PHYSICAL ACTIVITY AND SYMPTOMS OF ANXIETY AND DEPRESSION AMONG MEDICAL STUDENTS DURING A PANDEMIC

ATIVIDADE FÍSICA E SINTOMAS DE ANSIEDADE E DEPRESSÃO ENTRE ESTUDANTES DE MEDICINA DURANTE A PANDEMIA

ACTIVIDAD FÍSICA, SÍNTOMAS DE ANSIEDAD Y DEPRESIÓN EN ESTUDIANTES DE MEDICINA DURANTE LA PANDEMIA

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ABSTRACT

Introduction: Decreased physical activity has been associated with poorer mental health and is a cause for concern during the COVID-19 pandemic. Objective: To compare groups of medical students (MS) who practiced different levels of moderate and vigorous physical activity (MVPA) during the COVID-19 pandemic, in relation to symptoms of anxiety and depression (BAI-BDI), sleep quality (PSQI), and physical activity (PA) - light, moderate, vigorous (LPA-MPA and VPA), and sedentary behavior (SB). Methods: This research is a cross-sectional study involving 218 MS. Data on the characteristics of the MS were collected through online forms: PA, SB, BAI, BDI, and PSQI. The Cohen's D (Effect Size - ES) and confidence interval (95% CI), Mann-Whitney test: Lower MVPA (Median=0 minute) and Higher MVPA (Median=390 minutes) were recorded. For the statistical analyses, we used: the Odds ratio (OR) for the presence of symptoms of high levels of anxiety and depression and poor sleep quality in the MS and MVPA. Results: We found a small ES for symptoms of depression (ES 0.26 95% CI 0.00 0.53 p=0.029), and significant differences (p<0.05) for symptoms of anxiety (ES 0.17 95% CI -0.09 0.44 p=0.037). There was also a significant tendency for sedentary behavior on weekdays (ES 0.27 95% CI 0.00 0.53 p = 0.051). The OR for MVPA and the presence of symptoms of high levels of anxiety was 0.407 (95% CI = 0.228 to 0.724). Conclusions: the MS who practiced higher MVPA presented less symptoms of anxiety and depression during the COVID-19 pandemic. ***Level of evidence III; Case-control study.***

Keywords: Sedentary behavior; University; Exercise; COVID-19; Coronavirus.

RESUMO

*Introdução: A diminuição da atividade física tem sido associada à piora da saúde mental e é motivo de preocupação durante a pandemia de COVID-19. Objetivo: Comparar grupos de estudantes de medicina (EM) que praticam diferentes níveis de atividade física moderada e vigorosa (AFMV) durante a pandemia de COVID-19, com relação aos sintomas de ansiedade e depressão (BAI-BDI), qualidade do sono (PSQI), e atividade física (AF) - leve, moderada, vigorosa (AFL, AFM, AFV) e comportamento sedentário (CS). Métodos: Esta pesquisa com desenho transversal avaliou 218 EM. Os dados das características dos EM foram coletados por meio de formulários on-line: AF, CS, BAI, BDI e PSQI. Para as análises estatísticas, utilizou-se odds ratio (OR) para a presença de sintomas elevados de ansiedade e depressão e má qualidade do sono de EM e AFMV. O D de Cohen (tamanho do efeito, TE) e o intervalo de confiança (IC de 95%), teste de Mann-Whitney: baixa MVPA (mediana = 0 minuto) e alta MVPA (Mediana = 390 minutos) foram registrados. Resultados: Encontramos um pequeno TE para sintomas de depressão (TE 0,26; IC de 95%; 0,00-0,53; p = 0,029) e diferenças significativas (p < 0,05) para sintomas de ansiedade (TE 0,17; IC de 95%; 0,09-0,44; p = 0,037). Também houve tendência de significância para o comportamento sedentário nos dias de semana (TE 0,27; IC de 95%; 0,00-0,53; p = 0,051). A OR para MVPA e a presença de sintomas de ansiedade elevada foi de 0,407 (IC de 95% = 0,228-0,724). Conclusões: Os EM que praticavam maior MVPA apresentaram menos sintomas de ansiedade e depressão durante a pandemia de COVID-19. **Nível de evidência III; Estudo de caso-controle.***

Descritores: Comportamento sedentário; Universidades; Exercício físico; COVID-19; Coronavírus.

