

# Effects of supervised physical training on anxiety, stress and depression after Covid-19

Efeitos do treinamento físico supervisionado na ansiedade, estresse e depressão após a Covid-19 Efectos del entrenamiento físico supervisado en la ansiedad, el estrés y la depresión después de la Covid-19

> Juliana Albuquerque Sampaio<sup>1</sup>, Arêtha de Meira Castro<sup>1</sup>, Erikson Custódio Alcântara<sup>1</sup>, Krislainy de Sousa Corrêa<sup>1</sup>

<sup>1</sup>Pontifícia Universidade Católica de Goiás. Goiânia, GO, Brazil

#### ABSTRACT

**Objective:** to assess anxiety, stress and depression before and after physical training in people affected by Covid-19. **Method:** a quasiexperimental study carried out in Goiania with patients who had moderate to severe Covid-19 after hospitalization. Anxiety, stress and depression were investigated using the DASS-21. The participants underwent eighteen physical training sessions, three times a week, consisting of aerobic, resistance and flexibility exercises. The Shapiro Wilk test was used for distribution and the paired t-test and Wilcoxon test with a significance level of p<0.05 were used for comparisons. **Results:** seventeen individuals took part, aged 55.59 (±5.20) years, predominantly women (64.7%), an average of seventeen days in hospital, the majority obese (52.9%) with some illness prior to Covid-19 (76.5%). There was a reduction in anxiety (median from 9.0 to 2.0 [p=0.001]), stress from 10.0 to 2.0 (p=0.001) and depression from 6.0 to 2.0 (p<0.001) after physical training. **Conclusion:** physical training was effective in improving anxiety, stress and depression after eighteen sessions.

Descriptors: COVID-19; Anxiety; Stress; Depression; Exercise.

#### RESUMO

**Objetivo:** avaliar ansiedade, estresse e depressão antes e após o treinamento físico em acometidos pela Covid-19. **Método:** estudo quase-experimental realizado em Goiânia com pacientes que tiveram Covid-19 moderada a grave, após internação. Investigou-se ansiedade, estresse e depressão por meio da DASS-21. Os participantes realizaram dezoito sessões de treinamento físico, três vezes/semana composto por exercícios aeróbios, resistidos e de flexibilidade. Utilizou-se teste Shapiro Wilk para distribuição e os testes t pareado e Wilcoxon com nível de significância de p<0,05 para comparações. **Resultado:** participaram dezessete indivíduos com 55,59(±5,20) anos, predominantemente mulheres (64,7%), média de dezessete dias internados, maioria obesos (52,9%) com alguma doença prévia à Covid-19 (76,5%). Houve redução da ansiedade (mediana de 9,0 para 2,0 [p=0,001]), estresse de 10,0 para 2,0 (p=0,001) e depressão de 6,0 para 2,0 (p<0,001) após treinamento físico. **Conclusão:** o treinamento físico foi eficaz para melhora da ansiedade, estresse e depressão após dezoito sessões. **Descritores:** COVID-19; Ansiedade; Estresse; Depressão; Exercício Físico.

#### RESUMEN

**Objetivo**: evaluar la ansiedad, el estrés y la depresión antes y después del entrenamiento físico en afectados por la Covid-19. **Método**: estudio cuasi-experimental realizado en Goiânia con pacientes que tuvieron Covid-19 moderada a grave, tras hospitalización. Se investigó la ansiedad, el estrés y la depresión mediante el DASS-21. Los participantes realizaron dieciocho sesiones de entrenamiento físico, tres veces por semana compuesto por ejercicios aeróbicos, de resistencia y de flexibilidad. Se utilizó la prueba Shapiro Wilk para distribución y las pruebas t pareada y *Wilcoxon* con nivel de significancia de p<0,05 para comparaciones. **Resultado**: participaron diecisiete individuos con 55,59 (±5,20) años, predominantemente mujeres (64,7%), media de diecisiete días hospitalizados, mayoría obesos (52,9%) con alguna enfermedad previa a la Covid-19 (76,5%). Hubo reducción de la ansiedad (mediana de 9,0 a 2,0 [p=0,001]), estrés de 10,0 a 2,0 (p=0,001) y depresión de 6,0 a 2,0 (p<0,001) tras el entrenamiento físico. **Conclusión:** el entrenamiento físico fue eficaz para mejorar la ansiedad, el estrés y la depresión después de dieciocho sesiones.

