Quality of life and depression symptoms: influences of COVID-19 and physical activity

Qualidade de vida e sintomas de depressão: influências da COVID-19 e atividade física

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ABSTRACT
Objective: To investigate the influence of COVID-19 diagnosis and physical activity on the Quality of Life and depressive symptoms in university students. Methodology: The sample comprised 238 undergraduates (22.4 ± 4.1 years, 170.3 ± 9.4 cm, and 67.4 ± 15.04 kg). QL was assessed using the WHOQOL-Bref, while depressive symptoms were evaluated with the Beck Depression Inventory (BDI). Participants responded to inquiries regarding whether they had been diagnosed with COVID-19 and their regular engagement in physical exercise. Results: Engaging in physical activity significantly contributed to notable increases in QL in the psychological (4.28%), environmental (8.01%), and physical (3.13%) domains, as well as a reduction in depressive symptoms (2.22%). Conclusion: individuals who had experienced and recovered from COVID reported a higher appreciation for their perceived physical and social well-being. Regular physical exercise played a significant role in enhancing overall quality of life and reducing depressive symptoms.

Keywords: Physical Activity. Depression. Quality of Fife. University Students.

RESUMO
Objetivo: Verificar a influência do diagnóstico de Covid-19 e da prática de atividade física na qualidade de vida e nos sintomas depressivos de estudantes universitários. Metodologia: A amostra foi de 238 graduandos (22,4 ± 4,1 anos, 170,3 ± 9,4 cm e 67,4 ± 15,04 Kg). Para avaliar a QV, utilizou-se o WHOQOL-Bref, enquanto os sintomas de depressão foram avaliados pelo Inventário de Depressão de Beck (BDI). Os participantes responderam a um questionamento se já haviam ou não sido diagnosticados com a COVID-19 e se praticavam exercícios físicos regularmente. Resultados: A prática de atividade física influenciou em aumentos significativos na QV nos domínios psicológico (4,28%), ambiental (8,01%), físico (3,13%) e redução dos sintomas depressivos (2,22%). Conclusão: Ter sido acometido e ter se recuperado da covid, incitou uma supervalorização na autopercepção de aspectos físicos e sociais e que a prática de exercício físico influenciou positivamente a QV e a redução dos sintomas depressivos.

Palavras-chave: Atividade Física. Depressão. Qualidade de Vida. Universitários.

INTRODUCTION

The pandemic caused by the SARS-CoV-2 virus, responsible for COVID19, a highly contagious disease, spread rapidly around the world and reached enormous proportions[1]. At the beginning of the pandemic, various measures were implemented aiming at its combat and the protection of the population[2]. However, among the preventive and contingency attitudes towards the pandemic, the social isolation imposed by the governments of various countries led to barriers in social relationships and physical distancing, which, in turn, directly affected the perception of people's quality of life[3].

Quality of life is an indicator that can be used to verify the feeling of wellbeing, through physical, social, and psychological aspects[4]. Satisfaction with well-being in this context reflects many aspects of an individual's life, such as work, family, social relationships, leisure moments, among others. The reduction or absence of these factors can reflect negatively on their sense of well-being and consequently on the individual's quality of life[5].

Azevedo et al.[6] conducted a study before the COVID-19 pandemic, examining the correlation between quality of life, mental health aspects like depression symptoms, and the level of physical activity practice among university students. The results showed that the more physically active the individual is, the lower the prevalence of depression symptoms. Furthermore, the level of physical activity positively influenced the perception of students' quality of life. The study by Teixeira et al.[7], in turn, pointed out that the quality of life classified as unsatisfactory in university students may have been affected by the pandemic; and physical activity, on the other hand, contributed to its improvement.

Indeed, with the onset of the pandemic, changes occurred in the routine of university students that negatively influenced their physical and psychological health[8]. The change from a face-to-face study routine to a remote (online) format triggered additional concerns in students about academic performance, difficulties with internet access, and adaptation to the new learning method, the interruption of practical classes and curricular internships, concerns with the development of tasks, and possible delay in the progress and completion of the course[9]. In addition, there was a reduction in social interaction, due to isolation protocols[10]. All these changes may compromise students' mental health since social interaction is related to good quality of life indices[11].