RESUMEN

Introducción: La disminución de la actividad física se ha asociado con un empeoramiento de la salud mental y es motivo de preocupación durante la pandemia de COVID-19. Objetivo: Comparar grupos de estudiantes de medicina (EM) con diferentes momentos de actividad física moderada y vigorosa (AFMV) durante la pandemia COVID-19, en relación a los síntomas de ansiedad y depresión (BAI-BDI), calidad de sueño (PSQI) y actividad física (AF) - comportamiento leve, moderado, vigoroso (LPA-MPA y VPA) y sedentario (SB). Métodos: Esta encuesta transversal evaluó 218 EM. Los datos se recogieron mediante formularios online sobre las características del grupo PA, SB, BAI, BDI y PSQI. D de Cohen (ES) y el intervalo de confianza (IC del 95%), prueba de Mann-Whitney: AFMV baja (mediana = 0 minutos) y

AFMV (mediana = 390 minutos); En el análisis estadístico se utilizó la razón de probabilidades (OR) para la presencia de síntomas de ansiedad alta y síntomas depresivos, la mala calidad del sueño de la EM y la MVPA. *Resultados:* Una pequeña EE para síntomas de depresión (ES 0.26 IC 95% 0.00 0.53 p = 0.029) y diferencias significativas (p <0.05) para síntomas de ansiedad (ES 0.17 IC 95% -0, 09 0.44 p = 0.037).Se verificó tendencia de significancia para el día de la semana SB (ES 0.27 IC 95% 0.00 0.53 p = 0.051). Se verificó la OR para AFMV y la presencia de síntomas de alta ansiedad de 0,407 (IC del 95% = 0,228 a 0,724). *Conclusiones:* La EM con un AFMV más alto tiene menos síntomas de ansiedad y síntomas de depresión durante la pandemia de COVID-19. **Nivel de evidencia III; Estudio de casos y controles.**

Descriptores: Conducta sedentaria; Universidades; Ejercicio físico; COVID-19; Coronavirus..

INTRODUCTION

In December 2019, the coronavirus disease (COVID-19) emerged in Wuhan city and rapidly spread throughout China[1,] and in January 2021, more than 90 million cases of the disease and 2 million deaths were registered worldwide. Until the creation and distribution of vaccines, non-pharmacological interventions are recommended by the World Health Organization (WHO) to decrease contamination, with actions such as: Physical distancing (e.g., spacing); Banning large public events (e.g., sports, arts and entertainment, and religion); Quarantine and isolation at home when the environment is safe; Safe workplaces, public transport and international travel (e.g., home-offices, public transports, bans, and quarantine, respectively).[2]

Worldwide data show that in March 2020, the recommendations of the WHO impacted approximately 1.5 billion students around the world (84% of those matriculated) through closed schools,[3] which resulted in the educational system being maintained by activities in the students' homes through online platforms during this period. In Brazil, this scenario occurred from March to December 2020, with no current prediction for a complete return.[3]

One important consequence of social isolation because of the COVID-19 pandemic is the decrease in physical activity by the general population.[4,5] Decreased physical activity has been associated with worsening mental health and is a cause for concern during the pandemic.[6,7] In fact, the relation between physical activity and mental health has already been described,[8-10] with convergent evidence indicating the use of physical activity in the primary prevention of different mental conditions, such as anxiety and depression.[8,11,12]

Understanding the relationship between physical activity and the mental health of medical students (MS) during the COVID-19 pandemic is essential, mainly because before the pandemic, this group already presented changes in physical activity[13,14] and mental health as high anxiety and depression symptoms and poor sleep quality.[15-18] In fact, two crucial meta-analyses showed that established depression or at least depression symptoms affect 27.2% of MS worldwide[18] and 51.5% of MS demonstrate poor sleep quality.[17]

Thus, the COVID-19 pandemic obliged Brazilian MS to perform their activities through online platforms for more than six months, decreasing physical activity. As a result, this population has a worse quality of mental health, which can be aggravated by less physical activity. Thus, we proposed to perform a cross-sectional study, identifying and comparing groups of MS with different times of moderate and vigorous physical activity (MVPA), about the anxiety and depression symptoms, sleep quality, and domains of physical activity – light physical activity (LPA), moderate physical activity (MPA), vigorous physical activity (VPA), and sedentary behavior (SB). We hypothesized that a worsening level of MVPA during the COVID-19 pandemic is related to higher scores on the scales of anxiety symptoms and depression symptoms, in addition to poor sleep quality in MS.

