento (OR = 1,71; IC 95%: 1,25 - 2,34), por dois meses ou mais (OR = 1,43; IC 95%: 1,10 - 1,85), ou cômodo per capita de 1,20 (OR = 1,51; IC 95%: 1,13 - 2,01), e homens em distanciamento (OR = 1,61; IC 95%: 1,10 - 2,34), por dois meses ou mais (OR = 1,42; IC 95%: 1,02 - 1,96) e que residiam na região Nordeste (OR = 2,34; IC 95%: 1,20 - 4,57) e Sudeste (OR = 2,96; IC 95%: 1,47 - 5,96). Conclusão: A pandemia resultou em aumento percebido do CS e diminuição da AF, especialmente entre mulheres mais velhas, em distanciamento e menor cômodo per capita, assim como entre homens em distanciamento.

Palavras-chave: *Adulto; Exercício físico; Inatividade física; Pandemias; Universidades.*

Introduction

On March 11, 2020, the World Health Organization officially recognized COVID-19 (coronavirus disease 2019), caused by the SARS-CoV-2 virus, as a pandemic[1]. In Brazil, the first case was reported on February 26 of that same year, and as of the present date (April 18, 2024), there have been 38,777,842 confirmed cases and 711,650 deaths[2]. The causative agent of COVID-19, SARS-CoV-2, exhibited high transmissibility, spreading rapidly among individuals[3,4].

At the onset of the pandemic, no preventive or therapeutic measures were available to curb the virus's spread. As a result, non-pharmaceutical interventions, such as social distancing and mask-wearing, were adopted[3,5]. These restrictions significantly impacted lifestyle, with recommendations for people to stay home, leading to increased time spent in sedentary behaviors and decreased physical activity[1,3]. In Brazil, these restrictions were formalized with the approval of Law No. 13,979 on February 6, 2020, to address the pandemic[3,5,6].

Social distancing measures proved effective in combating COVID-19[7]. A review study revealed that these measures led to an increase in screen time, higher consumption of ultra-processed foods and alcohol, and a reduction in physical activity[8]. During the pandemic, university students may have been more vulnerable to the adverse effects of social distancing, experiencing heightened stress, anxiety, and depression during this period[9,10]. It was observed that Brazilian university students, in addition to facing the fear of infection, also experienced increased physical inactivity and mental health challenges[11]. Physical inactivity is associated with various critical health conditions (e.g., obesity, hypertension, cardiovascular disease, diabetes mellitus, and mental and bone health issues) and can contribute to premature mortality[12].

It is essential to study the factors influencing lifestyle changes in the university community during the pandemic, particularly regarding physical activity and sedentary behavior, given this population's vulnerability to high-stress levels and adoption of risk behaviors that may affect their physical and mental health. Identifying lifestyle changes and associated factors can support policies and positive actions to enhance an active lifestyle in the university community. This study aimed to estimate the prevalence and associated factors of perceived changes in physical activity and sedentary behavior in the university community during the COVID-19 pandemic. We expect to observe a decrease in physical activity and an increase in sedentary behavior, particularly among the population that spent extended time in social isolation.

Methods

This study is a multicenter, observational cross-sectional study derived from the baseline of the research titled "Impact of the COVID-19 Pandemic on the Lifestyle of Students and Employees of Higher Education Institutions." The research received approval from the Research Ethics Committees of all participating higher education institutions (HEIs): Federal University of Recôncavo da Bahia (*Universidade Federal do Recôncavo da Bahia* - UFRB), Federal University of Southern Bahia (*Universidade Federal do Sul da Bahia* - UFSB), Federal University of Bahia (*Universidade Federal da Bahia* - UFBA), State University of Santa Cruz (*Universidade Estadual de Santa Cruz* - UESC), Federal University of Amazonas (*Universidade Federal do Amazonas* - UFAM), Federal University of Alagoas (*Universidade Federal de Alagoas* - UFAL), Federal University of Triângulo Mineiro (*Universidade Federal do Triângulo Mineiro* - UFTM), Federal University of Viçosa (*Universidade Federal de Viços*a - UFV), Federal University of Mato Grosso do Sul (*Universidade Federal de Mato Grosso do Sul* - UFMS), Methodist Faculty of Santa Maria (*Faculdade Metodista de Santa Maria* - FSM), and Union Teaching Center of Southwest Paraná (*Universitário União de Ensino do Sudoeste do Paraná* - UNISEP). The Informed Consent Form (ICF) was presented online to inform participants about their agreement to join the study. No personal information was collected to ensure anonymity.

The study participants were selected by convenience sampling among undergraduate students, administrative staff, and faculty members of the Brazilian HEIs (UFRB, UFSB, UFBA, UESC, UFAM, UFAL, UFTM, UFV, UFMS, FSM, and UNISEP). The inclusion criteria were enrollment or active institutional affiliation as an undergraduate student, administrative staff, or professor at the HEIs, and age over 18 years. Exclusion criteria included students who had already graduated, postgraduate students, administrative staff, and faculty members on leave. This information was included in the ICF and as questions in the instrument for participant screening.

The first survey of this study was conducted between August and September 2020. Data was collected through an online questionnaire created in Google

Forms and shared via emails containing brief information about the research and a link to the form[13]. Contact information for all individuals was obtained from existing databases at the HEIs. A snowball sampling strategy was employed to maximize participation, with dissemination through WhatsApp and an informative text message with the research link shared within internal university community groups, encouraging members to share it with colleagues, students, and staff. A social media account on Instagram was also created to promote the study, featuring posts about the research and a link in the description. Additionally, the invitation was publicized on the websites and social media pages of all participating HEIs.

The dependent variables of this study included physical activity and sedentary behavior. The question regarding physical activity was structured as follows: "Comparing the last seven days with the period when the pandemic began, have you engaged in moderate physical activities in your leisure time, such as walking, running, cycling, dancing, or something similar that makes you breathe somewhat harder than usual, at a frequency of...". The question regarding sedentary behavior was structured as follows: "Comparing the last seven days with the period when the pandemic began, have you been sitting, lying down, or in a reclined position at a frequency of...". For both variables, the responses "much less than before" and "less than before" were grouped into "less than before," and the responses "more than before" and "much more than before" were grouped into "more than before." The grouped responses resulted in the categories: a) less than before, b) remains the same, and c) more than before. The Lifestyle Changes Perception Questionnaire During the Period of Social Distancing (PERMEV) was validated for the university community[13], showing face and content validity for physical activity (83.1% relevance; 88.4% appropriateness) and sedentary behavior (94.8% relevance; 92.3% appropriateness). It also showed clarity validity (80% and 88%) and reproducibility (k = 0.340; k = 0.375) for questions on physical activity and sedentary behavior.

