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How COVID-19 pandemic impacted students' and staff's physical activity at a Brazilian University?

Como a pandemia de coronavírus impactou estudantes e servidores de uma universidade do sul do Brasil?

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ABSTRACT

Introduction: Physical activity and its positive effects on coronavirus have been extensively discussed in the literature. However, there is still a lack of evidence on the effects of the coronavirus pandemic on the health-related behaviors of the Brazilian university community. Objective: To describe physical activity practice during the coronavirus pandemic among students and staff of a southern Brazilian university, as well as its association with sociodemographic characteristics. Methods: This self-administered web-based cross-sectional study was carried out among a southern Brazilian community. The main outcome of this study was leisure time physical activity before and during the coronavirus pandemic. Results: Considering only leisure-time, 21% and 24% of the students and staff, respectively, reported achieving physical activity recommendations (≥150 minutes per week). There was a decline of more than 15 percentage points in physical activity practice comparing to pre and during the pandemic, and those following the protocols of staying at home presented lower levels of leisure-time physical activity. Physical activity practice was mainly performed at home and without any professional help. Conclusion: Leisure-time physical activity prevalence during the pandemic was relatively low (compared with Brazilian population) among students and staff, and participants who followed the staying at home protocols presented lower levels of physical activity.

Keywords: Physical activity; Coronavirus; Epidemiology; Universities.

RESUMO

Introdução: O efeito positivo da atividade física durante a pandemia de coronavírus foi amplamente discutida na literatura. Entretanto, ainda existe uma lacuna nos efeitos relacionados à saúde da comunidade universitária de brasileiros. Objetivo: Descrever sobre a prática da atividade física durante a pandemia de coronavírus entre estudantes e servidores de uma universidade no sul do Brasil, bem como sua associação com características sociodemográficas. Métodos: Através de um questionário online auto aplicado, uma comunidade universitária participou deste estudo transversal. O desfecho principal deste estudo foi tempo em atividade física de lazer antes e durante a pandemia de coronavírus. Resultado: Levando em consideração apenas as atividades físicas de lazer, 21% e 24% dos estudantes e servidores, respectivamente, reportaram atingir as recomendações (≥150 minutos por semana). Houve um declínio de mais de 15 pontos percentuais no nível de atividade física comparando antes e durante a pandemia, e aqueles que seguiram os protocolos de isolamento social apresentaram níveis menores de atividade física. A prática de atividade física foi realizada principalmente em casa e sem ajuda de profissional especializado. Conclusão: A prevalência de atividade física no lazer durante a pandemia foi relativamente baixa (comparado com a população brasileira) entre estudantes e servidores, sendo aqueles que cumpriram os protocolos de isolamento social apresentaram menores níveis de atividade física.

Palavras-chave: *Atividade física; Coronavírus; Epidemiologia; Universidades.*

Introduction

The COVID-19 pandemic rapidly spread in 2020 and remains impacting the social and health dynamics worldwide. In response, the World Health Organization published recommendations of protective measures to limit the circulation of the virus in the population[1], with a strong emphasis on social distancing and stay-at-home orientation. To minimally comply with these measures, a series of lifestyle changes were necessary, potentially impacting negatively on some health-related behaviors[2].

Physical activity (PA) and its positive effects on COVID-19 have been extensively discussed in the literature. Physical inactivity is associated with risk factors for COVID-19 severity, such as obesity, cardiovascular diseases, and diabetes[3]. In addition, the progression of the disease could be worse for inactive individuals, since they have a greater risk of hospitalizations and complications due to COVID-19[4]. In Brazil, hospitalization rates were 37.6% lower for physically active patients when compared to inactive ones[5]. Along with the biological effects, an active lifestyle might also help decrease the mental health burden related to the COVID-19 pandemic[6].

However, evidence points out an increase in physical inactivity during this period, with an incidence of physical inactivity of 70% in the first wave of COVID-19[6,7], especially due to social distancing measures. In Brazil, the early stages of social restriction were marked by a decline in PA practice and an increase in screen time, ultra-processed food intake, cigarette smoking, and alcohol consumption[8]. This scenario affected the overall population, but the pattern was even more markedly observed among disadvantaged populations[9], since some political choices of the Brazilian government during the COVID-19 crisis led to the exacerbation of the already established social inequalities in the country[10].

Another group that could be heavily affected by the pandemic is university students and staff. To minimize the virus spread, Brazilian universities were closed from March 2020 until mid-2022, which clearly impacted the routine and behaviors of the academic community. Evidence from other countries suggests that COVID-19 might impact sleep quality and mental health in this group[11,12]. However, there is still lack of evidence on the effects of the COVID-19 pandemic on the health-related behaviors of the Brazilian university community, mostly comparing with pre-pandemic prevalence. Thus, the present study aims to describe PA practice during the COVID-19 pandemic among students and staff of a southern Brazilian university, as well as its association with sociodemographic characteristics.

Methods

This web-based cross-sectional study was carried out between July and August of 2020 in Pelotas, a city with approximately 340,000 inhabitants in Southern Brazil[13], and participants were from the Federal University of Pelotas community. We considered eligible all students (18,814 undergraduate and 3,781 graduate) and staff (1,369 academic staff and 1,256 administrative staff) of this public university. Each participant who agreed to participate signed an informed consent term electronically before starting the survey. This study was approved by the Human Research Ethics Committee of the Federal University of Pelotas under protocol number 4.103.085.

Prior to data collection, the questionnaire was piloted to assess the understanding of the instruments used and its duration (n = 8; time for answering the questionnaire = 15 minutes). All eligible participants received an email through the University system with information about the survey and the questionnaire link to take part in it. The questionnaire link was also made available on the survey's official social media page on Instagram and Facebook. The questionnaire was hosted online in REDCap software[14]. The first page of the questionnaire contained the informed consent form. To access the questionnaire, participants had to click 'Yes' after the question that asked whether they agreed to participate. If the participant agreed to participate, 65 mandatory close-ended items were applied.

The main outcome of this study was leisure time physical activity (LTPA) during the COVID-19 pandemic measured by the leisure-time domain of IPAQ (International Physical Activity Questionnaire), which measures frequency and intensity. We considered the individual as active if reporting ≥150 minutes of LTPA in the seven days prior to the survey. Two secondary outcomes were considered: first, if the individual practiced any PA (e.g.: gymnastics, sports, walking, running, or other) before the pandemic, and second, for those individuals who performed any LTPA during the pandemic, we asked the participants about where they performed those PA (at home, indoor, outdoor, or other), if the participant received guidance from a trained professional (yes or no) – if yes, whether it was the same as before the COVID-19 pandemic, by new

professional guidance, by videos or internet posts without professional bond, or other way. Lastly, we asked if the participants used to practice LTPA before social distancing started in Brazil.