Descriptores: COVID-19; Ansiedad; Estrés; Depresión; Ejercicio Físico.

# **INTRODUCTION**

Covid-19 emerged at the end of 2019 and in March 2020, being characterized as a highly pandemic disease by the World Health Organization (WHO), caused by the SARS-Cov-2 virus (WHO)<sup>1</sup>. It manifests itself in a mild, moderate or severe form and with rapid spread, mainly via the respiratory route<sup>2</sup>.

Various alterations are found in individuals affected by the disease, such as changes in the lung parenchyma<sup>3</sup>, muscular alterations, mainly due to prolonged hospitalization, fatigue, muscle and joint pain, impaired mobility and daily activities, dyspnea, oxygen desaturation on exertion, anxiety, stress and depression<sup>4</sup>.



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Studies show that type 2 coronavirus can invade the central nervous system (CNS)5 and increase the levels of pro-inflammatory cytokines present in various psychiatric disorders6. Changes in cytokines can result in a change in the metabolism of neurotransmitters, triggering behavioral changes, placing the immune system as a link between Covid-19 and psychopathological problems<sup>7</sup>.

It is important that mental disorders are identified and treated, as they hinder physical performance, quality of life, socialization and improved health in individuals after contamination<sup>8</sup>.

Physical training, in addition to improving the dynamics and power of musculoskeletal function, is responsible for improving mood and sleep quality, reducing symptoms of anxiety, stress, depression and influencing the increase in positive emotions and cognitive sensations, as well as the perception of well-being<sup>9</sup>.

In order to investigate the new benefits of physical training, there is a need for experimental studies with protocols that cover resistance, aerobic and flexibility exercises, focused on recovering functionality and with a possible impact on coping with psychopathological symptoms in individuals affected by Covid-19, including symptoms such as anxiety, stress and depression. In the long term, these studies could influence public policies to have an impact on the mental health of patients affected by the pandemic.

In this context, the aim of this study was to assess levels of anxiety, stress and depression before and after supervised physical training in individuals who had been hospitalized for Covid-19.

#### METHOD

This is a quasi-experimental, before-and-after study, carried out at the physiotherapy outpatient clinic of a university hospital in central-western Brazil, from September 2021 to May 2022.

Patients diagnosed with coronavirus infection based on Transcriptase Reaction combined with Polymerase Chain Reaction (RT-PCR) or antigen tests, at least 28 days after the onset of symptoms, who were admitted and referred to the institution's outpatient clinic, over 18 years of age and those who signed the Free and Informed Consent Form (FICF) were included.

Individuals with decompensated cardiovascular disease, a history of acute myocardial infarction in the last three months, neurological, neuromuscular or orthopedic diseases that prevented physical training, as well as those diagnosed with cancer and/or heart failure according to the New York Heart Association (NYHA) functional classification grades III and IV were excluded. Those who were unable to perform any of the study's assessments, who needed to suspend training due to clinical complications and who had low adherence to the physical training program with an attendance rate of less than 70% were excluded from the study.

The initial assessment was carried out over two days using a semi-structured form containing data such as age, gender, schooling, number of people living in the same house, monthly income, existence of a chronic disease prior to Covid-19, occupation, medication in use, smoking load and whether or not physical activity had been carried out prior to the disease. In addition to this questionnaire, the Depression Anxiety and Stress Scale (DASS-21) was used to assess anxiety, stress and depression both before and after supervised physical training.

After the initial assessment, the participants underwent eighteen sessions of supervised physical training three times a week, one hour and fifteen minutes a day, consisting of muscular strength, aerobic and flexibility exercises, using the load defined in the One Repetition Maximum (1RM) test as the parameters for the increase, starting at 50% of 1RM and adjusting the evolution of this load weekly after a new test. The resistance exercises were implemented using three sets of eight to 12 repetitions.

During physical training, the modified Borg scale was presented to the participant so that they could learn to distinguish their respiratory fatigue and the degree of peripheral muscle fatigue during effort. They were instructed to maintain their subjective perception of exertion between four and six on that scale.

The target heart rate established by Karvonen's formula [Training Frequency = Resting HR + % (HRmax - Resting HR)] was also used as the effort parameter during training, at an intensity of 60 to 80% of maximum heart rate<sup>10</sup>. If one of the intensity limits was reached, the intensity of the exercise was reduced to keep within the prescribed limits. Aerobic exercise was performed on a treadmill or bicycle, depending on each participant's ability, and the time was increased to 30 minutes per session.