Additionally, worldwide, the prevalence of mental disorders has increased in recent years12. Data from the World Health Organization report that more than 50% of the population has some mental disorder, including depressive symptoms[6,13–15]. Indeed, university students have presented symptoms of depression, especially during the period of the COVID-19 pandemic. The study routine and the overload of activities since many students have a dual burden of obligations, that is, work and study simultaneously have been increasing even more levels of responsibilities and demands[9,14,16]. Thus, Silva et al.[8] identified that 57% of the academics evaluated in their study presented symptoms of depression. In addition, Son et al.[9] reinforce that the indices of depressive symptoms among students became even more evident due to the COVID-19 pandemic.

Although these studies have previously provided information regarding the period of the pandemic and its effects on quality of life and depressive symptoms in a generalized context, a better understanding of the influence of the disease itself on quality of life and depressive symptoms is necessary, as well as the influence of physical activity practice as a strategy for health promotion among university students.

Thus, the present study aimed to verify the influence of the COVID-19 diagnosis and physical activity practice on the quality of life and depressive symptoms of university students.

METHODOLOGY

A cross-sectional, quantitative study was conducted[17]. The study population comprised undergraduates from the University of Brasília (UnB), aged between 18 and 42 years. The sample consisted of 238 students, with 128 females and 110 males, from 44 different courses, who volunteered to participate in the research.

All students enrolled in the Sports Practices in the first semester of 2021 were invited to participate in the research, which corresponded to elective subjects offered by Physical Education faculty members to students from all courses and periods, regardless of the area of study. All students who agreed to participate in the research signed the Informed Consent Form beforehand. The Research Ethics Committee approved the study procedures under opinion number 5.567.405.

The research instruments were adapted to the Google Forms platform and sent along with an anamnesis to verify sample characterization information (gender, body mass, and height), as well as whether they regularly practiced physical activity before the start of the sports practice course, that is, during the pandemic, which corresponded to the period preceding the collections (yes/no). These instruments aimed also to verify whether the students had been diagnosed with COVID-19 (yes/no) from the start of the pandemic until responding to the questionnaire. The questionnaires were available for response over a two-week period.

To assess quality of life, the "World Health Organization Quality of Life Instrument" short version (WHOQOL-BREF) validated for use in Brazil was employed as a tool. This instrument consists of 26 questions that result in scores ranging from 0 to 100, on a Likert scale: the closer to 100, the better the quality of life. The results are given in four quality of life domains: physical domain, psychological domain, social domain, and environmental domain[18].

The Beck Depression Inventory (BDI) was used to assess depression symptoms. It is a tool consisting of 21 items related to symptoms present in depression (behavioral, cognitive, affective, and somatic). The total BDI score can range from 0 to 63, based on the sum of the items, with higher scores indicating more severe depression symptoms[19].

For data analysis, continuous variables were expressed as mean and standard deviation, while categorical variables were summarized in absolute frequencies (count) and relative frequencies (% relative to the total). Considering the normality of the data, the sample was compared, through independent t-tests, regarding the quality of life domains and the depressive symptoms score between (1) students who had been diagnosed with COVID-19 vs. students who had not been diagnosed with COVID-19; (2) students who practiced physical activities vs. students who did not practice physical activities.

To determine the influence of the COVID-19 diagnosis and the practice of physical activities on the quality of life domains and depressive symptoms of students, multiple linear regression analyses were performed, adopting as dependent variables the scores of: quality of life in the physical domain, quality of life in the psychological domain, quality of life in the social domain, quality of life in the environmental domain, and depressive symptoms. As independent variables, the previous diagnosis of COVID-19 (yes/no) and regular physical activity practice (yes/no) were used.