The covariates used in this study were gender (male or female), age (<25; 25 – 34; ≥35 years for students and <35; 35 – 44; ≥45 years for staff, divided based on the distribution of the sample), family income in the last month (up to BRL 1,000; BRL 1,001 –2,500; BRL 2,501 – 5,000; BRL 5,001 – 10,000; more than BRL 10,001 for students and up to 5,000; BRL 5,001 – 10,000; more than BRL 10,001 for staff – note that US$1.00 was around BRL5.20 during data collection), self-reported skin color (white; black or brown; yellow or indigenous), household composition (live alone; live with family members; live with friends; live with a partner; other), maternal education (incomplete high school, complete high school, incomplete college, complete college, complete post-graduation), level of education (up to complete high school, incomplete college, complete college or complete post-graduation for students and incomplete college, complete college or complete post-graduation for staff), university position (undergraduate students, or graduate students/post-doc for students; administrative staff or academic staff for professional services staff), if the participant is currently employed (no; yes, up to 20h/week; yes, 20h-40h/week; or yes, more than 40h/week) – only for students –, and self-reported level of social distancing (low, some or quite hard/isolated).

The statistical analyses presented in this study were mainly descriptive, based on proportions and their respective 95% confidence intervals. Fisher's exact test was used to evaluate the association between each of the covariates and the outcome. All analyses were performed in Stata version 15.1 (Stata Corporation, College Station, TX, USA), adopting a significance level of 5%.

Results

The sample size comprised 2,853 individuals, of which 2,175 were students from the university and 678 were university staff, representing a response rate of 25.8% among students and 9.6% among university staff. Comparisons between the total university community and the studied sample according to gender, skin color and age are described in Supplementary Table 1. According to Table 1, most participants were female (71.0% of students and 60.6% of staff), white (78.3% of students and 92.9% of staff), lived with family members (59.8% of

Table 1 – Descriptive characteristics of the analytic sample.

	n (%)	95% CI
Students		
Gender		
Male	625 (29.0)	27.1 – 31.0
Female	1529 (71.0)	69.0 - 72.9
Age		
<25 years	1171 (54.6)	52.5 - 56.7
25-34 years	643 (30.0)	28.1 – 32.0
≥35 years	331 (15.4)	14.0 – 17.0
Family income (last month)		
Up to BRL 1,000	254 (13.4)	12.0 - 15.1
BRL 1,001 – 2,500	668 (35.4)	33.2 - 37.5
BRL 2,501 – 5,000	538 (28.5)	26.5 - 30.6
BRL 5,001 – 10,000	277 (14.7)	13.1 - 16.3
More than BRL 10,001	152 (8.0)	6.9 - 9.4
Skin color		
White	1684 (78.3)	76.5 - 79.9
Black or Brown	446 (20.7)	19.1 - 22.5
Yellow or indigenous	22 (1.0)	0.7 - 1.5
Household structure		
Live alone	286 (13.4)	12.0 - 14.9
Live with family members	1276 (59.8)	57.7 - 61.9
Live with friends	159 (7.5)	6.4 - 8.6
Live with a partner	369 (17.3)	15.7 – 19.0
Other	44 (2.1)	1.5 - 2.8
Maternal education		
Incomplete high school	725 (34.0)	32.0 – 36.0
Complete high school	503 (23.6)	21.8 - 25.4
Incomplete college	116 (5.4)	4.6 - 6.5
Complete college	516 (24.2)	22.4 - 26.1
Complete graduation	272 (12.8)	11.4 - 14.2
Education		
Up to complete high school	370 (17.3)	15.7 - 18.9
Incomplete college	1064 (49.7)	47.6 - 51.8
Complete college	338 (15.8)	14.3 - 17.4
Complete graduation	370 (17.3)	15.7 - 18.9
University bond		
Undergraduate student	1652 (76.0)	74.1 - 77.7
Graduation student or post-doc	523 (24.0)	22.3 - 25.9
Employment status		
No	1521 (73.0)	71.1 - 74.9
Yes, up to 20h/week	226 (10.8)	9.6 - 12.3
Yes, 20h to 40h/week	250 (12.0)	10.7 - 13.5
Yes, more than 40h/week	86 (4.1)	3.4 - 5.1
Social distancing		
Low	95 (4.4)	3.6 - 5.4
Some	431 (20.1)	18.4 - 21.8
Quite hard/Isolated	1622 (75.5)	73.6 - 77.3
Physical activity before COVID-19		
No	685 (34.6)	32.6 - 36.8

Continue…

Continue of **Table 1 –** Descriptive characteristics of the analytic sample.

