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Effect of Aerobic and Balancing Exercises on Anxiety and Dizziness in Patients with Covid-19

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ABSTRACT

Background: The pathogen that causes COVID-19 is identified as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), is the pathogen that triggered the global pandemic., has emerged as a significant threat to global health, infecting over half a million people worldwide and resulting in numerous fatalities. Individuals diagnosed with COVID-19 frequently experience increased anxiety and disrupted sleep patterns as a result of isolation and medical treatment. Purpose: This study aims to evaluate the impact of aerobic and balance exercises on anxiety and dizziness in post-COVID-19 patients. **Subjects**: The study involved 30 post-COVID-19 patients aged 45 to 65 years, experiencing anxiety and dizziness. Participants were randomly assigned to two groups and selected from the outpatient clinic at General Sohag Hospital. **Methods**: Group (A): The program included 15 patients who participated in aerobic exercises, balance training, and relaxation techniques over a four-week period, attending sessions three times per week. Group (B): Comprised 15 patients who performed only relaxation exercises focused on physical relaxation for the same duration and frequency. All participants underwent assessments both before and after the intervention using the Hamilton Anxiety Scale, the Berg Balance Scale, and by measuring respiratory function through maximum voluntary ventilation.

Results: Both groups (A and B) showed significant improvements when comparing pre- and post-treatment assessments.demonstrated a notable reduction in anxiety and dizziness, along with a significant increase in maximum voluntary ventilation following the 4-week training period. After treatment, the mean scores on the Hamilton Anxiety Scale (HAMA) were 17.2 ± 1.74 for Group A and 21.73 ± 1.44 for Group B. The mean scores on the Berg Balance Scale were 26.67 ± 5.73 for Group A and 22.2 ± 3.59 for Group B. Additionally, the mean values of maximum voluntary ventilation were 117.2 ± 16.74 for Group A and 108.13 ± 16.25 for Group B. However, participants in Group A, Participants who engaged in aerobic and balance exercises alongside relaxation techniques experienced a significantly greater decrease in anxiety and dizziness, along with a notable improvement in maximum voluntary ventilation ($P < 0.001$) compared to Group B. Conclusion: Aerobic and balance exercises, combined with relaxation techniques, are an effective approach to managing anxiety and dizziness in post-COVID-19 patients.

Keywords: *Aerobic exercises, Balance exercises, anxiety and dizziness disorder*

1. INTRODUCTION

In December 2019, multiple pneumonia cases of unknown origin emerged in Wuhan, Hubei, China. The clinical symptoms were similar to those of viral pneumonia. Advanced sequencing of samples from the lower respiratory tract revealed a new coronavirus, later named the 2019 novel coronavirus (COVID-19). On February 12, 2020, the disease caused by this virus was officially designated as Coronavirus Disease 2019 (COVID-19). By March 11, 2020, the World Health Organization (WHO) declared the outbreak a pandemic, with the virus spreading to 114 countries, resulting in over 118,000 cases and

more than 4,000 deaths1.

COVID-19 is caused by an RNA virus that exhibits a crown-like structure when viewed under an electron microscope, a feature attributed to the glycoprotein spikes on its outer envelope[2]. The most frequently observed symptoms are fever, dry cough, shortness of breath, and acute respiratory distress. However, some individuals may show no symptoms at all, while others might experience mild manifestations such as headaches, dizziness, fatigue, myalgia, non-productive cough, and anosmia. The overall mortality rate is estimated to be around 8%, with respiratory failure due to hypoxia or multiple organ failure being the primary causes of death [3].

As the outbreak spread, additional cases were reported in other parts of China and internationally. The virus primarily spreads through respiratory droplets and direct close contact with an infected individual. Patients diagnosed with this novel coronavirus infection are considered the main sources of transmission and require isolation for treatment. Clinical observations reveal that isolation measures have caused some patients to experience anxiety, dizziness, sleep disturbances, and negative effects on physical health. Anxiety, a form of psychological stress, has been shown to trigger physiological changes that weaken the immune system [4]. Engaging in regular physical activity has been demonstrated to enhance various health outcomes, including physical, physiological, and mental well-being[5].