MATERIAL AND METHODS

Study area and population

Ethics and Research Committee approved this cross-sectional study (authorization number: 4.049.214) and followed the precepts of the Declaration of Helsinki.[19] All MS agreed and signed the consent form. We developed the study between September 21st and November 5th, 2020. During this period, 28,572 deaths from COVID-19 were recorded in Brazil and approximately 25,000 daily cases.[20] Specifically, the Sao Paulo state, the epicenter of the pandemic in Brazil, up to January 15th, 2020, registered more than 1.6 million cases, 49,000 deaths due to COVID-19 complications (approximately 1/4 of that registered in Brazil in the period) what results in values committed for health in pandemic around R$5.26 billion only in São Paulo state.[20]

All MS from the 1st to the 12th semester, regularly matriculated at the Santo Amaro University, of both sexes, ≥ 18 years old, were invited to participate in the study. Contact was made via WhatsApp to present the proposal to evaluate the outcomes of interest (level of physical activity, SB, anxiety symptoms, depression symptoms, and quality of sleep). If the MS agreed to participate in the research, wed sent a link to the questionnaire (Google forms) containing the consent form and the questionnaires for the respective outcomes.

Characteristics sample and self-perception during the COVID-19 pandemic

We also included data regarding the characteristics of the sample on a questionnaire. We collected the following information: age, sex, semester of the course, the city lived before matriculating at medical school, the practice of physical exercise program, COVID-19 diagnosis, use of smoke and alcohol) and questions on the subject's self-perception regarding the worsening of their level of physical activity and SB, anxiety symptoms, depression symptoms, and quality of sleep during the COVID-19 pandemic. The sample size was determined using the *Epitools epidemiological calculator*[21] available at (https://epitools.ausvet.com. au/) and used data from previous studies on depression symptoms[18] considering the accuracy of 0.05, power of 0.9, and a population of MS at the university evaluated of 1,000 MS, which indicated the necessity to evaluate at least 210MS.

Physical activity and sedentary behavior assessment

We evaluated the level of physical activity by the *International physical activity questionnaire* (IPAQ),[22] a tool widely used and validated for the Brazilian population.[23] The questionnaire contains eight questions considering the routine of the previous seven days regarding physical activity and SB. We did a dichotomous division of the sample into two groups: Lower MVPA and Higher MVPA. The groups' Median and Interquartile (25 - 75) was: Lower MVPA = 0.0 (0.0 - 60.0) and Higher MVPA = 390 (265.0 - 540.0). We presented more details in the Results section.

Mood assessment

We evaluated the mood through the validated instruments: *Beck anxiety inventory* (BAI)[24] and *Beck depressive inventory* (BDI).[25] Both questionnaires are composed of 21 multiple choice statements, each with four possible responses (0-3), and the final score ranges from 0 to 63 points.

The BAI is a widely used tool (26), validated for the Brazilian population.[27] The cut-off point adopted to identify low and high anxiety symptoms followed that shown in a previous study:[28] <13 points (low anxiety symptoms) and ≥ 13 points (high anxiety symptoms).

The BDI is also a commonly used tool, validated for the Brazilian population.[29] The cut-off point adopted to identify low and high depression symptoms followed that shown in previous studies:[30,31] <10 points (low depression symptoms) and ≥ 10 points (high depression symptoms).

Sleep assessment

The *Pittsburgh Sleep Quality Index* (PSQI) was used to analyze sleep quality.[32] This tool is commonly used and was validated for the Brazilian population.[33] The Pittsburgh scale contains questions regarding the sleep habits of the subject during the previous month (time to go to sleep, time to fall asleep, time to wake up, real hours of sleep, in addition to the frequency (1, 2, or 3 times a week) of difficulty going to sleep in 30 minutes, waking up at night/dawn, getting up at night to go to the bathroom, difficulty breathing, coughing, snoring, cold, heat, bad dreams, other reasons). The final score ranges from 0 to 21 points. The most commonly reported cut-off point for MS in a recent meta-analysis was adopted:[34] < 6 points (good sleep quality) and ≥ 6 points (poor sleep quality).