	n (%)	95% CI
Yes	1292 (65.4)	63.2 - 67.4
Physical activity during COVID-19		
No	972 (49.3)	47.1 - 51.5
Yes	1001 (50.7)	48.5 - 52.9
Physical activity in the last 7 days		
Inactive	1560 (79.0)	77.1 - 80.7
Active	415 (21.0)	19.3 - 22.9
Where physical activity was performed during COVID-19		
At home	633 (63.3)	60.3 - 66.2
Outdoor (e.g. plaza, street)	249 (24.9)	22.3 - 27.7
Indoor (e.g. gym, club)	79 (7.9)	6.4 - 9.7
Other	39 (3.9)	2.9 - 5.3
Physical activity with instructor		
No	733 (73.4)	70.5 – 76.0
Yes	266 (26.6)	24.0 - 29.5
Instructor		
Same as before COVID-19	97 (42.0)	35.8 - 48.5
New during COVID-19	43 (18.6)	14.1 - 24.2
No contact, only internet media	82 (35.5)	29.6 - 41.9
Other	9 (3.9)	2.0 - 7.3
Staff		
Gender		
Male	263 (39.4)	35.7 - 43.1
Female	405 (60.6)	56.9 - 64.3
Age		
<35 years	104 (16.3)	13.6 - 19.3
35-44 years	233 (36.5)	32.8 - 40.3
≥45 years	302 (47.3)	43.4 - 51.1
Family income (last month)		
Up to 5,000	89 (13.9)	11.5 - 16.9
BRL 5,001 – 10,000	195 (30.6)	27.1 - 34.3
More than BRL 10,000	354 (55.5)	51.6 - 59.3
Skin color		
White	617 (92.9)	90.7 - 94.6
Black or Brown	45 (6.8)	5.1 - 9.0
Yellow or indigenous	2 (0.3)	0.1 - 1.2
Household structure		
Live alone	116 (17.5)	14.8 - 20.6
Live with family members	303 (45.8)	42.0 - 49.6
Live with friends	1 (0.2)	0.0 - 1.1
Live with a partner	235 (35.5)	31.9 - 39.2
Other	7 (1.1)	0.5 - 2.2
Maternal education		
Incomplete high school	282 (42.9)	39.1 - 46.7
Complete high school	127 (19.3)	16.5 - 22.5
Incomplete college	31 (4.7)	3.3 - 6.6
Complete college	142 (21.6)	18.6 - 24.9
Complete graduation	76 (11.6)	9.3 - 14.2
Education		
Incomplete college	7 (1.1)	0.5 - 2.2
Complete college	48 (7.2)	5.5 - 9.5
Complete graduation	609 (91.7)	89.4 - 93.6
University bond		
Administrative staff	233 (34.4)	30.9 - 38.0
Academic staff	445 (65.6)	62.0 - 69.1
Social distancing		
Low	7 (1.1)	0.5 - 2.2
Some	74 (11.2)	9.0 - 13.8
Quite hard/Isolated	582 (87.8)	85.1 - 90.1
Physical activity before COVID-19		
No	130 (21.6)	18.5 - 25.0
Yes	473 (78.4)	75.0 - 81.5
Physical activity during COVID-19		
No	258 (42.7)	38.8 - 46.7
Yes	346 (57.3)	53.3 - 61.2
Physical activity in the last 7 days		
Inactive	456 (76.0)	72.4 - 79.3
Active	144 (24.0)	20.7 - 27.6
Where physical activity was performed during COVID-19		
At home	221 (63.9)	58.7 - 68.8
Outdoor (e.g. plaza, street)	72 (20.8)	16.8 - 25.4
Indoor (e.g. gym, club)	38 (11.0)	8.1 - 14.8
Other	15 (4.3)	2.6 - 7.1
Physical activity with instructor		
No	173 (50.3)	45.0 - 55.6
Yes	171 (49.7)	44.4 - 55.0
Instructor		
Same as before COVID-19	112 (68.3)	60.7 - 75.0
New during COVID-19	21 (12.8)	8.5 - 18.9
No contact, only internet media	26 (15.9)	11.0 - 22.3
Other	5 (3.0)	1.3 - 7.2

Table 2 – Prevalence of individuals practicing any leisure time physical activity before and during the pandemic, and prevalence of active individuals (≥150 minutes per week) considering only leisure time physical activity during the pandemic stratified by sex.

	Before COVID-19	During COVID-19	Active individuals during COVID-19
Students			
Males	70.0 (66.1 – 73.6)	52.2 (48.1 – 56.3)	26.5 (23.0 – 30.3)
Females	63.5 (60.9 – 66.0)	50.1 (47.5 – 52.8)	18.8 (16.8 – 20.9)
Total	65.4 (63.2 – 67.4)	50.7 (48.5 – 52.9)	21.0 (19.3 – 22.9)
Staff			
Males	78.0 (72.2 – 82.8)	57.6 (51.2 – 63.8)	26.8 (21.5 – 32.9)
Females	78.8 (74.3 – 82.6)	57.1 (51.9 – 62.0)	22.2 (18.2 – 26.8)
Total	78.4 (75.0 – 81.6)	57.3 (53.3 – 61.2)	24.0 (20.7 – 27.6)

students and 45.8% of staff), and whose mothers did not complete high school (34.0% for students and 42.9% for

staff). Considering only students, most of the sample was 25 years or younger (54.6%) and with a family income between BRL 1,001 – 2,500. Yet, considering only staff, we had a greater number of people with 45 years or older (47.3%), and earning more than BRL 10,000 (55.5%).

According to Table 2, for students enrolled in both undergraduate and post-graduation programs, the prevalence of LTPA (≥150 minutes per week) before and during the pandemic was 65.4% (70.0% for males and 63.5% for females) and 50.7% (52.2% for males and 50.1% for females), respectively. During the pandemic, the prevalence of active individuals for the entire student sample was 21.0% (26.5% for males and 18.8% for females). For staff, the prevalence of LTPA (≥150 minutes per week) before and during the pandemic was 78.4% (78.0% for males and 78.8% for females) and 57.3% (57.6% for males and 57.1% for females), respectively. During the pandemic, the prevalence of active individuals for the entire staff sample was 24.0% (22.2% for males and 26.8% for females).

According to Table 3, the most active student males were those with brown or black skin color, those active

Table 3 – Physical activity (≥150 minutes in the last 7 days) during COVID-19 among students and sociodemographic variables.

	Active males % (95% CI)	p-value*	Active females % (95% CI)	p-value*
Students				
Age		0.696		0.850
<25 years	27.0 (22.1 – 32.5)		18.4 (15.9 – 21.3)	
25-34 years	24.5 (18.8 – 31.1)		18.8 (15.4 – 22.9)	
≥35 years	28.8 (20.9 – 38.3)		20.2 (15.1 – 26.5)	
Family income (last month)		0.155		<0.001
Up to BRL 1,000	20.6 (12.4 – 32.4)		14.6 (9.9 – 21.0)	
BRL 1,001 – 2,500	22.8 (17.1 – 29.7)		15.5 (12.4 – 19.1)	
BRL 2,501 – 5,000	27.7 (21.1 – 35.5)		15.7 (12.3 – 19.9)	
BRL 5,001 – 10,000	30.1 (20.7 – 41.6)		27.0 (21.1 – 33.8)	
More than BRL 10,001	39.5 (26.2 – 54.7)		36.5 (27.5 – 46.5)	
Skin color		0.037		0.065
White	24.0 (20.2 – 28.2)		19.7 (17.5 – 22.2)	
Black or brown	35.7 (27.4 – 44.8)		14.7 (11.1 – 19.3)	
Yellow or indigenous	33.3 (11.1 – 66.7)		33.3 (13.1 – 62.4)	
Household structure		0.559		0.417
Live alone	27.5 (19.3 – 37.5)		21.4 (15.9 – 28.3)	
Live with family members	26.8 (22.2 – 32.0)		19.0 (16.5 – 21.8)	
Live with friends	34.7 (22.8 – 48.9)		22.0 (14.9 – 31.2)	
Live with a partner	22.0 (14.9 – 31.2)		15.0 (11.1 – 20.1)	
Other	20.0 (5.0 – 54.2)		22.2 (10.3 – 41.5)	
Maternal education		0.583		0.081
Incomplete high school	27.8 (21.8 – 34.7)		16.7 (13.6 – 20.4)	
Complete high school	21.1 (14.8 – 29.3)		18.1 (14.3 – 22.6)	
Incomplete college	29.6 (15.5 – 49.1)		16.0 (9.3 – 26.1)	
Complete college	27.1 (20.4 – 34.9)		19.5 (15.6 – 24.1)	
Complete graduation	30.6 (21.7 – 41.2)		26.3 (20.3 – 33.3)	
Education		0.518		0.006
Up to complete high school	23.5 (16.3 – 32.7)		14.8 (10.8 – 19.9)	
Incomplete college	27.1 (22.3 – 32.7)		17.7 (15.1 – 20.8)	
Complete college	22.2 (14.8 – 32.0)		17.5 (13.1 – 23.0)	
Complete graduation	30.9 (22.5 – 40.8)		26.5 (21.4 – 32.3)	