Research has shown that adaptive physical exercise routines practiced at home during prolonged periods of enforced inactivity (such as pandemic-related lockdowns) can mitigate the negative physiological and psychological effects of sedentary behavior[6].

The presence of dizziness can significantly impact quality of life, as it may lead to falls, which are a major cause of mortality among older adults. Dizziness has also been associated with reduced ability to perform social, professional, and family roles, as well as psychological consequences such as depression, loss of confidence, impaired concentration, and reduced productivity. However, it remains challenging to determine whether psychological issues are a precursor to or a consequence of vestibular disorders[7].

Anxiety disorders and balance dysfunctions share overlapping neural pathways that involve monoaminergic systems. This connection helps explain why anxiety is often associated with balance impairments. These neural circuits converge in the parabrachial nucleus, a critical area for integrating vestibular and visceral information. This region is also involved in symptoms of anxiety, fear, and avoidance. Dizziness and balance disturbances can lead to psychological symptoms such as insecurity, irritability, lack of confidence, anxiety, panic, depression, depersonalization, and a sense of detachment from reality[8].

Aerobic and endurance exercises are forms of physical activity that enhance cardiovascular and pulmonary function. Engaging in these activities is believed to promote well-being while also helping to alleviate negative emotional states like anxiety and depression. Aerobic exercise involves the repetitive use of large muscle groups to move the body against gravity. Moderate-intensity aerobic exercise results in a slight increase in respiration and heart rate, while vigorous-intensity exercise causes a more pronounced rise in both [9].

The COVID-19 pandemic has significantly impacted individuals' physical, psychological, and social well-being, with common issues including dizziness, anxiety, and reduced physical fitness. Prolonged isolation and sedentary lifestyles have further worsened these problems, negatively affecting overall quality of life[10].

Evidence suggests that physical exercise, particularly aerobic and endurance activities, can enhance physical health, psychological resilience, and balance, all of which are essential for maintaining independence and preventing falls. Since anxiety, balance issues, and dizziness are interconnected through shared neural pathways, structured physical exercise programs may play a crucial role in addressing these challenges[11].

However, there is limited evidence on the effectiveness of adaptive exercise programs in combating these issues during pandemic restrictions. This study aimed to evaluate the impact of an adaptive physical exercise program on overall physical health, balance, and psychological well-being during the COVID-19 pandemic, focusing on whether regular aerobic and endurance exercises can reduce dizziness and anxiety, and enhance overall functional health and quality of life [12].

Materials and Methods

This study was carried out between May and June 2020 on a sample of 30 patients diagnosed with dizziness and imbalance after contracting COVID-19, who were referred by a physician. The participants, ranging in age from 45 to 65 years, were recruited from the outpatient department of Sohag General Hospital. The patients were randomly divided into two equal groups, each consisting of 15 participants. Ethical approval for The research was approved by the Ethics Committee of the Faculty of Physical Therapy, Cairo University (Approval No: P.T.REC/0112/003396). and the study was registered with the clinical trial registration number NCT04996225.

Group A (Study Group): This group included 15 patients who took part in aerobic exercises, balance training, and relaxation techniques.

Group B (Control Group): This group was made up of 15 patients who were provided with relaxation exercises only, specifically physical relaxation techniques. Both groups attended treatment sessions three times a week for a period of four weeks. Assessments were conducted for all participants in both groups before and after the treatment program, utilizing the Hamilton Anxiety Scale (HAMA). the Berg Balance Scale (BBS), and respiratory functions measured by Maximum Voluntary Ventilation (MVV). The exclusion criteria included pregnant women, cancer patients, smokers, and individuals with chronic heart conditions.

Outcome measures

HAMA: The HAMA is a commonly used instrument to evaluate the severity of anxiety symptoms. It contains 14 items, each scored on a 5-point scale from 0 (absent) to 4 (severe). The overall score ranges from 0 to 56, with scores under 17 suggesting mild anxiety, 18–24 indicating mild to moderate anxiety, and 25–30 indicating moderate to severe anxiety. Scores above 30 are rare but represent very severe anxiety[13].

BBS: This scale evaluates static and dynamic balance abilities and is highly reliable for assessing balance in patients with conditions such as multiple sclerosis. It includes 14 items of increasing difficulty, scored on a 5-point Likert scale (0–4). The maximum score is 56, with lower scores indicating greater balance impairment.[14].