Statistical analysis

We performed descriptive analysis, and we presented the characteristics of the participants in percentile and absolute values. The data were analyzed using IBM SPSS Statistics, version 22 (SPSS Inc., Chicago, IL, USA). First, we tested the data for normality using the Shapiro-Wilk test and the Levene test's equality of variances. For nonparametric data, we described variables as the median and interquartile range (25 – 75). Next, we performed to assess the differences between the groups the analyses using the nonparametric Mann-Whitney test. Next, we calculated the odds ratio (OR) for the presence of elevated anxiety symptoms, elevated depressive symptoms, and poor sleep quality of medical students who perform MVPA and the risk ratio prevalence for high anxiety symptoms, high depressive symptoms, and poor sleep quality of medical students who do not perform MVPA, with data presented as OR and 95% confidence intervals (95%CI). We used the Cohen's D Effect Size (ES) - 0 to <0.30 | small, |> 0.30 | to | <0.8 | medium, and |> 0.80 | large (Cohen, 2013) - and confidence interval (95%CI) for determining the magnitude of difference and the precision of the estimate of the magnitude. Finally, we used the Spearman test to verify the correlations between anxiety symptoms, depression symptoms, sleep quality, SB on days of the week, SB on weekend days, LPA, MPA, and VPA. We considered a value of $p \leq 0.05$ as the limit of statistical significance.

RESULTS

The 12 semesters, totaling approximately 20 classes and 1,000 students, were contacted via WhatsApp message, in the respective class groups, by the class representatives. Thus, we included 218 MS (21,8%) who answered the questionnaire. Table 1 presents the results regarding the characteristics of the sample.

The sample was predominantly composed of young people between 18 and 25 years (85.8%), female (77.5%), matriculated from the 1st to the 4th semester - basic cycle (53.6%), and the majority (72.0%) already lived in the city of São Paulo before enrolling on the medical course. A high percentage of MS did not realize ≥300 minutes MVPA (68.3%) and

Table 1. Characteristics of the participants.

Variable		% of MS	Total MS
Age			
18 to 25 years		85.8	187
26 to 30 years		9.6	21
31 to 35 years		1.8	4
36 to 41 years		2.8	6
Sex			
Female		77.5	169
Male		22.5	49
Semester you are studying			
1	Basic cycle (53.6%)	11.7	26
2		6.0	13
3		26.6	58
4		8.3	18
5	Clinical cycle (41.4%)	8.3	18
6		16.1	35
7		6.4	14
8		10.6	23
9	Boarding school (6.0%)	3.7	8
10		1.8	4
11		0.5	1
Did you live in this city before matriculating at medical school?			
Yes		72.0	157
No		28.0	61
Minutes of MVPA accumulated weekly?			
0 to 299 minutes		68.3	149
≥ 300 minutes		31.7	69
SB ≥ than 8 hours			
Yes		82.1	179
No		17.9	39
Have you performed systematic physical exercises in the last six months? (This includes weight training, swimming, dancing, or any other type of activities, performed as part of your routine)			
Yes		66.5	145
No		33.5	73
Anxiety symptoms			
0 to 12 points (low anxiety symptoms *)		49.5	108
>12 points (high anxiety symptoms *)		50.5	110
Depression symptoms			
0 to 10 points (low depression symptoms **)		49.5	108
>10 points (elevated depression symptoms **)		50.5	110
Sleep quality			
Good sleep quality		34.9	76
Poor sleep quality		65.1	142
Have you had a COVID-19 diagnosis?			
Yes		9.2	20
No		90.8	198
Do you consider that the COVID-19 pandemic changed your level of physical activity and SB?			
Yes		83.5	182
No		16.5	36
Do you consider that the COVID-19 pandemic changed your level of anxiety symptoms?			
Yes		82.2	179
No		17.8	39
Do you consider that the COVID-19 pandemic changed your level of depression symptoms?			
Yes		54.6	119
No		45.4	99
Do you use cigarettes?			
Yes		16.1	35
No		83.9	183
Do you use alcohol?			
Yes		66.1	144
No		33.9	74

SB = sedentary behavior; MVPA = moderate and vigorous physical activity; *Based on a cut-off of SÆMUNDSSON et al. (2011). **Based on cut-off of Gomes et al., (2012).

did more than 8 hours a day of sedentary behavior (82.1%). In addition, 9.2% of MS reported COVID-19 diagnosis.