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Continue of **Table 3 –** Physical activity (≥150 minutes in the last 7 days) during COVID-19 among students and sociodemographic variables.

	Active males % (95% CI)	p-value*	Active females % (95% CI)	p-value*
University bond		0.722		0.057
Undergraduate student	26.8 (22.9 – 31.1)		17.6 (15.4 – 20.1)	
Graduate student or post-doc	25.2 (18.2 – 33.8)		22.1 (18.2 – 26.7)	
Work		0.466		0.834
No	25.9 (21.8 – 30.5)		19.5 (17.2 – 22.1)	
Yes, up to 20h/week	27.8 (17.5 – 41.1)		18.3 (12.9 – 25.2)	
Yes, 20h to 40h/week	34.3 (24.1 – 46.1)		17.5 (12.3 – 24.4)	
Yes, more than 40h/week	22.5 (12.1 – 37.9)		15.0 (6.9 – 29.6)	
Social distancing		0.045		0.030
Low	33.3 (18.9 – 51.7)		19.2 (10.7 – 32.2)	
Some	34.5 (26.5 – 43.4)		24.3 (19.6 – 29.7)	
Quite hard/Isolated	23.8 (19.9 – 28.1)		17.4 (15.2 – 19.7)	
Physical activity before COVID-19		<0.001		<0.001
No	5.9 (3.2 – 10.5)		7.6 (5.6 – 10.2)	
Yes	35.4 (30.8 – 40.2)		25.3 (22.6 – 28.3)	
Physical activity with instructor		0.006		<0.001
No	44.7 (38.5 – 51.0)		29.3 (25.4 – 33.5)	
Yes	66.0 (51.9 – 77.7)		48.1 (41.5 – 54.8)	
Total	26.5 (23.0 – 30.3)		18.8 (16.8 – 20.9)	
	Staff			
Age		0.184		0.588
<35 years	17.9 (8.8 – 33.2)		21.8 (12.8 - 34.7)	
35-44 years	21.5 (13.2 - 33.2)		19.4 (13.7 - 26.9)	
≥45 years	30.8 (23.0 - 39.7)		24.4 (18.3 - 31.6)	
Family income (last month)		0.199		0.001
Up to 5,000	25.0 (13.0 - 42.7)		2.2 (0.3 - 14.0)	
BRL 5,001 – 10,000	17.9 (9.9 - 30.2)		28.3 (21.0 - 37.1)	
More than BRL 10,000	30.4 (23.2 - 38.7)		23.0 (17.4 - 29.6)	
Skin color		0.765		0.207
White	26.9 (21.3 - 33.3)		22.9 (18.8 - 27.6)	
Black or brown	30.0 (14.1 - 52.8)		10.5 (2.6 - 33.8)	
Household structure		0.829		0.103
Live alone	23.8 (13.3 - 39.0)		21.5 (13.2 - 33.2)	
Live with family members	27.0 (19.2 - 36.6)		18.0 (13.0 - 24.5)	
Live with a partner	28.9 (20.4 - 39.1)		28.5 (21.2 - 37.1)	
Maternal education		0.959		0.427
Incomplete high school	24.0 (16.4 - 33.5)		21.2 (15.4 - 28.3)	
Complete high school	27.7 (16.7 - 42.1)		20.6 (12.6 - 31.9)	
Incomplete college	30.0 (9.9 - 62.5)		26.3 (11.4 - 49.9)	
Complete college	29.4 (18.5 - 43.3)		18.9 (11.5 - 29.5)	
Complete graduation	26.7 (13.9 - 45.1)		33.3 (20.8 - 48.8)	
Education		0.523		0.335
Incomplete college	25.0 (3.3 - 76.4)		0.0 (0.0 - 0.0)	
Complete college	15.8 (5.1 - 39.3)		10.5 (2.6 - 33.8)	

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	Active males % (95% CI)	p-value*	Active females % (95% CI)	p-value*
Complete graduation	27.8 (22.2 - 34.3)		23.0 (18.8 - 27.7)	
University bond		0.959		0.321
Administrative staff	27.0 (18.1 - 38.3)		19.2 (13.2 - 27.1)	
Academic staff	26.7 (20.4 - 34.1)		23.8 (18.8 - 29.6)	
Social distancing		0.012		0.821
Low	40.0 (9.9 - 80.1)		0.0 (0.0 - 0.0)	
Some	45.0 (30.4 - 60.5)		25.0 (11.7 - 45.7)	
Quite hard/Isolated	22.6 (17.2 - 29.2)		22.1 (18.0 - 26.9)	
Physical activity before COVID-19		<0.001		<0.001
No	3.8 (1.0 - 14.2)		2.6 (0.6 - 9.7)	
Yes	33.3 (26.9 - 40.5)		27.6 (22.7 - 33.1)	
Physical activity with instructor		0.145		0.417
No	39.1 (29.3 - 49.8)		34.1 (24.8 - 44.8)	
Yes	52.1 (38.0 - 65.8)		39.7 (31.3 - 48.7)	
Total	26.8 (21.5 – 32.9)		22.2 (18.2 – 26.8)	

*Fisher's exact test

before the pandemic, and those practicing PA with an instructor. On the other hand, the least active student males were those with white skin color and those considered quite hard/isolated in terms of social distancing. Considering female students, the poorest, those who were physically inactive before the pandemic, and those not practicing PA with an instructor were less active than their counterparts. Among staff, both men and women were less active if they were not practicing PA before the pandemic. In addition, men with low levels of social distancing and the poorest women were less active (Table 3).