MVV: It measures the maximum amount of air a person can inhale and exhale within a 12–15 second interval using maximum effort. Spirometry was used to assess pulmonary function, specifically MVV. Participants were instructed to breathe rapidly and forcefully during the test, with at least three attempts performed and a 60-second interval between each. The reproducibility criterion required a difference of less than 10 between the two highest MVV values[15].

Treatment Procedures

Participants were randomly allocated into two groups, each consisting of 15 patients. Both groups received treatment three times a week on alternate days for a period of four weeks, totaling 12 sessions. All sessions were supervised, and Participants were free to withdraw from the study at any point. Informed consent was collected from all participants following a detailed explanation of the study. No adverse effects were reported, and The analysis incorporated data from all participants.

Group A (Study Group):

Patients in this group received aerobic exercises, balance exercises, and relaxation exercises.

Aerobic Exercise Program:

The aerobic training began with a 2–3-minute warm-up at a slow pace to prepare the muscles and cardiovascular system. The maximum heart rate (MHR) for each patient was calculated using the formula: MHR = 220 - age. During the active phase, the pulse rate was maintained between 65% and 75% of the MHR for 15–20 minutes, not exceeding 85% of the MHR. Patients were instructed to stop if they felt tired or dizzy. The session concluded with a 5-minute cool-down phase, gradually reducing the speed to zero[16].

Balance Exercise Program[17]:

Balance exercises included standing on one leg near a support surface, stepping forward and backward, and performing side steps. Mini squats with a knee flexion angle of 15–30 degrees were also included to strengthen the quadriceps. Each exercise was performed for a specific number of repetitions, such as 30 reps for stepping and 10 reps for mini squats.

Patients were advised to wear running shoes and stay hydrated during the sessions.

Group B (Control Group):

Patients in this group performed relaxation exercises only.

Physical Relaxation Exercises:

Diaphragmatic breathing exercise:

Patients were instructed to adopt a comfortable position, such as sitting or lying down, in a quiet and warm environment. Diaphragmatic breathing exercises were performed for approximately 5 repetitions over 5 minutes, with relaxation intervals in between. Patients were guided to breathe deeply through the nose, allowing the abdomen to expand like a balloon, and exhale slowly through the mouth[18].

All patients were screened by a specialized physician to ensure no underlying conditions or medications interfered with the treatment program.

Table (4).: Mean values for Maximum voluntary ventilation before and after treatment for both groups (A and B)

Results

The statistical analysis for this study was performed using SPSS for Windows, version 22 (SPSS Inc., Chicago, Illinois,

USA). A p-value of ≤ 0.05 was regarded as statistically significant. An unpaired t-test was used to compare the mean values between the two groups, while a paired t-test was applied to compare pre-treatment and post-treatment data within each group.

The results of this study demonstrate that incorporating aerobic and balance exercises alongside relaxation exercises (Group A) resulted in significantly greater improvements in anxiety, balance, and respiratory function compared to relaxation exercises alone (Group B). The intergroup comparisons highlight the superior effectiveness of the intervention in Group A in addressing anxiety symptoms, enhancing balance, and improving respiratory capacity in COVID-19 patients.

1-Demographic Characteristics

The demographic characteristics of the participants, including age, weight, height, and BMI, were analyzed to ensure that the two groups were comparable at baseline. The results showed no significant differences between Group A and Group B for any of these parameters. The mean age was 28.4 ± 2.11 years in Group A and 29.6 ± 3.68 years in Group B (p = 0.38). Similarly, the mean weight was 72.5 ± 10.06 kg in Group A and 75 ± 7.07 kg in Group B (p = 0.52). The mean height was 164.8 ± 9.64 cm in Group A and 166.9 ± 6.75 cm in Group B (p = 0.58), while the mean BMI was 26.65 ± 2.68 kg/m² in Group A and 26.87 ± 1.11 kg/m² in Group B (p = 0.81). These findings confirm that the two groups were similar in demographic characteristics, ensuring that any observed differences in outcomes were due to the intervention rather than baseline differences.

Table 1: Subjects' Demographic Characteristics.

A comparison of the participants' general characteristics in both groups revealed no significant differences in average age, weight, height, or BMI ($p < 0.05$)

Table 1. Descriptive statistics and t test for the mean age, weight, height, and BMI of both groups (group A and B).