The independent variables included sociodemographic characteristics, residential characteristics, and health conditions. Among the sociodemographic variables: place of residence (Brazilian region), gender (male and female), race/color (white, black, mixed-race, yellow, and red), age group (up to 29 years, 30–39 years, 40 years or older), marital status (single, widowed, separated, married, or cohabiting), and per capita room (calculated as the total number of rooms divided by the total number of residents) classified as up to 1.20, 1.21 to 1.80, and above 1.80. Among residential characteristics: whether in social distancing (yes or no), duration of distancing (up to 2 months or 2 months or more), residence quality for social distancing purposes (poor, fair, or good), residence with a garden/terrace/backyard or any open/green area (yes or no), and whether residing in places with a garden/terrace/backyard or any open/green area helps cope with social distancing (does not help, helps a little, or helps a lot). Health conditions were assessed through self-perceived health status (poor, fair, or good).

Data Analysis

Descriptive statistics were conducted on the exposure variables (sociodemographic, residential, and social distancing characteristics) and outcomes (perceived changes in physical activity and sedentary behavior). Pearson's chi-square test assessed differences in the proportions of study variables by gender. For crude and adjusted analyses, multinomial logistic regression stratified by gender was applied to estimate odds ratios (OR) and their respective 95% confidence intervals (95% CI) for the behaviors "less than before" and "more than before," with "remains the same" as the reference category. The adjusted model considered independent variables significant in the crude analysis ($p < 0.05$). Data analysis was performed using IBM® SPSS® statistical software version 20.0 (2011), IBM Corp., Armonk, NY. A significance level of 5% was adopted.

Results

A total of 4,980 members of the university communities participated in this study, but 169 were excluded due to duplicate responses. Only two individuals indicated their refusal to participate in the research. Therefore, the final sample consisted of 4,809 participants. Among those, 74% (n = 3,555) were students, of which 65.8% (n = 3,163) identified as female, 42.4% (n = 2,006) as white, 59.5% (n = 2,822) were aged 29 or younger, 68.2% (n = 3,102) were single, 58.9% (n = 2,823) were from the Northeast region of Brazil, and 60.1% (n = 2,857) reported good health perception. Regarding housing characteristics, 83% (n = 3,991) reported having four or more rooms in their residence, 26.1% (n = 1,255) lived with up to three people, and 38.4% (n = 1,849) had four or more household members.

Most participants (62%; n = 2,930) reported having

Table 1 – Characteristics of the study participants.