Figure 1 shows the gender-specific prevalence of LTPA according to participant's routine during COVID-19, stratified by students and staff. Participants who were following the protocols of staying at home were the ones with a lower prevalence of LTPA. Among those participants reporting LTPA practice, most individuals practiced their physical activities at home, followed by outdoors (parks or plazas) for both males and females (Figure 2). Lastly, Supplementary Figure 1 shows the prevalence of LTPA among active individuals according to professional aid. More than half of the students and staff kept the same type of contact with trained professionals as before the pandemic (either online or in person), and almost 1/5 of students and staff started online classes with physical education professionals.

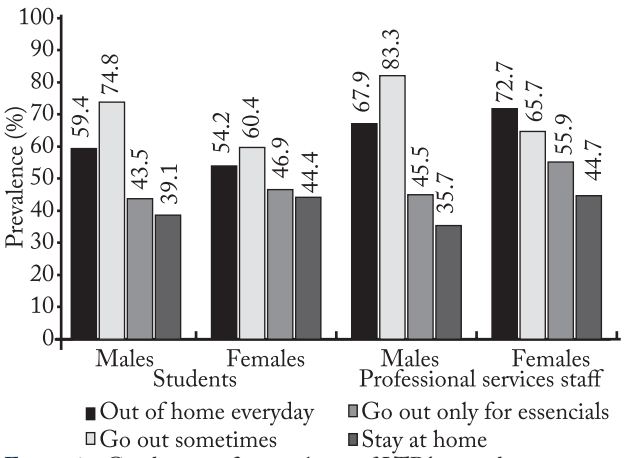

Figure 1 – Gender-specific prevalence of LTPA according to participant's routine during COVID-19 pandemic

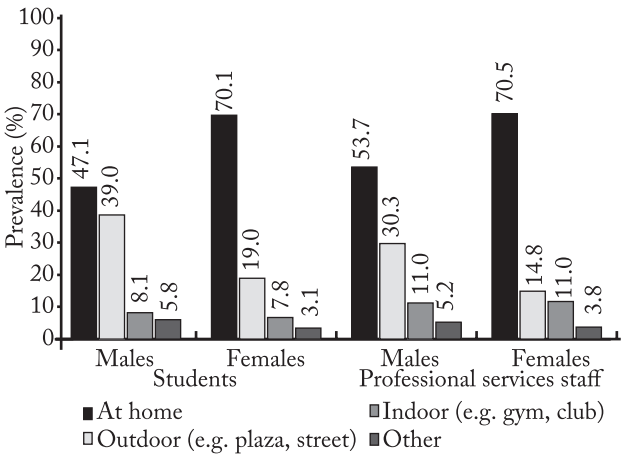

Figure 2 – Gender-specific prevalence of LTPA according to participant's place of practice

Discussion

The present study described LTPA practices amid COVID-19 pandemic among students and staff of a southern Brazilian university, in addition to the association of the outcome with sociodemographic characteristics. Around one-quarter of the participants reported achieving PA recommendations (≥150 minutes per week) only considering leisure-time. There was a decline of more than 15 percentage points in PA practice comparing pre- and during the pandemic, and those following the protocols of staying at home presented lower levels of LTPA. PA practice was mainly performed at home and without any professional help.

The pandemic has negatively impacted several outcomes of the world's population, such as mental health[15,16], food insecurity[17], education[18], unemployment[19], and sleep quality[15]. In addition to that, the prevalence of PA has declined[20]. Considering university students' samples, we found only one study that, surprisingly, showed a positive effect of the COVID-19 pandemic on PA levels when comparing pre and post pandemic prevalences, however the authors acknowledge the possibility of selection bias due to voluntary sample selection[21]. All other studies identified a decline in PA prevalence during the pandemic[22–24]. A Canadian study with 125 university students demonstrated a 6-percentage point reduction in the prevalence of achieving the Canadian 24-Hour Movement Guidelines for Adults (from 36% to 30%)[22]. Also, evidence from Australian university students showed a decline of around 30 percent on student's sufficient levels of PA during the pandemic[23]. A review of university students' PA levels pre- and during the pandemic also found a reduction in PA levels in 9 of the 10 studies included, despite the overall low quality of evidence[25].

It is known that PA can improve the mental health burden of the world's population[26]. A meta-analysis including 12 empirical cohort studies from different countries showed that the risk of developing depression was higher for those individuals in the lowest group of LTPA, with a dose-response component[27]. At the same time, according to our data, just a few participants reported ≥150 minutes per week of LTPA. Therefore, it is relevant to spread to the population the importance of maintaining a healthy routine (such as a good diet and PA) for general wellbeing, as well as to help looking after mental health due to its impact during the pandemic.

Women's family income impacted heavily on PA levels both for students and staff, however, this pattern was not observed for men. This could be due to the unequal gender labor distribution. It is still socially accepted that women, especially those with lower income, are the main caregiver of children and responsible for most of the household activities[28]. Summing this up to formal work, poorer women have been suffering from a double burden of activities for a long time. During the pandemic (with lockdowns and "stay at home" policies), that pattern increased gender inequalities, reducing women's leisure time and, consequently, decreasing PA levels[29].

The reduction in PA practice is an expected development of the social distancing measures taken to reduce COVID-19 spread[8], since a favorable environment to practice PA at home is accessible to few. Our results showed that social distancing and a stay-at-home routine were related to lower prevalence of LTPA. Similarly, a systematic review study on PA and sedentary behavior from before to during the COVID-19 pandemic, found a decline in PA levels in 64 out of the 66 studies included, in which all of them reported a reduction higher than 50%[30].

Given the complex nature of PA, a wide set of contextual aspects can contribute to the choice or opportunity of practice. Online classes or personal trainers are usually expensive and require an adequate infrastructure (i.e., large room, silence, equipment) therefore, socioeconomically disadvantaged subgroups are less likely to maintain such activities during COVID-19[31]. Also, it is possible that the level of priority of PA practice, or even other health-related aspects of life, was lowered, because of the economic challenges posed by the pandemic. The reduction in PA could be even more expressive among families with children or older people, in which the care for those individuals demands time and effort of the family, reducing the opportunity for LTPA[32,33].

On the other hand, our study demonstrates a positive impact of PA practice before the pandemic over the maintenance of this behavior during the COVID-19 social distancing period. We found no studies evaluating the effect of PA before the pandemic over the prevalence of PA during the pandemic. The literature is focused on PA changes during this period. Further research is needed to strengthen the evidence found in the present study.