Table 2 presents the odds ratios for the presence of elevated anxiety symptoms, elevated depressive symptoms, and poor sleep quality of medical students who perform MVPA and the risk ratio prevalence for high anxiety symptoms, high depressive symptoms, and poor sleep quality of medical students who do not perform MVPA.

The odds ratio to MVPA and elevated anxiety symptoms was 0.407 (95%CI = 0.228 to 0.724).

Figure 1 shows the comparisons between the two groups, dichotomized into lower MVPA group and higher MVPA group for BAI, BDI, and PSQI.

The comparisons between Lower MVPA and Higher MVPA indicate statistically significant differences for anxiety symptoms, small ES and statistically significant differences for depression symptoms, and no differences for sleep quality.

Table 2. Odds ratios for the presence of elevated anxiety symptoms, elevated depressive symptoms, and poor sleep quality of medical students who perform MVPA and risk ratio prevalence for high anxiety symptoms, high depressive symptoms, and poor sleep quality of medical students who do not perform MVPA.

Odds ratio				Risk ratio prevalence	
Variables	Value	95% confidence interval		Variables	%
		Lower	Upper		
Perform MVPA and presence of elevated anxiety symptoms	0.407*	0.228	0.724	Not perform MVPA and presence of elevated anxiety symptoms	64%
Perform MVPA and presence of elevated depression symptoms	0.673	0.384	1.182	Not perform MVPA and presence of high depressive symptoms	56%
Perform MVPA and presence of poor sleep quality	0.652	0.365	1.163	Not perform MVPA and presence of poor sleep quality	59%

MVPA = moderate and vigorous physical activity; * = confidence interval without crossing 1.0 (difference with statistical significance).

Table 3 presents the comparisons between the two groups, dichotomized into lower MVPA group and higher MVPA group for IPAQ outcomes.

We verified for moderate to large ES and statistically significant differences for the variable's physical activity: light PA, moderate PA, and vigorous PA. In addition, we verified a moderate ES and tendency of statistically significant differences for weekday SB and a large ES and statistically significant differences for the variable MVPA. We did not verify differences for sleep quality, SB on weekend days and SB on days of the week.

Table 4 shows the correlation between different physical activity levels, SB on days of the week, and SB weekend days for anxiety symptoms, depression symptoms, and sleep quality.

We verified correlation with statistically significant differences between Anxiety Symptoms and VPA or MVPA; Depression Symptoms and MPA or VPA or MVPA. SB weekend days (hours per day) and VPA or MVPA.

Table 5 presents an exploratory analysis with comparisons between dichotomized groups considering: Sex (female and male), Alcohol use (Yes or No), COVID-19 diagnosis (Yes or No), Changes in the level of PA or SB due to the COVID-19 pandemic (Yes or No), Anxiety symptoms >12 points (Yes or No), Depression symptoms >10 points (Yes or No), Performing systematic physical exercises in the last six months (Yes or No into lower MVPA group and score of MVPA, Sleep quality, Anxiety symptoms, and Depression symptoms.

Table 4. Correlation between physical activity levels, and SB on all days of the week, SB weekday anxiety symptoms, depression symptoms, sleep quality.