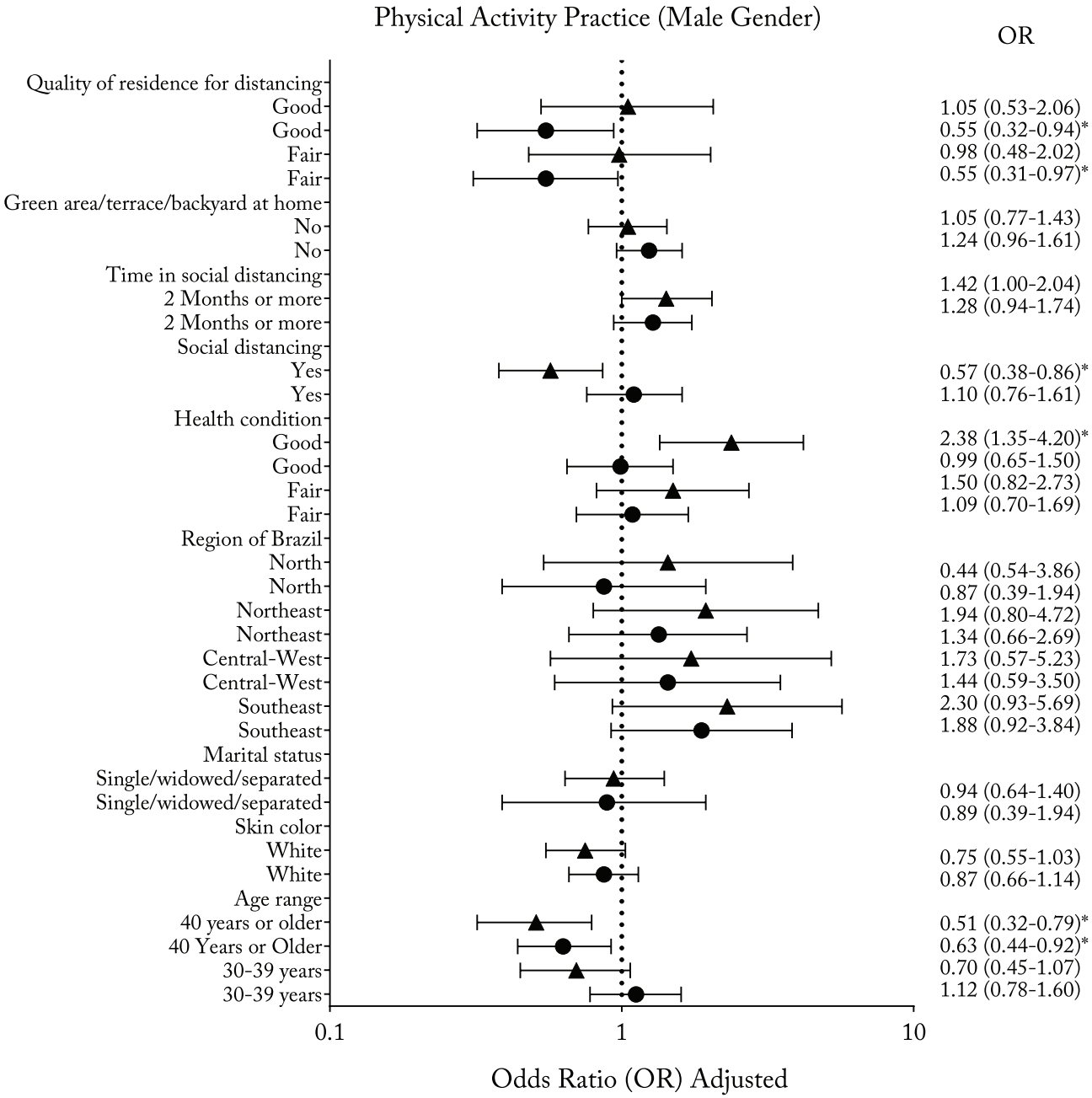
Variables	All (n = 4,809)	Female gender (n = 3,163)	Male gender (n = 1,635)	x^2 (p value)
		n (%)		
Age range				
Up to 29 years	2,822 (59.5)	1,914 (60.5)	908 (55.5)	12.685 (0.002)*
30-39 years	928 (19.5)	594 (18.8)	333 (20.4)	
40 years or older	998 (21.0)	619 (19.6)	379 (23.2)	
University affiliation				
Student	3,555 (74.0)	2,370 (75.0)	1,180 (72.2)	4.485 (0.034)*
Staff/faculty	1,251 (26.0)	790 (25.0)	455 (27.8)	
Race/color				
White	2,006 (42.4)	1,315 (41.6)	691 (42.3)	0.094 (0.759)
Black/brown/yellow/red	2,722 (57.6)	1,796 (56.8)	926 (56.6)	
Marital status				
Single/widowed/separated	3,102 (68.2)	2,080 (65.8)	1,022 (62.5)	7.777 (0.005)*
Married/living together	1,445 (31.8)	908 (28.7)	537 (32.8)	
Region of Brazil				
North	415 (8.7)	277 (8.8)	138 (8.4)	
Northeast	2,823 (58.9)	1,839 (58.1)	984 (60.2)	
Central-West	197 (4.1)	129 (4.1)	68 (4.2)	2.060 (0.725)
Southeast	1,196 (24.9)	806 (25.5)	390 (23.9)	
South	163 (3.4)	108 (3.4)	55 (3.4)	
Room per capita in residence				
Up 1.20	1,533 (35.6)	936 (29.6)	597 (36.5)	
1.21 to 1.80	1,397 (32.4)	946 (29.9)	451 (27.6)	21.257 (<0.001)*
Above 1.80	1,382 (32.1)	944 (29.8)	438 (26.8)	
Health condition				
Good	2,857 (60.1)	1,863 (58.9)		
Fair	1,419 (29.9)	950 (30.0)	994 (60.8)	1.505 (0.471)
Poor	477 (10.0)	319 (10.1)	469 (28.7)	
Social distancing				
Yes	3,905 (82.8)	2,620 (82.8)	1,285 (78.6)	14.446 (<0.001)*
No	813 (17.2)	489 (15.5)	324 (19.8)	
Time in social distancing				
Up to 2 months	1,128 (24.6)	707 (22.4)	421 (25.7)	9.508 (0.002)*
2 months or more	3,452 (75.4)	2,336 (73.9)	1,116 (68.3)	
Quality of residence for distancing				
Poor	357 (7.5)	230 (7.3)	127 (7.8)	
Fair	943 (19.9)	622 (19.7)	321 (19.6)	0.384 (0.825)
Good	3,444 (72.6)	2,275 (71.9)	1,169 (71.5)	
Green area/terrace/backyard at home				
Yes	2,930 (62.0)	1,937 (61.2)	993 (60.7)	0.133 (0.716)
No	1,799 (38.0)	1,180 (37.3)	619 (37.9)	
Green area/terrace/backyard helps with distancing				
Does not help	175 (3.7)	103 (3.3)	72 (4.4)	
Helps a little	1,194 (25.3)	740 (23.4)	454 (27.8)	17.267 (<0.001)*
Helps a lot	3,354 (71.0)	2,273 (71.9)	1,081 (66.1)	
Perception of change in physical activity				
Less	2,136 (44.6)	1,388 (43.9)	748 (45.7)	
Same	1,446 (30.2)	959 (30.3)	487 (29.8)	1.924 (0.382)
More	1,204 (25.2)	810 (25.6)	394 (24.1)	
Perception of change in sedentary behavior				
Less	358 (7.5)	246 (7.8)	112 (6.9)	
Same	878 (18.3)	529 (16.7)	349 (21.3)	16.078 (<0.001)*
More	3,549 (74.2)	2,382 (75.3)	1,167 (71.4)	

Significance *p < 0.05.

green areas, terraces, or backyards at home, and 71% (n = 3,354) stated that these spaces greatly facilitate physical activity. Concerning social distancing, 82.8% (n = 3,905) reported adhering to this measure during the study period, with 75.4% (n = 3,452) stating they had been socially distanced for two months or more. Additionally, 71.6% (n = 3,447) viewed social distancing as a good or excellent measure for controlling the pandemic, and 71% (n = 3,354) believed that having green areas, terraces, or backyards significantly aids in managing social distancing. The characteristics of the participants can be seen in Table 1.

Regarding perceived changes in physical activity, 44.6% (n = 2,136) reported a reduction in this behavior, 30.2% (n = 1,446) indicated that their behavior remained the same during the pandemic, and 25.2% (n = 1,204) reported an increase. Regarding sedentary behavior, 74.2% (n = 3,549) noticed higher levels compared to the period before the pandemic, while 18.3% (n = 878) perceived no changes, and 7.5% (n = 358) reported lower levels.