Among participants reporting PA practice during the pandemic, more than 50% of participants reporting LTPA practice during the pandemic persisted in

doing classes or being supervised by physical education professionals as before the pandemic. Therefore, keeping contact with physical education professionals might have impacted the maintenance of PA behavior[9]. Future studies may help to understand this relationship, which could also be influenced by the high socioeconomic profile, which both students and staff might have to be able to access private supervision for their physical activities and to keep their routine stable even in a pandemic scenario.

Our study presents an important limitation regarding sample representativeness. Despite efforts for large participation of the university community, the representativeness of our sample is not guaranteed[16]. The analytical sample of our study is younger and presents a higher proportion of female individuals than the eligible university community, which could underestimate the PA prevalence found in the present study since adult women usually present lower PA levels when compared to men. Therefore, our results should be interpreted with caution. This limitation could be partially explained by the online nature of our research, which could negatively impact representativeness and response rate. In addition to sociodemographic characteristics, the students and staff who answered our questionnaire, compared to the non-participants, may have different relationships with the university, different levels of interest in the research topic might be affected in dissimilar proportions by the pandemic. In general, the university community is not representative of the entire population since those achieving university levels are already socioeconomically benefited individuals. On the other hand, some strengths should be highlighted. Despite the response rate, we have a sample of students and staff from a public institution answering a validated questionnaire that has been used over most studies in the PA area, including questions about the context of the activities performed. In addition, our study has measures of PA at two time points (before and during the pandemic), allowing future studies to use our results to compare with post-pandemic LTPA prevalence.

Nevertheless, the present study raises relevant descriptive insights on PA levels, their correlates, and other characteristics of practice that can be important for institutions in the post-pandemic scenario. The LTPA prevalence during the pandemic was relatively low among students and staff and participants who followed the staying at home protocols presented lower levels of PA.

Conflict of interest

The authors declare no conflicts of interest.

Authors contributions

Martins RC: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft; Approval of the final version. Ricardo LIC: Formal Analysis, Writing – Original Draft; Approval of the final version. Crochemore-Silva I: Conceptualization; Supervision; Writing – Review & Editing; Approval of the final version. Demarco FF: Project administration; Writing – Review & Editing; Approval of the final version. Munhoz, TN: Project administration; Writing – Review & Editing; Approval of the final version. Levandowski ML: Project administration; Writing – Review & Editing; Approval of the final version. Cademartori MG: Project administration; Writing – Review & Editing; Approval of the final version. Schuch HS: Project administration; Writing – Review & Editing; Approval of the final version. Hallal PC: Supervision; Writing – Review & Editing; Approval of the final version.

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

The authors did not use artificial intelligence tools for preparation of the manuscript.

Availability of research data and other materials

The data of this study is available on demand from referees.

Preprint

The manuscript was previously published as a preprint. Server name Preprints: medRxiv. doi Preprint: https://doi.org/10.1101/2022.11.23.22280287

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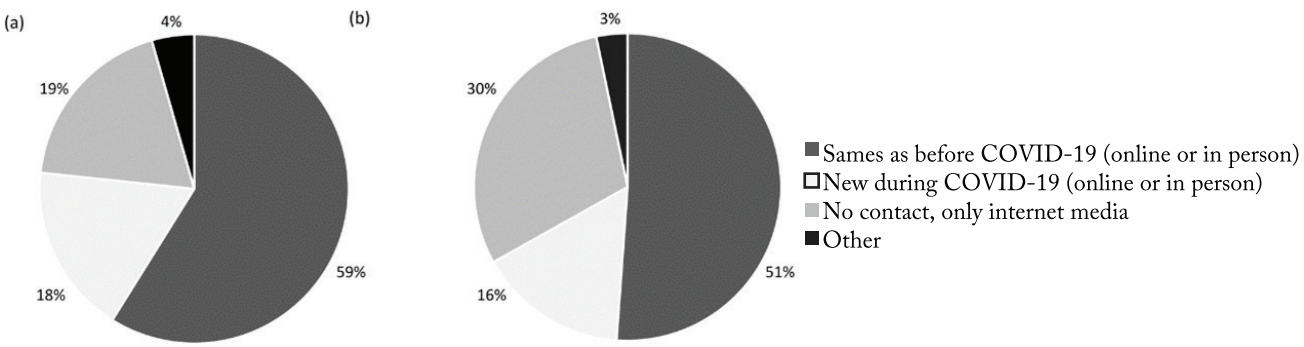
Suplementary material

Supplementary Table 1 – Comparison of analytic sample (n = 2,175 students and n = 678 staff) and eligible participants (n = 22,595 students and n = 2,625 staff).

	Students				Staff			
	UFPel		Analytic sample		UFPel		Analytic sample	
	N	%	N	%	N	%	N	%
Sex		p<0.001				p=0.001		
Male	10,144	44.9	625	29.0	1,221	46.5	263	39.4
Female	12,451	55.1	1,529	71.0	1,404	53.5	405	60.6
Total	22,595	100.0	2,154	100.0	2,625	100.0	668	100.0
Skin color		p=0.195				p=0.333		
White	14,266	76.9	1684	78.3	2,349	91.1	617	92.9
Black or Brown	4,124	22.2	446	20.7	219	8.5	45	6.8
Yellow or Indigenous	156	0.9	22	1.0	10	0.4	2	0.3
Total	18,546	100.0	2,150	100.0	2,578	100.0	664	100.0
Age (in years)		p<0.001				p=0.009		
<25	10,671	47.3	1,171	54.6	3	0.1	4	0.6
25-30	5,937	26.4	503	23.5	81	3.1	31	4.7
≥31	5,934	26.3	471	22	2,541	96.8	629	94.7
Total	22,542	100.0	2,145	100.0	2,625	100.0	664	100.0

Supplementary Figure 1 – Prevalence of LTPA among active individuals according to professional aid



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

Anonymous

Format

- Does the article adhere to the manuscript preparation guidelines of the Revista Brasileira de Atividade Física e Saúde?
  Yes
- Is the manuscript well-structured, with sections such as Introduction, Methods, Results, and Discussion (Conclusion as part of the Discussion)?
  Yes
- Is the language appropriate, clear, precise, and objective?
  Yes
- Are there any indications of plagiarism in the manuscript?
  No
- **Suggestions/comments:**
  No evidence of plagiarism was found in the manuscript.

Abstract

- Are the abstract and summary adequate (containing objectives, study participants, variables studied, main results, and a conclusion) and do they reflect the manuscript's content?
  Partially
- **Suggestions/comments:**
  The contents of the abstract and summary differ. Standardization is required.