	LPA	MPA	VPA	MVPA
Anxiety Symptoms	-0.002	-0.075	-0.251*	-0.167**
Depression Symptoms	-0.096	-0.153**	-0.193**	-0.161**
Sleep quality	-0.016	-0.094	-0.088	-0.081
SB days of week (hours per day)	-0.039	-0.067	-0.090	-0.124
SB weekend days (hours per day)	-0.014	-0.099	-0.146**	-0.169**

LPA = light physical activity; MPA = moderate physical activity; VPA = vigorous physical activity; MVPA = moderate and vigorous physical activity; * = < 0.0001; ** = p<0.05; SB = sedentary behavior.
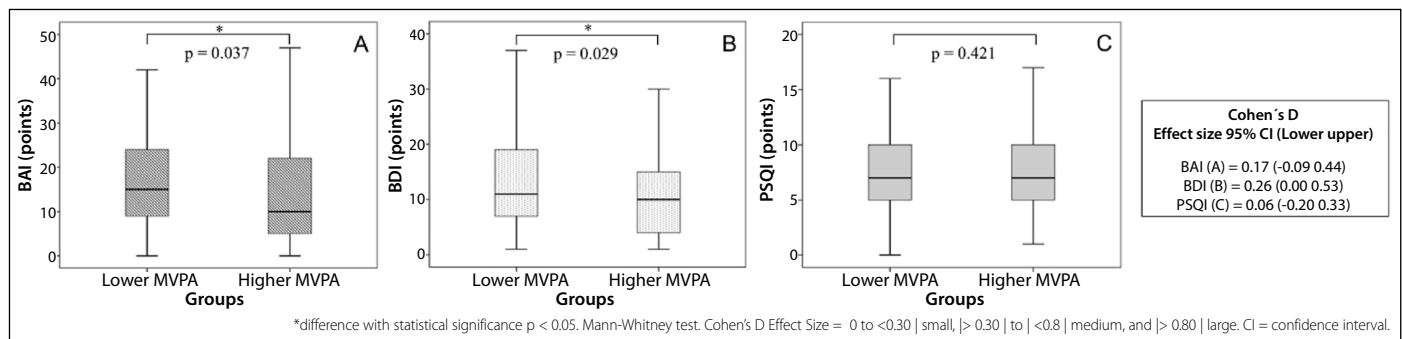

*difference with statistical significance p < 0.05. Mann-Whitney test. Cohen's D Effect Size = 0 to <0.30 | small, |> 0.30 | to | <0.8 | medium, and |> 0.80 | large. CI = confidence interval.

Figure 1. Box plots of comparisons between the two groups, dichotomized into lower moderate and vigorous physical activity (MVPA) group and higher MVPA group for: A) Beck anxiety inventory (BAI); B) Beck depression inventory (BDI); and C) Pittsburgh Sleep Quality Index (PSQI).

Table 3. Comparisons between the two groups, dichotomized into Lower MVPA and Higher MVPA for IPAQ outcomes.

Variable	Lower MVPA (n = 109)		Higher MVPA (n = 109)		Cohen's D - Effect Size for T-Test 95% CI (Lower Upper)	Mann-Whitney Test
	Median Interquartile (25 – 75)	Minimum maximum	Median Interquartile (25 – 75)	Minimum maximum		
IPAQ – LPA (minutes per week)	40.0 (0.0 – 120.0)	0.0 - 540.0	120.0 (5.0 – 270.0)	0.0 - 900.0	-0.52 (-0.79 -0.25)	p<0.001
IPAQ – MPA (minutes per week)	0.0 (0.0 – 60.0)	0.0 - 300.0	200.0 (120.0 – 360.0)	0.0– 1200.0	-1.54 (-1.81 -1.27)	p<0.001
IPAQ – VPA (minutes per week)	0.0 (0.0 – 0.0)	0.0 - 240.0	180 (40.0 – 270.0)	0.0 – 1080.0	-1.38 (-1.64 -1.11)	p<0.001
IPAQ – MVPA (minutes per week)	0.0 (0.0 – 60.0)	0.0 - 160.0	390 (265.0 – 540.0)	170.0 – 1470.0	-2.15 (-2.42 -1.88)	p<0.001
IPAQ – SB weekday (hours per day)	10.0 (8.5 – 14.0)	2.0– 18.0	10.0 (8.0 – 12.0)	3 - 16.0	0.27 (0.00 0.53)	p = 0.051
IPAQ – SB weekend days (hours per day)	9.0 (6.0 – 12.0)	3.0– 16.0	8.0 (6.0 – 10.5)	2 - 16.0	0.10 (-0.17 0.37)	n.s. p = 0.473
IPAQ – SB on days of week (hours per day)	10.0 (8.1 – 12.6)	4.3– 17.4	9.6 (7.6 – 11.8)	3.4 - 16.0	0.24 (-0.03 0.51)	n.s. p = 0.095

MVPA = moderate and vigorous physical activity; n = number of MS; 95% CI (95% Confidence interval); IPAQ- International physical activity questionnaire; LPA = Light Physical activity; MPA = Moderate physical activity – VPA = vigorous physical activity; MVPA = Moderate and vigorous physical activity; PA = Physical activity; SB = Sedentary behavior.