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To investigate symptoms related to anxiety, stress and depression, the DASS-21 was used, a validated scale that has twenty-one items in its reduced version. Four possible responses were analyzed in terms of frequency and/or severity, with (0) not applied at all; (1) applied to some degree, or for a short time; (2) applied to a considerable degree, or for a good part of the time and (3) applied a lot, or most of the time<sup>11</sup>.

Each subscale contains seven items. For depression, items 3, 5, 10, 13, 16, 17 and 21, which used the following questions: I didn't seem to be able to have any positive feelings; I found it difficult to take the initiative to do things; I felt I had nothing to look forward to in the future; I felt discouraged and depressed; I couldn't get excited about anything; I felt I didn't have much value as a person; I felt life was meaningless. For anxiety, items 2, 4, 7, 9, 15, 19 and 20, with the questions: I was aware that my mouth was dry; I felt difficulty breathing; I felt shaky; I worried about situations in which I might panic and it seemed ridiculous; I felt I was going to panic; I was aware of how my heart was working/beating in the absence of physical effort; I felt scared without having a good reason. For stress, items 1, 6, 8, 11, 12, 14 and 18 asked: I had difficulty calming down; I tended to overreact to situations; I felt that I was generally very nervous; I felt that I was agitated; I had difficulty relaxing; I was intolerant of things that prevented me from continuing what I was doing; I felt that I was sensitive. For the total score, the scores of the items analyzed were added together and multiplied by two<sup>12</sup>.

To classify the severity of the symptoms of anxiety, stress and depression, the severity classification table was used, in which the score is classified within a range that defines whether the severity is normal/mild, minimal, moderate, severe and very severe. For anxiety, a score of 0-7 is defined as normal/mild, 8-9 as minimal, 10-14 as moderate, 15-19 as severe and 24 points or more as very severe. For stress, scores of 0-14 were classified as normal/mild; 15-18 as minimal; 19-25 as moderate; 26-33 as severe and from 34 points onwards as very severe. Depression used scores of 0-9 to classify it as normal/mild; 10-13 as minimal; 14-20 as moderate; 21-27 as severe and very severe with more than 28 points<sup>13</sup>.

The analysis of continuous variables used mean, standard deviation or median with 25th and 75% percentiles. Absolute and relative frequencies were used for categorical variables. Data distribution was analyzed using the Shapiro Wilk test and the paired t-test and Wilcoxon test were used for comparisons. The significance level adopted was p<0.05.

The research protocol was approved by the Research Ethics Committee of the participating and co-participating institution and was carried out following the ethical precepts related to research carried out with human beings.

# RESULTS

Nineteen individuals took part in the study, but two were withdrawn due to low adherence and clinical complications. The characteristics of the participants are shown in Tables 1 and 2.

Table 1: Characterization of the participants (n=17). Goiânia, GO, Brazil, 2021.					
Variables		n (%)	μ(±SD)		
Sex	Female	11 (64.7%)	-		
	Male	6 (35.3%)	-		
Age			55.59(±5.20)		
N sessions			17.29(±1.57)		
Days hospitalized			17.41(±11.80)		
Body mass		-	80.70(±15.43)		
BMI		-	29.98(±5.12)		
BMI category	Normal	2 (11.8%)			
	Overweight	9 (52.9%)			
	Obesity	6 (35.3%)			

**Notes:**  $\mu$  - mean; SD - standard deviation.





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Variables		n (%)
Previous Covid-19 illnesses	Yes	13 (76.5%)
Number of previous illnesses	None	4 (23.5%)
	One disease	7 (41.2%)
	Two diseases	3 (17.6%)
	Three diseases	2 (11.8%)
Most prevalent diseases	Diabetes	5 (29.4%)
	Hypertension	7 (41.2%)
	Lung Disease	3 (17.6%)
Smoker	No	17 (100%)
Former smoker	Yes	5 (29.4%)
	No	12 (70.6%)
Uses medication	Yes	15 (88.2%)
Quantity of medication	No medication	2 (11.8%)
	One medicine	2 (11.8%)
	Two medicines	3 (17.6%)
	More than two medicines	10 (58.8%)
Previous physical activity	Yes	7 (41.2 %)
	No	10 (58.8%)
Modality	None	10 (58.8%)
	Aerobic	6 (35.3%)
	Aerobic and resistance	1 (5.9%)

 Table 2: Clinical and physical activity characterization of the participants (n=17). Goiânia, GO, Brazil, 2021.