Introduction

- Is the research problem clearly stated and delimited?
  Yes
- Is the research problem properly contextualized in relation to existing knowledge, moving from general to specific?
  Yes
- Are the reasons justifying the study (including assumptions) well-articulated?
  Yes
- Are the references supporting the research problem current and relevant?
  Yes
- Was the objective clearly stated?
  Yes
- **Suggestions/comments:**
  The objective is well-presented, addressing a knowledge gap and contributing originally to science. Study is significant for both the academic community and society and is well-grounded.

Methods

- Are the methodological procedures generally adequate for the research problem?
  Yes
- Are the methodological procedures sufficiently detailed?
  Yes
- Was the procedure for selecting or recruiting participants appropriate and clearly described?
  Yes
- Were the instruments used for data collection, including their psychometric qualities (e.g., reliability, internal consistency, validity), sufficiently described?
  Yes
- Is the data analysis plan appropriate and adequately described?
  Yes
- Are inclusion/exclusion criteria adequately described and appropriate?
  Partially
- Did the authors provide explanations about the ethical procedures adopted?
  Partially
- **Suggestions/comments:**
  Spaces marked with "X" in lines 13 and 14 must be completed: "This study was approved by the Human Research Ethics Committee of the XXXX under protocol number XXXXX."

Results

- Are the use of tables and figures appropriate and do they facilitate the presentation of study results?
  Yes
- Is the number of illustrations in line with the jour-

nal's submission guidelines?
Yes
- Are the numbers of participants at each study stage, as well as reasons for dropouts/refusals, presented?
Yes
- Are the participants' characteristics adequately described?
Yes
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?
Yes
- **Suggestions/comments:**
In Table 1, format issues must be addressed for "Where physical activity was performed during COVID-19" (repeated text).
Table titles should be centered relative to the content (e.g., "STUDENTS" is misaligned).
The same adjustments apply to Table 2.

Discussion

- Are the study's main findings presented?
Yes
- Are the study's limitations and strengths presented and discussed?
Partially
- Are the results discussed in light of the study's limitations and existing knowledge?
Yes
- Are the potential contributions of the main findings to scientific advancement, innovation, or real-world application discussed?
Yes
- **Suggestions/comments:**
The study's strengths should be explicitly presented.

Conclusion

- Is the conclusion adequately presented and consistent with the study's objective?
Yes
- Is the study conclusion original?
Yes
- **Suggestions/comments:**
The study's conclusion is original, adequately presented, and consistent with its objectives.

References

- Are the references current and sufficient?
Yes
- Are most references from original articles?
Yes
- Do the references follow the journal's guidelines (quantity and format)?
Yes
- Are citations within the text appropriate, accurately substantiating statements?
Yes
- **Suggestions/comments:**
References are current, sufficient, mostly original articles, and compliant with the journal's standards.

Comments to the author

- After making the suggested corrections and adjustments, the article can be accepted for publication.
- Thank you for the opportunity to contribute to ensuring the quality of this manuscript meets the standards of the Revista Brasileira de Atividade Física e Saúde.

Final decision

- Minor revisions required.

Reviewer B

Igor Massari Correia
Universidade de São Paulo, São Paulo, Brasil

Format

- Does the article adhere to the manuscript preparation guidelines of the Revista Brasileira de Atividade Física e Saúde?
Yes
- Is the manuscript well-structured, with sections such as Introduction, Methods, Results, and Discussion (Conclusion as part of the Discussion)?
Yes
- Is the language appropriate, clear, precise, and objective?
Yes
- Are there any indications of plagiarism in the manuscript?
No
- **Suggestions/comments:**
There are no indications of plagiarism. The text is original and adheres to the journal's guidelines.

Abstract

- Are the abstract and summary adequate (containing objectives, study participants, variables studied,

main results, and a conclusion) and do they reflect the manuscript's content?
Partially
- **Suggestions/comments:**
An introduction is missing in this abstract.
Line 5 (abstract): There were no questions solely about the pandemic. It would be interesting to mention both pre-pandemic and during the pandemic, for example. I only found out what you actually did after reading the entire article.
- Line 12: "Relatively low" compared to what?

Introduction

- Is the research problem clearly stated and delimited?
Yes
- Is the research problem properly contextualized in relation to existing knowledge, moving from general to specific?
Yes
- Are the reasons justifying the study (including assumptions) well-articulated?
Partially
- Are the references supporting the research problem current and relevant?
Yes
- Was the objective clearly stated?
Yes
- **Suggestions/comments:**
2nd paragraph, 2nd line: Physical activity or inactivity?
2nd paragraph, 3rd line: Include hospitalization rates, risk of sequelae... This could strengthen what you're saying.
2nd paragraph, 5th line... positive sociocultural effects: What kind of effects?
3rd paragraph: Epidemiological data in numbers strengthen what you're presenting. Saying that physical inactivity increased by 10%, for example, makes the introduction more robust. Simply saying it increased makes it a bit vague.
4th paragraph, 5th line: What is the importance of your work? What will the results bring to society? I believe this is somewhat missing in both the introduction and the discussion of the article.

Methods

- Are the methodological procedures generally adequate for the research problem?
Yes
- Are the methodological procedures sufficiently detailed?
Yes
- Was the procedure for selecting or recruiting participants appropriate and clearly described?
Partially
- Were the instruments used for data collection, including their psychometric qualities (e.g., reliability, internal consistency, validity), sufficiently described?
Partially
- Is the data analysis plan appropriate and adequately described?
Partially
- Are inclusion/exclusion criteria adequately described and appropriate?
Partially
- Did the authors provide explanations about the ethical procedures adopted?
Yes
- **Suggestions/comments:**
1st paragraph: The inclusion and exclusion criteria were missing.
2nd paragraph, 8th line: (...65 mandatory close-ended items opened on the screen) Please rephrase.
4th paragraph, 1st line: Why was this age categorization chosen? Provide explanations in the discussion.
5th paragraph: Why not perform a t-test to compare the difference between the main variables? I believe this would provide relevant data for your study.

Results

- Are the use of tables and figures appropriate and do they facilitate the presentation of study results?
Yes
- Is the number of illustrations in line with the journal's submission guidelines?
Yes
- Are the numbers of participants at each study stage, as well as reasons for dropouts/refusals, presented?
Yes
- Are the participants' characteristics adequately described?
Yes
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?