Before executing the regressions, the following assumptions were evaluated: 1) normality of the residuals through graphical analysis (histogram and PP plot of standardized residuals); 2) absence of multicollinearity for each pair of predictors through tolerance parameters and VIF; 3) testing of the independence of residuals (Durbin Watson test); 4) absence of outliers among the residuals; 5) homoscedasticity of the residuals (scatter plot of standardized residuals).

A hierarchical model was adopted for the insertion of independent variables in multiple linear regressions. For those predictor variables that showed statistical significance, the magnitudes of individual contribution in the model were determined by the analysis of B and its confidence interval. The level of significance adopted was alpha = 0.05. All analyses were performed using the SPSS statistical software (IBM, Greenville, SC) version 25.0.

RESULTS

In total, 238 individuals were evaluated, of which 69 (29%) were diagnosed with COVID-19, and the remaining 169 (71%) did not have the diagnosis confirmed. Of these, 113 (47.5%) regularly engaged in physical activities, while the other 125 (52.5%) did not engage in any physical activity. Other characteristics of the participants and quality of life (QoL) scores by domain are described in Table 1.

Tabela 1. Sample Characterization

Variables	Mean	Standard Deviation
Age (years)	22.51	4.08
Body Mass (kg)	67.41	15.09
Height (cm)	170.34	9.36
Physical Domain	48.71	11.90
Psychological Domain	55.83	12.84
Social Domain	62.78	20.11
Environmental Domain	62.96	16.82
Beck Score	10.80	7.43

The results regarding physical activity practice and quality of life domains (physical, psychological, social, and environmental) and depressive symptoms are described in Table 2.

Table 2. Sample Stratified by Physical Activity Practice

Variables	Physical Activity	p-value	Mean	Standard Deviation
Physical Domain	Yes	0.024	50.54	11.545
	No	0.024	47.06	12.035
Psychological Domain	Yes	0.009	58.11	12.584
	No	0.009	53.77	19.357
Social Domain	Yes	0.037	65.63	19.357
	No	0.037	60.20	20.519
Environmental Domain	Yes	0.001	67.23	15.063
	No	0.001	59.10	17.440
Beck Score	Yes	0.015	9.56	7.617
	No	0.015	11.92	7.188

The results regarding the COVID diagnosis and the quality of life domains (physical, psychological, social, and environmental) and depressive symptoms are described in Table 3.

Table 3. Sample Stratified by COVID Diagnosis

Variables	COVID Diagnosis	p-value	Mean	Standard Deviation
Physical Domain	Yes	**0.013**	51.71	11.534
	No	**0.012**	47.49	11.874
Psychological Domain	Yes	0.534	56.64	12.280
	No	0.524	55.50	13.084
Social Domain	Yes	**0.007**	68.24	20.872
	No	**0.010**	60.55	19.427
Environmental Domain	Yes	0.370	64.50	17.783
	No	0.387	62.34	16.424
Beck Score	Yes	**0.092**	9.52	6.657
	No	**0.074**	11.32	7.740

The results of the regressions regarding the COVID-19 diagnosis and depressive symptoms are presented in Table 4. The model that included the COVID diagnosis and physical activity practice was significant for predicting quality of life in the psychological domain (p = 0.031). The isolated COVID diagnosis did not show an association with quality of life in the psychological domain (p = 0.707). However, physical activity practice showed a positive association with quality of life in this domain (p = 0.010), indicating that physical activity practice (compared to not practicing) was associated with a 4.28% increase in quality of life in the psychological domain (p = 0.010).

Similarly, the regression model that included the COVID diagnosis and physical activity practice was also significant for predicting quality of life in the environmental domain (p = 0.001). The isolated COVID diagnosis did not show an association with quality of life in this domain (p = 0.580). In contrast, physical activity practice showed a positive association with quality of life in the environmental domain, with physical activity practice (compared to not practicing) being associated with an 8.01% increase in quality of life in this domain (p < 0.001).