	Group A	Group B	T-value	p-value	Significance
	$\overline{X}$ ±SD	$\overline{X}$ ±SD			
Age (years)	28.4±2.11	29.6±3.68	-0.89	0.38	**NS**
Weight (kg)	72.5±10.06	75±7.07	-0.64	0.52	**NS**
Height (cm)	164.8±9.64	166.9±6.75	-0.56	0.58	**NS**
BMI (kg/m²)	26.65±2.68	26.87±1.11	-0.23	0.81	**NS**

2- Hamilton Anxiety Scale scores were measured before and after treatment for both groups (A and B).

The HAMA was utilized to evaluate anxiety levels both before and after treatment in both groups. The pretreatment scores showed no significant difference between the groups, with Group A scoring 35.73 ± 3.34 and Group B scoring 36.27 ± 6.42 (p = 0.745). However, post-treatment scores showed a notable decrease in anxiety levels in both groups, with Group A showing a greater decrease (17.2 ± 1.74) compared to Group B (21.73 ± 1.44). The difference between the groups was found to be statistically significant (p = 0.005). Group A demonstrated a 51.87% improvement in anxiety levels, while Group B showed a 40.07% improvement. Within-group analysis also revealed significant reductions in anxiety scores from pretreatment to post-treatment in both groups (p = 0.0001). These results suggest that the addition of aerobic and balance exercises in Group A was more effective in reducing anxiety compared to relaxation exercises alone in Group B.

Hamilton anxiety scale before and after treatment for both groups (A and B):

Table 2: Mean values for Hamilton anxiety scale before and after treatment for both groups (A and B)

Hamilton anxiety scale	Group A	Group B	t-value	p-value	Sig
	$\overline{X}$ ± SD	$\overline{X}$ ± SD			
Pre-treatment	35.73 ± 3.34	36.27 ± 6.42	.332	.745	NS
Post-treatment	17.2 ± 1.74	21.73 ± 1.44	7.549	0.005	S
Mean difference	18.533	14.533			

% improvement	51.87%	40.07%			
t-value	26.369	8.529			
p-value	0.0001	0.0001			

3- The Berg Balance Scale was assessed before and after treatment for both groups (A and B):

The BBS was utilized to evaluate balance both before and after the treatment. There was no significant difference between the groups in the pretreatment scores, with Group A scoring 26.67 ± 5.73 and Group B scoring 22.2 ± 3.59 (p = 0.026). Post-treatment scores showed significant improvements in both groups, with Group A achieving a higher score (45.47 ± 8.83) compared to Group B (35.07 ± 3.20). A statistically significant difference was observed between the groups (p = 0.002). Group A exhibited a 70.50% improvement in balance, while Group B demonstrated a 57.95% improvement. Within-group analysis revealed significant improvements in balance scores from pretreatment to post-treatment in both groups (p = 0.0001). These findings indicate that the aerobic and balance exercises performed by Group A led to greater enhancements in balance compared to relaxation exercises alone in Group B.

Berg balance scale before and after treatment for both groups (A and B):

Table (3).: Mean values for Berg balance scale before and after treatment for both groups (A and B)

Berg balance scale	**Group A**	**Group B**	**t-value**	**p-value**	**Sig**
	$\overline{X}$ **± SD**	$\overline{X}$ **± SD**			
Pre-treatment	26.67 ±5.73	22.2 ± 3.59	2.674504	.026	NS
Post-treatment	45.47±8.83	35.07 ± 3.20	3.88925	.0002	S
Mean difference	-18.8	-12.86667			
% improvement	70.50%	57.95%			
t-value	6.666	11.188			
p-value	0.0001	0.0001			

4-Maximum voluntary ventilation before and after treatment for both groups (A and B)

The MVV was measured to assess respiratory function before and after treatment. Pretreatment scores showed no significant difference between the groups, with Group A scoring 103.33 ± 16.97 and Group B scoring 99.27 ± 25.40 (p = 0.22). Post-treatment scores revealed significant improvements in both groups, with Group A achieving a higher MVV (117.2 ± 16.74) compared to Group B (108.13 ± 16.25). The difference between the groups was statistically significant (p = 0.0002). Group A demonstrated a 77.27% improvement in MVV, while Group B showed a 42.20% improvement. Within-group analysis revealed significant increases in MVV from pretreatment to post-treatment in both groups (p = 0.0001). These results suggest that the inclusion of aerobic exercises in Group A had a more pronounced effect on improving respiratory function compared to relaxation exercises alone in Group B.