Table 5. Exploratory analysis with comparisons between two groups, considering MVPA, Sleep quality, PSQI, Anxiety symptoms, and Depression symptoms and Sex (female and male), Alcohol use (Yes or No), COVID-19 diagnosis (Yes or No), Changes in the level of PA or SB due to the COVID-19 pandemic (Yes or No), Anxiety symptoms >12 points (Yes or No), Depression symptoms >10 points (Yes or No), Performing systematic physical exercises in the last six months (Yes or No).*Based on cut-off of SÆMUNDSSON et. al., (2011). **Based on a cut-off of Gomes et al. (2012).

Variable	Groups	Median Interquartile (25 – 75)	Mann-Whitney Test	Median Interquartile (25 – 75)	Mann-Whitney Test
		MVPA - IPAQ		**Sleep quality - PSQI**	
Sex	Female (n=169)	160.0 (0.0 - 375.0)	p = 0.082	7.0 (5.0 - 10.0)	p = 0.854
	Male (n=49)	200.0 (0.0 - 435.0)		6.0 (4.0 - 9.0)	
Have you had a COVID-19 diagnosis?	Yes (n=20)	250.0 (0.0 - 472.5)	p = 0.281	8.0 (5.0 - 11.5)	p = 0.594
	No (n=198)	160.0 (0.0 - 360.0)		7.0 (5.0 - 10.0)	
COVID-19 pandemic changed your level of PA or SB?	Yes (n=182)	120.0 (0.0 - 360.0)	p = 0.121	7.0 (5.0 - 9.0)	p = 0.004
	No (n=36)	300 (135.0 - 525.0)		7.0 (5.0 - 13.0)	
Anxiety symptoms >12 points	Yes (n=110)	90.0 (0.0 - 285.0)	p = 0.005	8.0 (6.0 - 12.0)	p = 0.038
	No (n=108)	240.0 (60.0 - 450.0)		5.0 (4.0 - 8.0)	
Depression symptoms >10 points	Yes (n=110)	120.0 (0.0 - 332.5)	p < 0.0001	9.0 (6.0 - 12.0)	P= 0.003
	No (n=108)	205.0 (32.5 - 442.5)		5.0 (4.0 - 7.5)	
Perform physical exercises in the last 6 months	Yes (n=145)	300.0 (120.0 - 495.0)	p= 0.569	7.0 (4.8 - 10.0)	p< 0.0001
	No (n=73)	0.0 (0.0 - 60.0)		7.0 (5.0 - 9.0)	
		Anxiety symptoms - BAI		**Depression symptoms - BDI**	
Sex	Female (n=169)	14.00 (7.00 - 25.00)	p < 0.0001	11.0 (6.0 - 18.0)	p = 0.101
	Male (n=49)	9.00 (2.00 - 17.00)		9.0 (3.0 - 18.0)	
Have you had a COVID-19 diagnosis?	Yes (n=20)	12.50 (8.50 - 29.50)	p = 0.312	13.5 (6.0 - 23.8)	p = 0.113
	No (n=198)	13.00 (5.00 - 24.00)		10.0 (5.0 - 17.0)	
COVID-19 pandemic changed your level of PA or SB?	Yes (n=182)	12.50 (5.00 - 23.25)	p = 0.288	11.0 (6.0 - 16.3)	p = 0.997
	No (n=36)	15.50 (5.25 - 27.50)		8.5 (4.0 - 24.8)	
Anxiety symptoms >10 points*	Yes (n=110)	--	--	15.0 (10.0 - 23.0)	p < 0.0001
	No (n=108)	--		6.0 (3.0 - 11.0)	
Depression symptoms >10 points**	Yes (n=110)	21.00 (11.75 - 30.00)	p < 0.0001	--	--
	No (n=108)	6.00 (3.00 - 14.00)		--	
Perform physical exercises in the last 6 months	Yes (n=145)	10.00 (5.00 - 21.50)	p< 0.0001	10.0 (4.0 - 15.5)	p = 0.011
	No (n=73)	16.00 (9.00 - 26.00)		11.0 (7.0 - 22.0)	