Individuals who identified as female and aged 40



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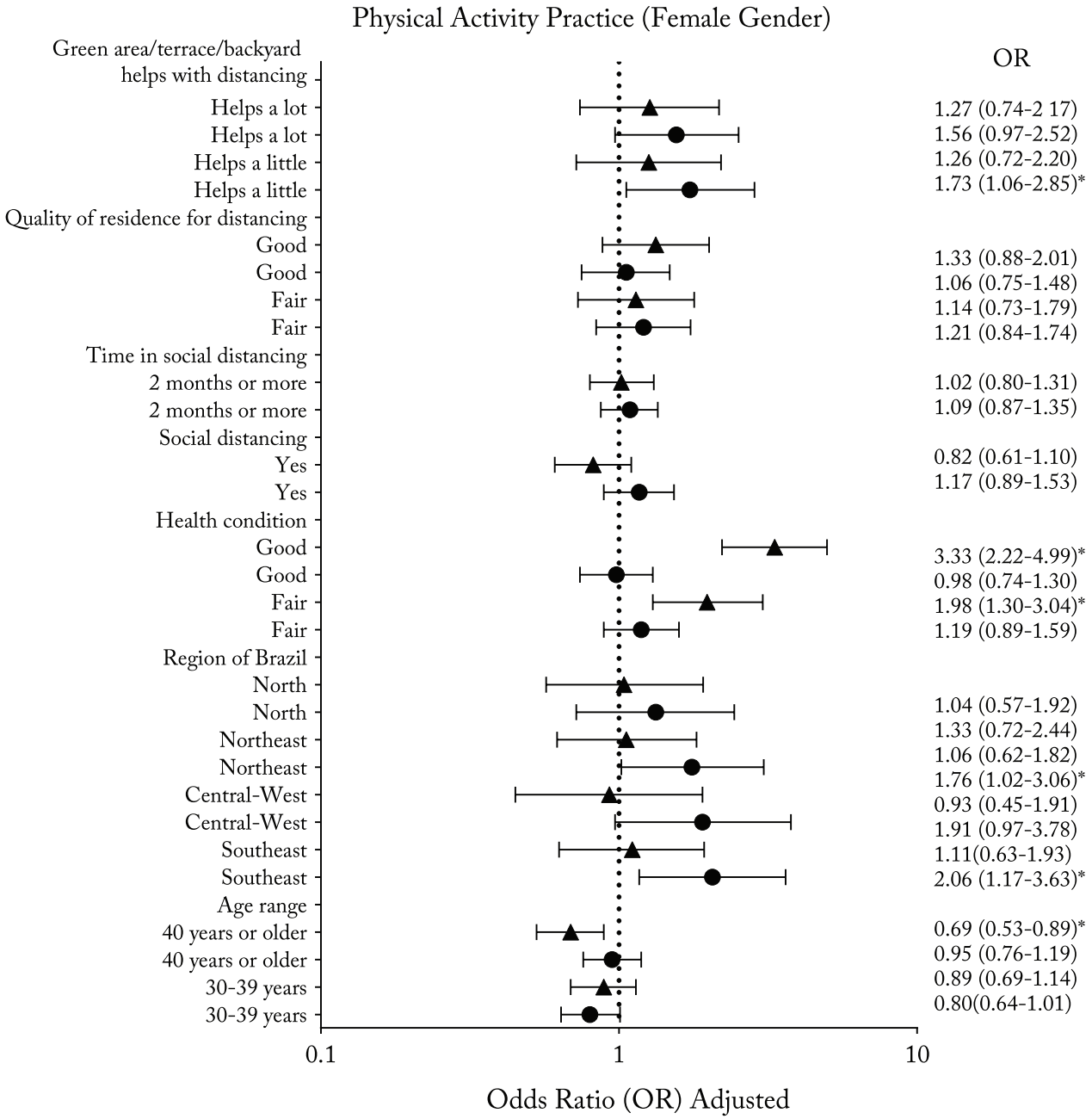
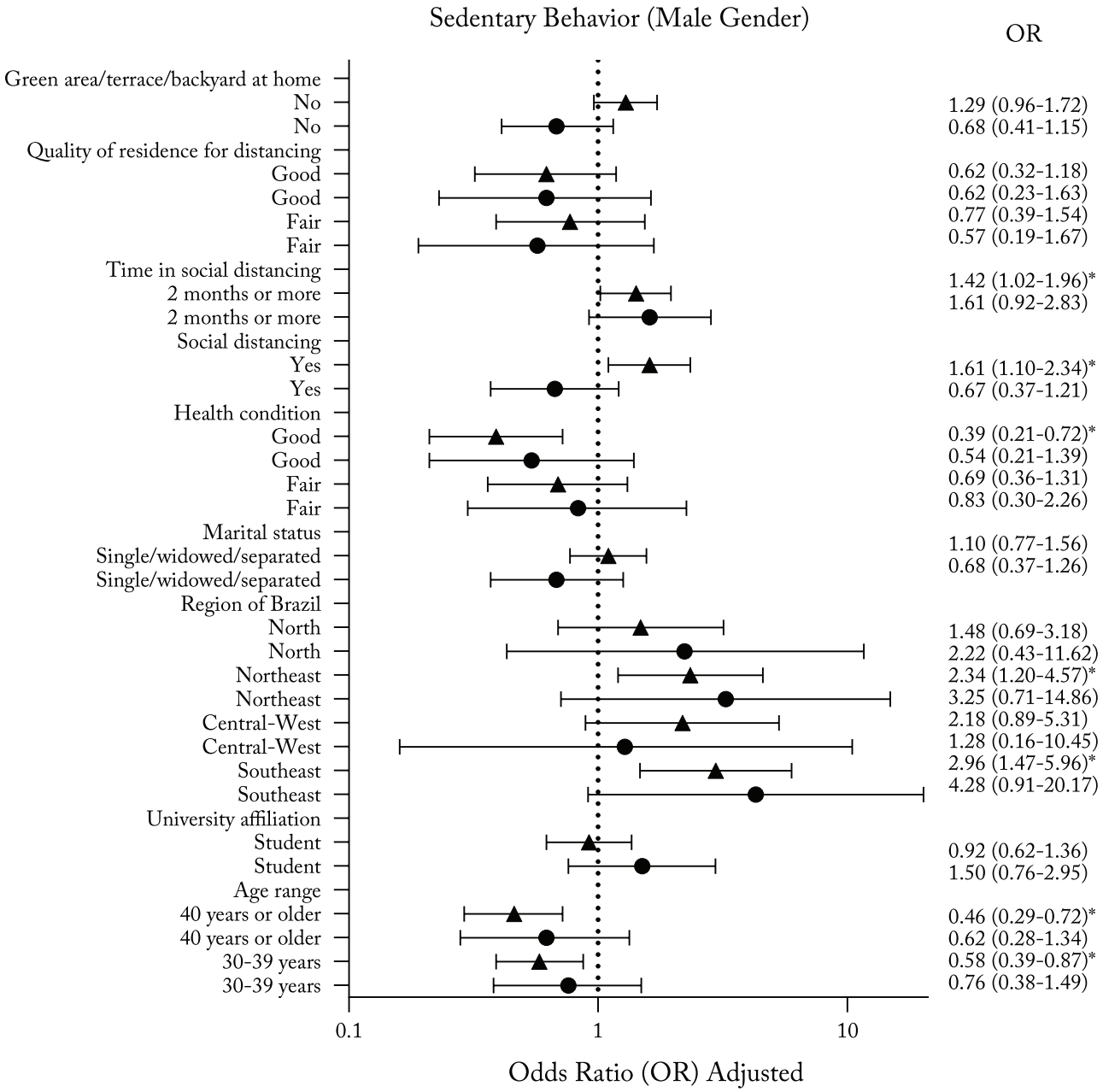