Of the seventeen who completed the study, 11 were female (64.7%), 13 had their own home (76.5%), six lived with two people in the same house (35.3%) and eight with no dependents (47.1%). The majority had a family income of between one and two minimum wages (n=9; 52.9%), eight had studied up to high school (47.1%), seven had primary education (41.2%) and two were illiterate (11.8%). The majority were married (n=10; 58.8%), three were divorced (17.6%), two were widowed (11.8%), one was single (5.9%) and one lived with his partner (5.9%). Cough was present in 35.3% of the participants (n=6), chest pain in 47.1% (n=8), asthenia and edema in 11.8% (n=2).

In addition, the majority of the sample was overweight (n=9; 52.9%), sedentary (n=10; 58.8%) and had at least one comorbidity.

The results obtained by applying the DASS-21 are shown in Table 3.

GO, Brazil, 2021.			
ASD	Before ( , )	After ( , )	p-value*
Anxiety	9,0 (6,0-11,0)	2,0 (0-6,0)	0,001*
Stress	10,0 (7,0-11,0)	2,0 (2,0-4,6)	0,001*
Depression	6,0 (4,0-8,0)	2,0 (0-4,0)	<0,001*
Overall Total	25,0 (16,0-30,1)	10,0 (2,0-14,6)	<0,001*

**Table 2:** Anxiety, stress and depression scores and DASS-21 scale total obtained before and after supervised physical training (n=17). Goiânia, GO, Brazil, 2021.

**Notes:** ASD - Anxiety, Stress and Depression; (,) - range; \*Paired t-test and Wilcoxon test, significance level: p<0.05.

There was a significant decrease in anxiety, stress and depression scores and in the total score of the scale.

The decrease in the severity of symptoms of anxiety, stress, depression and the overall total per participant was seen after supervised physical training and is shown in Figures 1 to 4.





Figure 1: Absolute frequency of the classification of clinical severity of anxiety before and after supervised physical training, according to the DASS-21. Goiânia, GO, Brazil, 2021.



Figure2: Absolute frequency of classification of clinical severity of stress before and after supervised physical training, according to DASS-21. Goiânia, GO, Brazil, 2021.



Figure 3: Absolute frequency of the classification of clinical severity of depression before and after supervised physical training, according to the DASS-21. Goiânia, GO, Brazil, 2021.



Figure 4: Absolute frequency of clinical severity classification before and after supervised physical training, according to DASS-21. Goiânia, GO, Brazil, 2021.



#### DISCUSSION

This study showed that supervised physical training in individuals affected by Covid-19 can contribute to improving the clinical severity of anxiety, stress and depression.

Psychosocial symptoms were studied in a cohort from Whuan Hospital in China, with 4.3% of the individuals having depression, 17.7% sleep disturbance and 1.7% dysphoria<sup>14</sup>. In addition, among those affected by Covid-19 there is evidence of an increased risk of anxiety by a ratio of 1.35 (1,34 -1,39); depressive disorders in 1.39 (1.34-1.43) and stress disorders in 1.38 (1.34-1.43). The risk is higher in patients who required hospitalization during the acute phase of the disease compared to those who were not hospitalized<sup>15</sup>. In our study, there was an occurrence of anxiety, stress and depression with an improvement in the initial indices after supervised physical training and the average length of stay was approximately two weeks, confirming the findings of the aforementioned study<sup>15</sup> regarding the association of hospitalization with acute symptoms of anxiety, stress and depression.

Anxiety, stress and depression have been very prevalent among patients affected by the novel coronavirus<sup>16,17</sup>, capable of triggering negative effects on mental health. Stress was reported in 96.2% of patients with Severe Acute Respiratory Syndrome (SARS)<sup>16</sup>, anxiety in 34.72% and depression in 28.47%<sup>17</sup>. This is associated with the fact that there are socio-environmental issues that favor the appearance of these symptoms such as social isolation due to the pandemic situation, social vulnerability and even physical inactivity<sup>18</sup>.

In addition, the high levels of pro-inflammatory cytokines, a situation present in several psychiatric disorders, results in changes in the immune psychoneuroendocrine circuits, which is also a factor that directly impacts the mental health of infected individuals<sup>6</sup>.

This study showed a high frequency of individuals with symptoms of anxiety, stress and depression in the initial assessment, carried out after hospital discharge, corroborating the findings of the above studies regarding the existence of psychopathological symptoms in individuals with severe Covid-19 and hospitalized.