Maximum voluntary ventilation before and after treatment for both groups (A and B)

Table (4).: Mean values for Maximum voluntary ventilation before and after treatment for both groups (A and B)

Maximum voluntary ventilation	**Group A**	**Group B**	**t-value**	**p-value**	**Sig**
	$\overline{X}$ **± SD**	$\overline{X}$ **± SD**			
Pre-treatment	103.33 ± 16.97	99.27 ± 25.40	0.6069	0.22	NS
Post-treatment	117.2 ± 16.74	108.13 ± 16.25	1.67555	0.0002	S
Mean difference	-13.8667	-8.86663			
% improvement	77.27%	42.20%			

t-value	8.971	2.280			
p-value	0.0001	0.0001			

2. DISCUSSION

The primary goal of this study was to evaluate the effects of aerobic and balance exercises on anxiety and dizziness in patients with COVID-19. The study involved 30 patients aged between 40 and 60 years, divided equally into two groups. All participants were assessed before and after four weeks of intervention using the Hamilton Anxiety Scale, the Berg Balance Scale, and respiratory function tests measured by Maximum Voluntary Ventilation (MVV). The findings demonstrated significant improvements in anxiety, balance, and respiratory function in the group that performed aerobic and balance exercises compared to the group that only performed relaxation exercises.

Through the continuous and rhythmic movement of large muscle groups, aerobic exercise enhances the body's ability to absorb and utilize oxygen effectively. It is commonly employed to improve lung function, particularly spirometry metrics, and many experts emphasize its significance[19].

Aerobic exercise can also serve as an affordable therapy option to help individuals manage anxiety and improve their performance in academic and professional settings, especially for those experiencing high levels of both trait and state anxiety as well as other mental health challenges[20].

Traditionally, the positive effects of exercise on mood have been linked to moderate-intensity aerobic activities. Such exercises generally lead to reductions in stress, depression, anger, and anxiety, while also boosting energy levels. However, some research suggests that engaging in high-intensity exercise may result in adverse mood changes, which could negatively impact well-being and partially explain why people may struggle to stick with their exercise routines[21].

The positive impact of exercise on mood has been observed particularly with moderate-intensity aerobic activities. Such exercises are typically effective in lowering stress, depression, anger, and anxiety, while also enhancing energy and vitality. However, some studies suggest that high-intensity exercise might cause negative mood shifts, which could explain why some individuals find it difficult to maintain regular exercise routines[21].

Due to its numerous physical and psychological benefits, exercise is increasingly being recognized as a therapeutic option for individuals with various psychiatric conditions. Recent research has highlighted that regular physical activity can have significant anti-anxiety and antidepressant effects[22].

A study by Gaudlitz et al. (2015) found that combining aerobic exercise with cognitive-behavioral therapy (CBT) offers additional benefits in reducing anxiety. Moreover, it was discovered that performing aerobic exercise on a treadmill at 70% of VO2max for 30 minutes led to a reduction in anxiety levels and a decrease in the frequency of panic attacks among patients with panic disorder[24].

Several studies have suggested that aerobic exercise may be less effective in alleviating anxiety symptoms in patients with panic disorder (PD) compared to other treatment approaches. Medication has been identified as the most effective treatment, while cognitive-behavioral therapy (CBT) has also shown to be beneficial[25].

A meta-analysis conducted by Bartley et al. (2013) **[26]** found no substantial evidence to support aerobic exercise as an effective intervention for managing anxiety symptoms. The lack of a standardized protocol for aerobic exercise might have influenced these findings.

Contrary to these results, Gaudlitz et al. (2015) **[23]**, reported that combining aerobic exercise (30 minutes at 70% VO2max, three times per week) with CBT significantly reduced anxiety levels. Another study demonstrated that aerobic exercises (six 20-minute sessions at 70% of maximum heart rate) effectively decreased anxiety sensitivity when compared to a non-exercise control group.