Figure 1 – Adjusted analysis for physical activity practice.
● Perception of "lower" than before COVID-19; ▲ Perception of "higher" than before COVID-19; *Significant association.
Reference groups for multinomial regression: Age range - up to 29 years; Green area/terrace/backyard in the residence - yes; Green area/terrace/backyard help with distancing - does not help; Health condition - poor; Marital status - married/living together; Quality of residence for distancing – poor; Region of Brazil – South; Race/color - black/brown/yellow/red; Social distancing – no; Time in social distancing - up to 2 months.

or older had a reduced likelihood of being physically active (OR = 0.69; 95% CI: 0.53 – 0.89), as did those residing in the Northeast (OR = 1.76; 95% CI: 1.02 – 3.06) and Southeast regions (OR = 2.06; 95% CI: 1.17 – 3.63). Among males, those who reported being socially distanced (OR = 0.57; 95% CI: 0.38 – 0.86) and those aged 40 or older (OR = 0.51; 95% CI: 0.32 – 0.79) also exhibited a lower likelihood of being physically active compared to participants aged 29 or younger who were not socially distanced and lived in the South region. Conversely, the chances of physical activity increased for females who perceived their health as good (OR = 3.33; 95% CI: 2.22 – 4.99) or fair (OR = 1.98; 95% CI: 1.30 – 3.04), as well as for males who rated their health as good (OR = 2.38; 95% CI: 1.35 – 4.20) compared to participants who perceived

their health as poor (Figure 1).

Among those with a reduced chance of becoming more sedentary were women who perceived their health as good (OR = 0.42; 95% CI: 0.26 – 0.67) and those aged between 30 and 39 years (OR: 0.66; 95% CI: 0.47 – 0.92) or 40 years or older (OR = 0.50; 95% CI: 0.35 – 0.73). Men with good health perception also exhibited reduced odds (OR = 0.39; 95% CI: 0.21 – 0.72), as well as those aged between 30 and 39 years (OR = 0.58; 95% CI: 0.39 – 0.87) or 40 years or older (OR = 0.46; 95% CI: 0.29 – 0.72), compared to participants who had poor health perception and were aged 29 or younger. On the other hand, women who were socially distanced (OR = 1.71; 95% CI: 1.25 – 2.34) for two months or more (OR = 1.43; 95% CI: 1.10 – 1.85), or had a per capita room availability of 1.20 (OR = 1.51; 95% CI: 1.13 – 2.01), and men in social distancing (OR = 1.61; 95% CI: 1.10 – 2.34) for two months or more (OR = 1.42; 95% CI: 1.02 – 1.96), who resided in the Northeast (OR = 1.42; 95% CI: 2.34 – 4.57) and Southeast regions (OR = 2.96; 95% CI: 1.47 – 5.96), had a higher likelihood of becoming more sedentary compared to those who were not socially distanced for less than two months, with a per capita room availabili-



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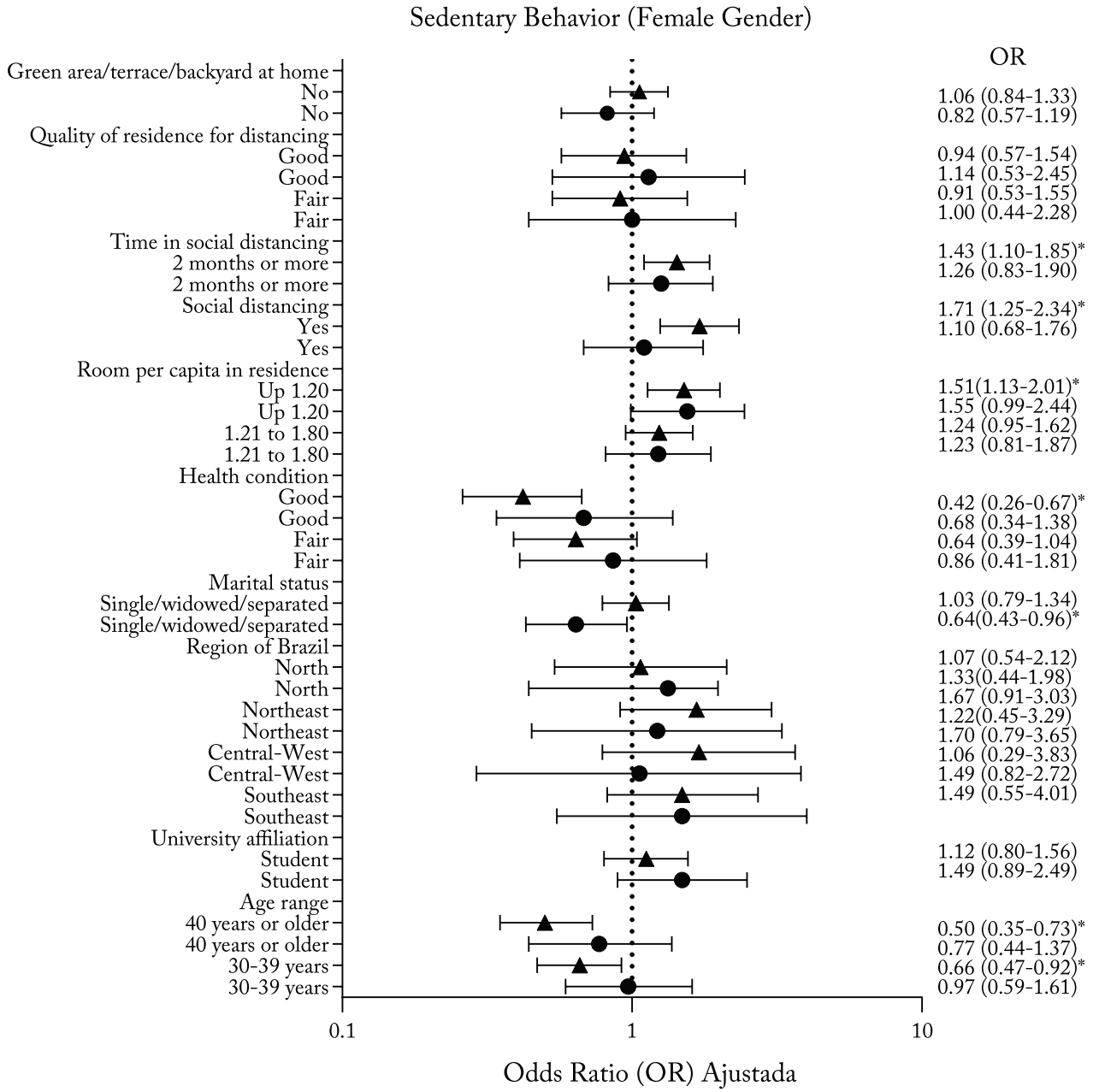