In the study carried out in Bangladesh, which also assessed participants' mental health using the DASS-21, in the city of Dhaka there was a higher prevalence of anxiety (80.0%), stress (64.2%) and depression (59.8%). In the city of Chittagong, anxiety (57.3%), depression (47.7%) and stress (39.5%) were prevalent. They observed that patients experienced a combination of the three symptoms, with 52.8% of patients in Dhaka and 34.4% in Chittagong<sup>19</sup>. Our study also showed a combination of the three symptoms in some of the individuals assessed.

Supervised physical training is indicated for the physical and mental improvement of people who have been contaminated by Covid-19<sup>20</sup>. Post-Covid-19 rehabilitation programs have shown a regression in anxiety, stress and depression rates after physical training<sup>20</sup>, corroborating our study which also showed a reduction in anxiety, stress and depression scores after eighteen sessions of supervised physical training.

The positive changes perceived after supervised physical training in relation to anxiety, stress and depression can be explained by the fact that routine, weekly physical activity is responsible for lowering blood cortisol levels, a neurotransmitter that causes stress, and the consequent increase in neurotransmitters such as serotonin and  $\beta$ -endorphin, which are responsible for feelings of pleasure and well-being<sup>21</sup>.

Before contracting Covid-19, most of the patients who took part in this study didn't do any kind of physical exercise. Physical training is a non-invasive treatment that is widely indicated for musculoskeletal, cardiopulmonary and metabolic dysfunctions and corroborates a study that found that patients with Covid-19 who had been inactive for the last two years were more likely to be hospitalized, require ICU care, acquire psychopathological symptoms and have a higher mortality rate than active patients<sup>22</sup>.

It is worth noting that physical activity of at least 150 minutes per week of moderate intensity, or 75 minutes per week of vigorous intensity aerobic exercise, is associated with a 34.3% lower prevalence of hospitalization for Covid-19<sup>23</sup>. In addition, therapeutic exercise helps to reduce inflammatory cytokines<sup>24</sup> and the immune system response by improving the circulation of immunoglobulins, neutrophils, natural killer cells, cytotoxic T cells and immature B cells<sup>25</sup>. This may explain the reduction in symptoms of anxiety, stress and depression found in our study after supervised physical training.

Physical exercise should be considered as a prophylactic therapeutic action for patients who have been infected by the virus and have not manifested the severe form. Studies recommend monitoring people who did not show symptoms in the acute period of infection, since many persistent symptomatic manifestations can appear 3 and/or 6 months after hospital discharge, strongly justifying the indication of physical exercise<sup>26,27</sup>.



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This study found that most of the participants had diseases prior to Covid-19, such as diabetes, systemic arterial hypertension and lung disease. This finding corroborates the studies which showed, respectively, that more than 80% and 60% of their sample had at least one comorbidity<sup>28,29</sup>. This condition is associated with a greater chance of complications from Covid-19 and a worse prognosis for the disease<sup>30</sup>.

The overweight and obesity found in this study are predisposing factors to the worsening of Covid-19 and with it the increase in psychosocial symptoms such as anxiety, stress and depression<sup>31-33</sup>. Overweight people had a 1.84-fold chance of developing severe Covid-19, while obese people had a 3.4-fold chance<sup>31</sup>.

The average age of the participants in this study was fifty-five, as found in other studies with this population<sup>26,28,34</sup>. It should be noted that over the years, individuals become more prone to viral diseases and have a greater chance of worsening them34. This is due to the pre-existence of reduced immunity and, most of the time, because they have concomitant chronic diseases<sup>29,35</sup>.

# **Study limitations**

The study has limitations due to the small sample size and the lack of a comparison group. Data collection was carried out at the same time as the vaccination period, which explains the reduction in serious cases with hospitalizations and the consequent reduction in the number of individuals included in the study.

In addition, it was not possible to have a comparison group because at that time the hospital where the study was carried out only allowed the rehabilitation of people affected by Covid-19. It should be noted that the instrument used to assess symptoms of anxiety, stress and depression is used to screen for symptoms and not to diagnose them; however, it is a simple, low-cost tool that can be implemented in physical training programs.

# CONCLUSION

Supervised physical training was associated with an improvement in psychopathological symptoms such as anxiety, stress and depression after eighteen sessions. In this context, the study contributes to guiding health professionals and authorities in drawing up protocols for the physical and mental treatment of people affected by Covid-19.

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# Author's contibutions

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