DISCUSSION

The objective of this study was to compare groups of MS during the COVID-19 pandemic with different times of MVPA about domains of anxiety and depression symptoms, sleep quality, and physical activity - light, moderate, vigorous, and sedentary behavior. To our knowledge, this is the first study with a Brazilian sample, and MS with higher MVPA present lower anxiety symptoms and depression symptoms during the COVID-19 pandemic.

Higher time of MVPA was related to decreased anxiety symptoms and depression symptoms in clinical populations[10,11] and in MS[17] which supports our findings. Interestingly, in MS, the main barriers to physical activity are studying and working in extra periods,[13] which could have worsened in the pandemic period, mainly because during the COVID-19 pandemic, the online activities for MS represent a challenge related to time management.[35] Information on the MS participants before the pandemic to compare changes in MVPA or anxiety symptoms and depression symptoms would allow better analysis. However, data of Italian MS showed decreased MVPA during the COVID-19 pandemic compared to a period outside the pandemic (approximately 50%) and an increase in SB (approximately 20%)[36] which also supports our findings.

We verified moderate and large ES and statistically significant differences in physical activity (LPA, MPA, VPA). Although we expected the differences for MPA and VPA as the group was dichotomized by the MVPA variable (MVPA = MPA + VPA), the difference for LPA is an important finding. Higher LPA may reflect lower SB, which is a behavior targeted for change and represents a big challenge for the area of sports medicine. Although we did not observe an ES and statistically significant difference for all SB measurements, small ES and a tendency to statistically significant difference were observed for SB on weekdays. SB has been associated with worse mental health in different clinical groups,[10] and

specifically during the COVID-19 pandemic, studies have already verified this relationship in other samples of the population,[5] as well as greater SB in medical students, as already highlighted.[36]

It is essential to highlight that in our results, 68.3% did not perform 300 minutes of MVPA per week, and 82.1% remained in SB for more than 8 hours a day, even though 66.5% of MS reported that they had performed systematic physical exercise practices in the previous six months. This situation could have been influenced by the location for performance of systematic physical exercise (e.g., gym), which also closed, inhibiting the practice of physical exercise in this period. The data above indicate that the COVID-19 pandemic worsened the situation of low MVPA activity for 68.3% of MS since the observed values are higher than those verified in previous studies with MS in Thailand of 49.5%[13] and the United States of 22.0%.[14]

Finally, we highlight three points that together show the worst situation for MS during the COVID-19 pandemic. First, regarding anxiety symptoms, depression symptoms, and quality of sleep, more than half the sample (50.5%, 50.5%, and 66.2%, respectively) presented values classified as high anxiety and depression symptoms and poor sleep quality. These values are higher than other studies performed in periods outside the pandemic.[18] Second, the majority of MS considered that the pandemic had altered their level of physical activity and SB (83.5%), anxiety symptoms (82.2%), and depression symptoms (54.6%). Third, approximately 10% of the sample had been diagnosed with COVID-19.

Our study has limitations. The cross-sectional design and the absence of outcomes of MS in periods outside the COVID-19 pandemic (repeated measures) are limitations. In addition, comparing MS with other groups of students from other health courses is essential for understanding whether other students (e.g., Physiotherapy or Physical Education) demonstrate a similar impact of the COVID-19 pandemic on

MVPA, anxiety symptoms, and depression symptoms. The lack of a sample of MS from a different University is also a limitation. Physical activity and sleep quality assessments carried out by questionnaires are a limitation, mainly due to the subjectivity of the measure. Including MS who were diagnosed with COVID-19 can also be considered a limitation, despite the percentage being 10% of the sample.

CONCLUSION

We concluded that MS who perform more minutes MVPA a week (Median=390 minutes) present a lower presence of anxiety symptoms and depression symptoms than MS who perform lower minutes MVPA a week (Median=0 minute).

All authors declare no potential conflict of interest related to this article

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