Figure 2 – Adjusted analysis for sedentary behavior.
● Perception of "lower" than before COVID-19; ▲ Perception of "higher" than before COVID-19; *Significant association.
Age range - up to 29 years; Green area/terrace/backyard in residence - yes; Health condition - poor; Marital status - married/living together; Quality of residence for distancing - poor; Region of Brazil - South; Social distancing – no; Room per capita in residence – above 1.80; Time in social distancing - up to 2 months; University affiliation - Staff/faculty.

ty of 1.80 in their residence and who lived in the South region (Figure 2).

Discussion

The main findings of this study indicate that approximately 44.6% (n = 2,136) of participants reported lower levels of physical activity than before the pandemic (65% female). In comparison, 74.2% (n = 3,549) reported increased sedentary behavior (67.1% female). Women aged 40 and older, as well as men in the same age group who were socially distanced, exhibited lower perceived physical activity. Conversely, women with a good or fair perception of health and men reporting good health perception were associated with higher perceived physical activity. Regarding sedentary behavior, women who were socially distanced for two months or more, with a per capita room availability of 1.20, and men socially distanced for the same duration

showed higher perceived sedentary behavior.

Studies worldwide report a decrease in self-reported physical activity during the isolation period caused by the pandemic[14,15]. In Brazil, other studies have also observed a significant decline in physical activity among adults compared to the pre-pandemic period[3,11,16,17]. Tavares et al.[18] identified a high prevalence of physical inactivity in leisure among university students at the Federal University of Uberlândia, approximately 44.4%. Available information indicates that the need for social distancing negatively influences health practices, contributing to an increased risk of chronic diseases[12].

Individuals of the female gender generally exhibit lower levels of physical activity compared to those of the male gender[19], and this difference increased during COVID-19[20]. In our study, the proportion of women who reported a perceived reduction in physical activity in this context did not significantly differ from that of men. This result suggests that although women face specific barriers, such as greater dedication to household tasks, the impact of these barriers during the isolation period may not have accentuated the difference in leisure physical activity compared to men[21].

Negative self-evaluation of health among university community members is associated with inadequate behaviors regarding physical activity and sedentary behavior[22,23]. Cheval et al.[24] observed that those who were active and had less sedentary time during the isolation caused by COVID-19 had a better perception of health. In our study, we found that those with a good perception of health were more likely to be active and less likely to be sedentary, reinforcing the role of perceived efficacy in adopting positive behaviors, even during the social distancing period imposed by the public health emergency.

Other studies conducted with populations from other countries reported a significant increase in sedentary behavior globally[25,26]. Considerable increases in sedentary behavior have been observed among adults of both genders[26]. The behavioral changes during the isolation period, where individuals had to remain indoors, reducing daily commuting for work, study, and leisure, were linked to increased physical inactivity[25,27]. These changes may be related to the social and environmental barriers experienced during isolation[25].

In this study, concerning sedentary behavior, it was identified that the duration of social distancing is associated with a higher likelihood of increased sedentary behavior, something previously noted by Botero et al.[17]. Our findings also corroborate a study conducted with Brazilian adults during the COVID-19 pandemic, which observed greater chances of sedentary behavior among older individuals[17]. However, contrary to these findings, a study conducted with Brazilian teachers in the municipal education system of Campo Grande, Mato Grosso do Sul, noted that younger individuals exhibited a higher likelihood of increased sedentary behavior, which may highlight a characteristic related to teachers' work[28].

Furthermore, other barriers contributed to increased physical inactivity and sedentary behavior in the population. Adoption remote work resulted in more time in front of screens—generally seated—while mobility restrictions and the prohibition of outdoor sports limited opportunities for exercise[29]. Additionally, sociodemographic and economic factors may restrict access to resources for engaging in physical activity, reflecting existing inequalities in the country[30,31]. At the same time mental health issues such as stress, anxiety, and depression also play a significant role in decreasing participation in physical activities[4].

Data from the Surveillance System for Risk and Protection Factors for Chronic Diseases via Telephone Inquiry (Vigitel)[32] indicate that after the pandemic, Brazilian adults who do not meet physical activity recommendations decreased from 47.1% in 2021 to 37% in 2023. Furthermore, the recommended level of physical activity during leisure increased from 36.7% in 2021 to 40.6% in 2023, surpassing pre-pandemic levels. Regarding sedentary behavior, free time spent watching television also showed a reduction, decreasing from 25.1% in 2021 to 23.2% in 2023.

This study has limitations that must be considered when interpreting these results. The selection of HEIs was based on convenience, which could compromise the results. However, due to the sample size and similar patterns of pandemic impact on university community members throughout Brazil, it is understood that the information provided allows for characterizing behavioral patterns during one of the most critical moments of the pandemic. Physical activity and sedentary behavior were self-reported through questionnaires, meaning the information may be overestimated or underestimated[33]. However, the instrument used in this research shows satisfactory validity, reproducibility, and clarity for measuring changes in these behaviors during the pandemic[13]. Another possible limitation is the data collection method (online); however, various strategies were employed to invite participation in the research to

avoid potential biases.

In conclusion, the restrictions imposed by the COVID-19 pandemic were associated with a perceived increase in sedentary behavior and a reduction in perceived physical activity among members of the university community in Brazil. Factors such as living region, family income, distancing practices, and perceived health conditions emerged as important considerations for active and sedentary behaviors during the pandemic. These results can contribute to developing university policies and actions promoting an active and healthy lifestyle.