Likewise, the model that included the COVID diagnosis and physical activity practice was significant in the aspect of quality of life in the physical domain (p = 0.021), with both COVID diagnosis and physical activity practice being associated with quality of life in the physical domain (p = 0.041). In this sense, having been affected by COVID (compared to not having been) resulted in a 3.88% increase in quality of life in the physical domain (p = 0.021). Moreover, practicing physical activity (compared to not practicing) resulted in a 3.13% increase in quality of life in this domain (p = 0.041).

In the social domain, the model that included the COVID diagnosis and physical activity practice was also significant for predicting quality of life (p = 0.005). Having had the COVID diagnosis (compared to not having had it) resulted in a 7.17% increase in quality of life in this domain (p = 0.012). Physical activity practice did not show an association with quality of life in the social domain (p = 0.064).

Finally, the model that included the COVID diagnosis and physical activity practice was also significant for predicting depressive symptoms (p = 0.017). The isolated COVID diagnosis did not show an association with depressive symptoms (p = 0.142). However, practicing physical activity showed a negative association with the presence/severity of depressive symptoms, with physical activity practice (compared to not practicing) resulting in a 2.22% reduction in depressive symptoms (p = 0.022).

Table 4. Regression Results

Variables		B Coeffi-cient	t	p-Value	95% CI of B	
					Lower Limite	Upper Limit
Quality of Life Psycho-logical Domain	COVID Sim	0.685	0.376	0.707	-2.908	4.278
	Atividade física Sim	4.284	2.586	**0.010**	1.020	7.549
Quality of Life Environ-mental Domain	COVID Sim	1.302	0.554	0.580	-3.330	5.934
	Atividade física Sim	8.013	3.751	**<0.001**	3.805	12.222
Quality of Life Physical Domain	COVID Sim	3.887	2.315	**0.021**	0.579	7.195
	Atividade física Sim	3.137	2.056	**0.041**	0.131	6.143
Quality of Life Social Domain	COVID Sim	7.171	2.529	**0.012**	1.585	12.756
	Atividade física Sim	4.802	1.864	0.064	-0.273	0.015
Depressive Symptoms	COVID Sim	-1.560	-1.47	0.143	-3.646	0.526
	Atividade física Sim	-2.225	-2.31	**0.022**	-4.120	-0.329

Note: For all dependent variables, not having a Covid-19 diagnosis and not practicing physical activity are the reference categories. Bold values indicate significant predictors ($p < 0.05$).

DISCUSSION

This study explored the impact of a COVID-19 diagnosis and physical activity on the quality of life and depressive symptoms of university students. It found that a COVID-19 diagnosis alone predicts quality of life in the physical and social domains, but not in the psychological and environmental domains, nor in the presence of depressive symptoms.

Physical activity was positively associated with quality of life across all domains assessed, except for the social domain. Individuals engaging in regular physical activity showed better quality of life in the psychological, environmental, physical, and social domains. These findings support previous research highlighting the mental health and quality of life benefits of regular physical activity during and after the COVID-19 pandemic[7,20–22].

In the psychological domain, physical activity led to a 4.28% increase in quality of life. Regular physical activity has been linked to mood improvements, anxiety reduction, and depression prevention[6,13–15].

Azevedo et al.[6] report that anxiety and depression can occur at any stage of life and focused their study on the prevalence of anxiety and depression, the level of physical activity, and the quality of life among university students. They found that 23% of students had depressive symptoms, and 72% were considered physically active. They suggested that the percentage of students with depressive symptoms could have been higher if the majority did not engage in physical activity. Thus, the results of this study underline the significance of physical activity as a promising strategy for promoting mental health by improving depression and anxiety. Similarly, our findings highlight the importance of regular physical activity in the psychological, environmental, and physical domains, as well as in depressive symptoms.