Partially
- **Suggestions/comments:**
  2nd paragraph, 1st line: Undergraduate? Graduate? All?
  2nd paragraph, 1st line: LTPA what? Insufficient? More than 150 minutes? It was a bit unclear.
  2nd paragraph, 3rd line (...prevalence of active individuals): At what time?
  2nd paragraph, 4th line (... For staff, the prevalence of LTPA before…): Same issue here.
  3rd paragraph, 4th line (.. low level of social distancing): This is not what is mentioned throughout the paper. I recommend reviewing the results and writing accordingly.
  3rd paragraph, 4th line (… students, the richest...): Is this the classification you used for higher earners? Please review some terms in English that can be improved.
  3rd paragraph, 4th line (...Those...): Improve the translation of the article.
  3rd paragraph, 7th line (… low levels of social distancing.): The same here.

Discussion
- Are the study's main findings presented?
  Yes
- Are the study's limitations and strengths presented and discussed?
  Partially
- Are the results discussed in light of the study's limitations and existing knowledge?
  Yes
- Are the potential contributions of the main findings to scientific advancement, innovation, or real-world application discussed?
  Partially
- **Suggestions/comments:**
  2nd paragraph, 4th line: Why? What makes this work different that could explain this result?
  2nd paragraph, 5th line: How much did the physical activity rate decrease? Is it close to what you presented? What are the characteristics of these studies?
  6th paragraph, 5th line (Also, it is possible that the ...): A reference is missing for this part.

Conclusion
- Is the conclusion adequately presented and consistent with the study's objective?
  Yes
- Is the study conclusion original?
  Yes
- **Suggestions/comments:**
  The study appears to be important for the field, but it needs to adjust some issues, which are outlined in the file I provided.

References
- Are the references current and sufficient?
  Yes
- Are most references from original articles?
  Yes
- Do the references follow the journal's guidelines (quantity and format)?
  Partially
- Are citations within the text appropriate, accurately substantiating statements?
  Yes
- **Suggestions/comments:**
  Please, adjust to the Journals format

Comments to the author
- The study appears to be important for the field, but it needs to adjust some issues, which are outlined in the file I provided.

Final decision
- Major revisions required.

Reviewer C
Anonymous

Format
- Does the article meet the manuscript submission guidelines for the Revista Brasileira de Atividade Física e Saúde?
  Yes
- In terms of formal aspects, is the manuscript well-structured, containing the sections: introduction, methods, results, and discussion (conclusion as part of the discussion)?
  Partially
- Is the language appropriate, clear, precise, and objective?
  Yes
- Was any indication of plagiarism observed in the manuscript?
  No

- **Suggestions/comments:**
  The conclusion is presented as a separate section, after the discussion.

Summary/abstract

- Is the summary and abstract adequate (containing: objective, information about the study participants, studied variables, main results, and a conclusion) and does it reflect the content of the manuscript?
  Yes
- **Suggestions/comments:**
  The summary is well-structured and complete.

Introduction

- Was the research problem clearly stated and delimited?
  Partially
- Is the research problem appropriately contextualized in relation to the existing knowledge, moving from general to specific?
  Yes
- Are the reasons that justify (including the authors' assumptions about the problem) the need for the study well-established in the writing?
  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:**
  Although the objective of the research is clearly identified, in my opinion, it is necessary to strengthen the rationale for why this research needs to be conducted. It is explicitly stated that "there is a lack of evidence on the effects of the COVID-19 pandemic on the health-related behaviors of the university community in Brazil," however, it is not explained why it is necessary to complement the existing information with the data to be investigated in this study.

Methods

- Are the methodological procedures generally appropriate for studying the research problem?
  Yes
- Are the methodological procedures for conducting the study sufficiently detailed?
  Yes
- Was the procedure for selecting or recruiting participants appropriate for the problem studied and clearly, objectively described?
  Yes
- Were information about the instruments used for data collection, their psychometric qualities (e.g., reproducibility, internal consistency, and validity), and, when applicable, the operational definition of the variables presented?
  Partially
- Is the data analysis plan adequate and adequately described?
  Yes
- Were the inclusion and/or exclusion criteria for the study sample described and appropriate for the study?
  Yes
- Did the authors provide clarifications about the ethical procedures adopted for conducting the research?
  Yes
- **Suggestions/comments:**
  It is recommended to mention the characteristics that were modified when adapting the IPAQ questionnaire, as well as indicate the number of people who participated in the piloting of the questionnaire and the necessary adjustments made before the global application of the instrument.

Results

- Is the use of tables and figures appropriate and does it facilitate the adequate presentation of the study results?
  Partially
- Is the number of illustrations in the article in accordance with the guidelines for manuscript submission to the journal?
  Yes
- Are the number of participants in each stage of the study, as well as the number and reasons for dropouts and refusals, presented in the manuscript?
  Yes
- Are the characteristics of the participants presented and are they sufficient?
  Yes
- Are the results presented appropriately, highlighting the main findings and avoiding unnecessary repetitions?
  Partially

- **Suggestions/comments:**
  Tables 1 and 3 are extremely extensive. If they are to be added as supplementary material and not in the final form of the article, I would recommend not referencing them in the text, as it would imply the need to review the supplementary material in a "mandatory" manner. However, I recommend mentioning the data in the text (as currently done), indicating that "the full information can be reviewed in the supplementary material." Considering this, the current table 2 would be the only one used in the article and, therefore, should be renamed as "Table 1" (and the only one) throughout the document.

Discussion

- Are the main findings of the study presented?
  Yes
- Are the limitations and strengths of the study discussed?
  Yes

  Are the results discussed in light of the study's limitations and the existing knowledge on the subject?
  Yes
- Are the potential contributions of the main findings to scientific development, innovation, or real-world intervention discussed by the authors?
  Yes
- **Suggestions/comments:**
  The discussion is adequate and complete.

Conclusion

- Was the conclusion presented appropriately and is it consistent with the study's objective?
  Yes
- Is the conclusion of the study original?
  Yes
- **Suggestions/comments:**
  The conclusion is appropriate, precise, and concise.

References

- Are the references up to date and sufficient?
  Partially
- Is most of the reference list composed of original articles?
  Yes
- Do the references meet the journal's guidelines [quantity and format]?
  Yes
- Are citations in the text appropriate, meaning the statements in the text are supported by actual references?
  Yes
- **Suggestions/comments:**
  There is only 1 reference from after 2021. I recommend updating the references and including more articles from 2023 and 2024.

Comments to the author

- The writing of the article is very good, it just needs minor corrections. Congratulations.

Final decision

- Minor revisions required.