Research has suggested that exercise can help regulate anxiety through both physiological and psychological mechanisms**[27]**. Physiologically, exercise might influence the serotonergic and noradrenergic systems. For instance, Broocks et al. (1991)**[28]** observed that physical activity enhances the turnover of 5-hydroxytryptamine (serotonin). Additionally, other studies have linked increased levels of atrial natriuretic peptide (ANP) to reduced anxiety.

Some individuals may feel anxious due to the physical effects of exercise, which is why many people with anxiety disorders tend to avoid it a phenomenon known as anxiety sensitivity. However, engaging in physical activity could help them build tolerance to these sensations and potentially reduce anxiety sensitivity**[29]**.

From a psychological perspective, the *emotion action tendencies theory* suggests that individuals with anxiety often withdraw from social situations. Participating in exercise may offer an opportunity for positive social interaction, thereby challenging this tendency. Additionally, the *Distraction Theory* proposes that exercise can serve as a mental break from daily stressors,

helping individuals shift their focus away from anxious thoughts and towards more calming and positive ones[30].

An increasing amount of evidence suggests that regular aerobic activities like running, cycling, or swimming can greatly improve mental well-being. Although a significant portion of research has concentrated on depression, panic disorder, and obsessive-compulsive disorder (OCD), some studies also indicate that aerobic exercise may help reduce symptoms of social anxiety. Both single sessions and extended aerobic exercise programs have been shown to contribute to better psychological health[31].

Short aerobic sessions of about 5 to 10 minutes can lead to immediate improvements in mood and anxiety levels. However, more structured exercise programs lasting 10 to 15 weeks appear to have a more profound and lasting impact on mental health. Aerobic exercise might also help reduce the hyperactivity of the sympathetic nervous system commonly seen in individuals with anxiety disorders, while enhancing parasympathetic activity, which promotes relaxation[32].

Some researchers have suggested alternative explanations for the anxiety-reducing effects of physical activity (PA), focusing on its influence on the endocannabinoid system and adenosine receptors. PA has been shown to increase the levels of endocannabinoids in the bloodstream, particularly anandamide. These neuromodulators can help alleviate anxiety and depression by affecting the signaling of other neurotransmitters, such as dopamine and glutamate, and by reducing metabolic activity in the prefrontal cortex[33].

When comparing dizziness in elderly individuals who are physically active to those who are not, several studies found no significant difference. This contrasts with the expectations of the researchers and the findings of Ruwer et al. (2005) [34]. However, further analysis using adjusted logistic regression revealed that Individuals who do not participate in regular exercise are 2.2 times more likely to experience dizziness compared to those who do.

Research has also indicated a moderate connection between the risk of falling and assessments of balance and mobility. According to the findings, maintaining good balance and mobility is crucial for reducing fall risk, which is strongly linked to the level of physical activity[35]. The American College of Sports Medicine (1998) [36] also emphasized that higher levels of physical activity in older adults are linked to fewer physical limitations.

A study conducted in Brazil examined the link between health conditions, the prevalence of falls, and the level of physical activity in 256 elderly participants. The results demonstrated that frequent physical activity is associated with a lower risk of falls and better health outcomes. In contrast, low levels of physical activity were linked to muscle weakness, limited joint mobility, and impaired motor control, all of which increase the likelihood of falls among the elderly[37].

Research has shown that participating in physical activity is linked to improved overall health and a lower risk of depression and falls in older adults. For elderly individuals dealing with depression, regular physical activity can significantly enhance both mental and clinical health. This is largely because physical exercise helps boost cognitive abilities, memory, and concentration, while also improving self-esteem and quality of life. Additionally, it has been found to lower anxiety and depression levels and support greater independence in daily activities[38]. Moreover, elderly people who are physically active tend to experience fewer symptoms of dizziness and vertigo, which subsequently decreases their risk of falls and related health complications[39].

3. CONCLUSION

In conclusion, incorporating aerobic and balance exercises alongside relaxation techniques can effectively reduce anxiety and dizziness while enhancing maximum voluntary ventilation in patients recovering from COVID-19. Thus, these exercises can be considered safe, affordable, and effective complementary treatment options for managing anxiety and dizziness in post-COVID patients.

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