In the environmental domain, physical activity showed a positive association with quality of life. Participants who engaged in physical activity reported higher quality of life in this domain compared to non-participants, indicating an 8.01% increase in quality of life for those who engaged in physical activity ($p < 0.001$). Outdoor

physical activity, for example, can enhance contact with nature and the environment, which is linked to better mental health and well-being indicators[23,24]. However, this study did not control for the location of physical activity. Regular physical activity can also increase a sense of control and autonomy, contributing to improved quality of life in the environmental domain[25].

In the physical domain, both a COVID-19 diagnosis and physical activity were associated with quality of life. Having a COVID-19 diagnosis resulted in a 3.88% increase in this domain, a surprising outcome given concerns over the negative effects of COVID-19 on quality of life[26]. Recovering from COVID-19 seemed to improve students' self-perception of their physical condition. In another context, selfcompassion was linked to psychological well-being among breast cancer survivors during the pandemic[27], and strategies to enhance self-compassion proved effective in improving patients' overall health[26]. Perhaps experiencing and overcoming certain diseases might influence feelings towards oneself and even promote an overvaluation of self-perception in aspects of quality of life, such as the physical domain.

Similarly, engaging in physical activity compared to not doing so led to a 3.13% increase in quality of life in this domain, emphasizing the importance of physical health as an essential component of postpandemic quality of life. COVID-19 may leave physical and functional sequelae in some individuals, but regular physical activity can serve as a protective factor by aiding recovery and muscle strengthening, thus enhancing well-being and recovery from comorbidities[3,16,24,28].

In the social domain, the COVID-19 diagnosis was associated with an increase in quality of life by 7.17%. However, physical activity did not show a correlation with quality of life in this domain. It is crucial to note that the social quality of life was impacted by the pandemic in several ways, such as social distancing and physical contact restrictions[3]. Yet, returning to daily activities after the isolation period may have a particularly significant impact on those who contracted and recovered from COVID-19. For cancer survivors, for example, social re-engagement, participation in paid employment, and daily activities were linked to well-being[29], which in turn, relates to quality of life[30].

Although physical activity may not have had a direct influence on the social domain, it likely played an indirect role by facilitating social interactions in safe environments, such as online exercise groups or outdoor activities with social distancing during the pandemic[21,31]. Indeed, social interaction, even online, can foster the development of social skills, which, in turn, is one of the possible strategies used for health promotion[11].

Regarding the presence/severity of depressive symptoms, the COVID-19 diagnosis showed no association, but physical activity displayed a negative correlation. Engaging in physical activity, as opposed to not, led to a 2.22% reduction in depressive symptoms. Scientific literature consistently highlights the beneficial effects of physical activity on the prevention and treatment of depression[20,32]. Indeed, regular physical activity is associated with the release of endorphins and other neurotransmitters that improve mood and reduce depressive symptoms[15].

While the study presents significant findings, its observational design, which prevents establishing causal relationships, is a limitation. However, strengths such as the sample size and regression analyses are noteworthy.

PRACTICAL APPLICATIONS

The student routine can lead to emotional and physical stress during undergraduate studies, which may have been exacerbated during the pandemic. This study's results indicated a positive influence of physical exercise on quality of life and

on reducing depressive symptoms. Therefore, it suggests practical applications like policies encouraging increased physical activity levels to promote health among university students.

CONCLUSION

In conclusion, an isolated COVID-19 diagnosis was not associated with quality of life in the psychological and environmental domains, nor in the presence of depressive symptoms in university students. However, contracting COVID-19 positively influenced the physical and social domains. Recovering from COVID-19, along with the satisfaction of returning to daily activities after respiratory syndrome improvement, may have boosted students' self-perception regarding aspects of their physical condition and social relationships.

Physical activity led to positive associations with quality of life in the psychological, environmental, and physical domains. Moreover, it was associated with a reduction in depressive symptoms.

These results highlight the importance of physical activity as a protective factor, improving well-being and mental health in university students, regardless of COVID-19 diagnosis. Therefore, strategies to encourage physical activity should be considered to improve quality of life and reduce depressive symptoms in this population.

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