Conflict of interest

The authors declare that there is no conflict of interest.

Author contributions

Silva Junior MCP: Conceptualization; Methodology; Data Analysis; Research; Writing the original manuscript; Approval of the final version. Menezes EC: Conceptualization; Methodology; Research; Supervision; Writing the original manuscript; Writing - review and editing; Approval of the final version. Tenório AS: Conceptualization; Methodology; Data Analysis; Research; Writing the original manuscript; Approval of the final version. Santos SFS: Conceptualization; Research; Supervision; Project Administration; Writing - review and editing; Approval of the final version. Sousa TF: Conceptualization; Research; Supervision; Project Administration; Writing - review and editing; Approval of the final version. Lima LRA: Conceptualization; Methodology; Research; Supervision; Writing the original manuscript; Writing - review and editing; Approval of the final version.

Declaration regarding the use of artificial intelligence tools in the writing process

The authors did not use any artificial intelligence tools to prepare the manuscript.

Availability of research data and other materials

The underlying content of the research text is contained within the manuscript.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

Leandro dos Santos
Universidad Pablo de Olavide: Sevilla, Andalucia, ES

Format

- Does the article meet the manuscript submission guidelines for the Revista Brasileira de Atividade Física e Saúde?
  Yes
- Regarding the formal aspects, is the manuscript well-structured, containing the sections: introduction, methods, results, and discussion (with conclusion as part of the discussion)?
  Yes
- Is the language appropriate, clear, precise, and objective?
  Partially
- Was there any indication of plagiarism in the manuscript?
  No
- **Suggestions/Comments:**
  The article makes a valuable contribution regarding changes in sedentary behavior and physical activity levels of a sample from the Brazilian university community.
  In general, the paper is well-written and presents consistent analyses.
  Some details deserve attention for the improvement of the study.

Abstract

- Is the abstract adequate (containing: objective, study participants' information, studied variables, main results, and a conclusion) and does it reflect the manuscript's content?
  Partially
- **Suggestions/Comments:**
  The abstract presents the main points, however, the conclusion deviates from the general objective of the study and needs adjustment.
  Additionally, it would be important to review the keywords to increase the chances of the article being found in database searches.

Introduction

- Is the research problem clearly stated and delimited?
  Partially
- Is the research problem appropriately contextualized with the existing knowledge, moving from the general to the specific?
  Partially
- Are the reasons justifying (including the authors' assumptions about the problem) the need for the study well-established?
  Partially
- Are the references used to support the presentation of the research problem current and relevant to the topic?
  Yes
- Was the objective clearly presented?
  Yes
- **Suggestions/Comments:**
  Paragraph 4: To understand the relevance of the proposal, I suggest stating the gap in the literature and/or the relevance of the study. Is there no information about this population regarding the proposal, or are the available data contradictory?
  What hypotheses did the authors start from?

Methods

- Are the methodological procedures generally appropriate to study the research problem?
  Yes
- Are the methodological procedures sufficiently detailed?
  Yes
- Was the procedure for selecting or recruiting participants appropriate for the research problem and sufficiently, clearly, and objectively described?
  Yes
- Was information about the instruments used for data collection provided, including their psychometric qualities (e.g., reproducibility, internal consistency, validity), and, when relevant, about the operational definition of variables?
  Yes
- Is the data analysis plan adequate and well-de-

scribed?
Yes
- Were the inclusion and/or exclusion criteria for the sample participants described and appropriate for the study?
Yes
- Did the authors provide clarification about the ethical procedures followed during the research?
Yes
- **Suggestions/Comments:**
The study was submitted to ethics committees, and participants signed an informed consent form to participate.

Results

- Is the use of tables and figures appropriate and does it help present the results of the study effectively?
Partially
- Is the number of illustrations in the article in line with the submission guidelines for the journal?
Yes
- Are the number of participants at each stage of the study, as well as the reasons for losses and refusals, presented in the manuscript?
Yes
- Are the participants' characteristics presented and sufficient?
Yes
- Are the results presented adequately, highlighting the main findings and avoiding unnecessary repetition?
Partially
- **Suggestions/Comments:**
It is necessary to translate the figures into Portuguese.

Discussion

- Are the main findings of the study presented?
Partially
- Are the study's limitations and strengths discussed?
Partially
- Are the results discussed in light of the study's limitations and the existing knowledge on the subject?
Partially
- Do the authors discuss the potential contributions of the main findings to scientific development, in-Novation, or real-world intervention?
Partially
- **Suggestions/Comments:**
In the document, I pointed out suggestions to strengthen the study. Clear and specific contributions need to be presented, avoiding vague or less applicable suggestions.
Paragraph 1: The general objective of the study also includes the prevalences of behaviors. Review and add the information.
Paragraph 2, line 6: Although the idea is understandable, the way it was phrased allows for double interpretation and does Not clearly present the authors' position. I suggest reformulating to clarify.
Paragraph 3: In addition to possible factors related to domestic work, other factors should be considered, such as work-from-home demands, limited access to physical activity spaces, concerns about safety, mental health, socioecoNomic factors, among others. Further insights can be provided.
- Conclusion: Was the study's conclusion adequately presented and consistent with the study's objective?
Partially
- Is the conclusion original?
Partially
- **Suggestions/Comments:**
- The conclusion needs to answer the research problem and suggest next steps and applications of the findings.
- Paragraph 9, line 4: It would be important to discuss these factors and infer possible reasons for such differences, considering regional differences and the influence of socioeconomic differences on the observed results.
- Paragraph 9, line 6: Although this reflection is relevant, it presents a vague assumption with No impact. I suggest focusing on specific actions and/or intervention suggestions in this context.

References

- Are the references updated and sufficient?
Yes
- Are most of the references original articles?
Yes
- Do the references comply with the journal's guidelines [quantity and format]?
Yes
- Is the citation in the text adequate, meaning the statements in the text cite references that truly support those claims?
Yes
- **Suggestions/Comments:**

The references were cited correctly.

Comments to the author

- The work has a good structure and makes an important contribution to the topic. However, adjustments are needed to make it more robust.
- I suggest a grammatical review to correct minor punctuation, verb conjugation, and other errors.
- The introduction needs attention regarding the justification of the research problem, highlighting the relevance of addressing this topic.
- In the results, the figures need to be translated into Portuguese.
- The discussion presents the main findings and supports them partially by discussing the literature, but some points, such as a better argumentation on sedentary behavior and physical activity in women, could be improved (see in the file).
- Practical applications and the relevance of the findings need to be reviewed and better argued.

Decision

Minor revisions needed

Reviewer B

Anonymous

Format

- Does the article meet the manuscript submission guidelines for the Revista Brasileira de Atividade Física e Saúde?
  Yes
- Regarding the formal aspects, is the manuscript well-structured, containing the sections: introduction, methods, results, and discussion (with conclusion as part of the discussion)?
  Yes
- Is the language appropriate, clear, precise, and objective?
  Yes
- Was there any indication of plagiarism in the manuscript?
  No
- **Suggestions/Comments:**
  The main analysis of the article refers to factors associated with changes in physical activity and sedentary behavior during the COVID-19 pandemic, however, there is no mention of associated factors in the title.

Abstract

- Is the abstract adequate (containing: objective, study participants' information, studied variables, main results, and a conclusion) and does it reflect the manuscript's content?
  Yes
- **Suggestions/Comments:**
  In sentences like: "There was a lower chance of higher sedentary behavior...", it could be rewritten as "...were less likely to have higher sedentary behavior..." for better clarity, as "lower chance of higher outcome" could confuse the reader.

Introduction

- Was the research problem clearly stated and delimited?
  Yes
- Is the research problem appropriately contextualized with the existing knowledge, moving from the general to the specific?
  Partially
- Are the reasons justifying (including the authors' assumptions about the problem) the need for the study well-established?
  Partially
- Are the references used to support the presentation of the research problem current and relevant to the topic?
  Yes
- Was the objective clearly presented?
  Partially
- **Suggestions/Comments:**
  Among the study's justifications (and also in the Conclusion paragraph), the authors mention, "This knowledge (of how the pandemic changed the lifestyle of the university community) could help implement actions to minimize the effects of future pandemics on lifestyle." Wouldn't it be more plausible to justify the importance of identifying changes in lifestyle and associated factors as a way to promote active lifestyle actions for the most affected groups, rather than focusing on future pandemics?

Methods

- Are the methodological procedures generally appropriate to study the research problem?
  Yes
- Are the methodological procedures sufficiently detailed?

Partially

- Was the procedure for selecting or recruiting participants appropriate for the research problem and sufficiently, clearly, and objectively described?
  Partially
- Were psychometric qualities of the instruments used for data collection (e.g., reproducibility, internal consistency, validity) provided, and, when relevant, the operational definition of variables?
  Partially
- Is the data analysis plan adequate and well-described?
  Partially
- Were the inclusion and/or exclusion criteria for the sample participants described and appropriate for the study?
  Yes
- Did the authors provide clarification about the ethical procedures followed during the research?
  Yes
- **Suggestions/Comments:**
  What criteria were used to select the associated factors in this study?
  It is necessary to provide psychometric details of the sedentary behavior and physical activity questions in the methodology, as well as cite their validation study, although the authors briefly referenced it at the end of the discussion.
  Regarding statistical analysis, the reference group for multiNomial regression needs to be detailed. In this regard, the results description should also be clearly detailed regarding the comparison group vs. the reference group. For example: women in good health were more likely to be more active, compared to those in poor health. This information should also be clarified in Figures 1 and 2, as they must be interpretable independently of the text (standalone).

Results

- Is the use of tables and figures appropriate and does it facilitate the adequate presentation of the study results?
  Yes
- Is the number of illustrations in the article in line with the submission guidelines for the journal?
  Yes
- Are the number of participants at each stage of the study, as well as the number and reasons for losses and refusals, presented in the manuscript?
  Yes
- Are the characteristics of the participants presented and sufficient?
  Partially
- Are the results presented adequately, highlighting the main findings and avoiding unnecessary repetition?
  Partially
- **Suggestions/Comments:**
  Table 1 presents the proportions of men and women within each category, instead of presenting the proportions of categories separately for women and men (as done in the main analysis). This approach did not allow for inferring if there is a difference in age group proportions between women and separately among men. What can only be inferred is whether there are more women than men in the age group up to 29 years, and so on. However, no test for comparing proportions was conducted. I would recommend the authors treat the categories of independent variables in columns instead of rows (e.g., total women = 3163 [100%]; up to 29 years = 1914 [60.5% of 3163]; 30-39 years = 594 [18.8% of 3163]; and 40 years or more = 619 [19.6% of 3163]), calculating whether there is a difference between these proportions based on being female. In some points of the discussion, the authors address differences in proportions that were not statistically confirmed in the study.

Discussion

- Are the main findings of the study presented?
  Yes
- Are the limitations and strengths of the study presented and discussed?
  Yes
- Are the results discussed in light of the study's limitations and existing knowledge on the topic?
  Yes
- Are the potential contributions of the main findings for scientific development, innovation, or real-world intervention discussed by the authors?
  Partially
- **Suggestions/Comments:**
  In some points of the discussion, the authors address differences in proportions that were not statistically confirmed in the study.

Conclusion

- Is the conclusion of the study presented adequately and consistent with the study's objective?
  Yes
- Is the conclusion original?
  Yes
- **Suggestions/Comments:**
  As mentioned in the justification of the study, the present results can contribute to promoting/direction actions to encourage an active lifestyle in groups most affected by the pandemic, rather than merely guiding actions in future pandemics.

References

- Are the references updated and sufficient?
  Yes
- Are most of them original articles?
  Yes
- Do the references comply with the journal's guidelines [quantity and format]?
  Yes
- Is the citation in the text adequate, i.e., do the statements in the text cite references that truly support those claims?
  Partially
- **Suggestions/Comments:**
  At the end of the Discussion, the authors state: "However, contrary to these findings, a study conducted with Brazilian teachers from the municipal education system in Campo Grande, Mato Grosso do Sul, showed that younger teachers had higher chances of elevated sedentary behavior, which may reflect a characteristic related to the work of teachers." However, reference 27 appears to be incorrectly cited, as the article mentioned does not correspond to the authors' information. The same issue occurred with reference 28. Both references seem to be 28 and 29, rather than 27 and 28.

Comments to the author

- Dear authors, the comments regarding the manuscript are detailed in the specific fields.

Decision

- Major revisions needed.