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ARTICLE

The Impact of Swimming Training on Negative Emotional States in Male University Students: A Quasi-Experimental Study

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ABSTRACT: This study aimed to investigate the impact of swimming training on negative emotional states in male university students. Male university students aged 18 to 25 were randomly assigned to either an experimental group (15 people) or a control group (15 people). Negative emotional states were tested using the depression, anxiety, and stress scales (DASS) (Lovibond and Lovibond, 1995). Differences over time between the experimental and control groups were assessed by 2×2 (group by time) repeated-measures analysis of variance. The mean scores of depression, anxiety, and stress significantly improved post-intervention in both groups, but the level of significance was higher in the experimental group. Therefore, it can be said that swimming training had a significant impact on improving negative emotional states in male university students. So, swimming training and the use of physical and sports activities for young people can help to improve and reduce the level of negative emotional states such as depression, anxiety, and stress in these people and even strengthen positive emotions in them.
KEYWORDS: Negative emotional states, Anxiety, Depression, Stress, Swimming training.

1 Introduction

The World Health Organization defines general health as “a state of complete physical, mental and social well-being” and emphasizes that mental health is particularly vital to our ability as individuals to think, feel and interact with one another (World Health Organization, 2018). In this regard, there is a deep history of mental illness in society, with references to mental health disorders dating back to 6500 BC (Farreras, 2023). However, this invisible domain has only recently been recognized and has gained its place on the global health scene (Liese et al., 2019). Results from the National Mental Health and Well-being Survey in Australia indicate that approximately half of the country's population (45.5%) will experience a mental health disorder at some point in their lives (Australian Government Department of Health, 2009). Similarly, statistics from the Canadian Community Health Survey on mental health indicate that one in seven Canadians used mental health services between 2016 and 2017, and further estimate that one-third of Canadians will be affected by a mental illness at some point in their lives (Public Health Agency of Canada, 2020).

These disorders not only affect the daily lives of those affected but also impose significant costs on society (Knapp & Wong, 2020). As of 2019, the World Health Organization reported that depression and anxiety cost the world $1 trillion annually (WHO, 2021). This amount does not include the social and emotional costs to friends and family who are suffering. Fortunately, increased understanding and attention to mental health disorders are expected to lead to increased international funding for mental health research and services (Liese et al., 2019). However, healthcare providers, government officials, and global health leaders must continue to advocate for the mental health of all people and communities around the world, as experts believe that international funding and research in this area are inadequate (Liese et al., 2019). This is especially true now, and more so than ever, after the COVID-19 outbreak. A study conducted at the beginning of the COVID-19 pandemic among residents of 194 cities in China found that 54% of respondents rated the psychological impact of the COVID-19 outbreak as moderate or severe, with 29% reporting moderate to severe anxiety symptoms and 17% reporting moderate to severe depressive symptoms (Wang et al., 2020).

Physical activity is a common and highly effective form of treatment for such disorders (Mikkelsen et al., 2017). Many high-quality studies show that physical activity can be effective in managing mental health conditions. For example, a systematic review of patients with major depressive disorder found that aerobic exercise had a significant antidepressant effect compared to non-exercise treatments (Morres et al., 2019). Also, Maleki et al. (2023), by examining the effectiveness of a massage and music course on competitive anxiety in elite rowers, found that using music and massage along with physical exercises is useful in reducing anxiety in elite rowers in high-pressure situations. Mohammadi et al. (2022), also examining the effect of cognitive-behavioral stress management training on competitive anxiety in karate girls, stated that awareness, training in stress reduction skills, modifying cognitive assessments, developing interpersonal skills, increasing emotional expression, and reducing social isolation are effective on competitive anxiety in athletes. Zargham Hajebi et al. (2018), examining the effect of aerobic exercise on depression and anxiety in mothers of children with ADHD, concluded that aerobic exercise reduced maternal depression and anxiety at post-test and follow-up. Promising findings such as these have led several other researchers to investigate whether a particular form of exercise is more successful than others in reducing symptoms of mental illness.

In the current literature, aquatic exercise has received much attention as a form of exercise because it can provide numerous physiological benefits. These benefits include reduced joint pain and improved joint mobility. In addition, it provides an opportunity for those who are unable to participate in land-based weight-bearing activities to increase their cardiovascular fitness (Kravitz & Mayo, 2006). A study of patients with fibromyalgia found that pain levels improved significantly after a 12-week swimming program. Over the years, various authors have investigated whether aquatic exercise could also be considered a suitable form of exercise in the treatment of mental illness. Aquatic exercise and its impact on mental health is a topic of interest, as previous research suggests that water has significant therapeutic effects on mental health. For example, a systematic review by Britton et al. (2020) concluded that exposure to visible surface water in the open air can directly impact mental health and psychosocial well-being. Furthermore, float therapy, in which participants float in a large tank of warm water and Epsom salts, has been shown to improve anxiety and related symptoms (Tran & Loshak, 2021).

Therefore, the combination of the therapeutic effects of water exposure with the therapeutic benefits of exercise could potentially make aquatic exercise a superior mental health intervention to land-based exercise for some populations. However, to the author's knowledge, no attempt has been made to summarize

the findings on this topic, indicating a lack of clear understanding of the effectiveness of aquatic exercise and swimming training on the mental health and emotions of different individuals in society. Therefore, considering the research gap in this field and the positive effects that have been shown in various studies of water exercise and sports on various psychological variables, this study attempts to examine the impact of swimming training on negative emotional states in male university students.

2 Methods

2.1 Participants

Male university students aged 18 to 25 years old took part in the study. All participants were fully aware of the purposes of the study and anonymous data collection. They were randomly divided into two groups: the swimming training group (15 people) and the control group (15 people). The design of the present study was a pre-test-post-test with a control group.

Participants were eligible for the present study if they met the following inclusion criteria: 1) men, 2) 18 yrs. To 25 yrs. old; 3) no specific respiratory or musculoskeletal disorders; 4) score 52.5 or below in the depression, anxiety, and stress scales (DASS); and 5) no loss of any relative or loved one during the past six months.

Exclusion criteria were: 1) mental disorders, such as substance use disorder, Major Depressive Disorder (MDD), Posttraumatic Stress Disorder (PTSD), Neurological disorders, such as seizures, Multiple Sclerosis (MS); 5) visual impairments; and 6) participation in less than 80% of swimming training sessions. In total, 30 men met the inclusion criteria and were able to comply with the study conditions.

A power analysis (using G*Power 3.1 software) indicated to detect an effect of moderate magnitude (f = 0.25; alfa-error = 0.05, power = 0.8, groups= 2, number of measurements= 2.00, correlation among repeated measures= 0.50) in repeated-measures analyses of variance (ANOVA), at least 28 participants were required to conduct this study (14 per group).

For this random group assignment, a computer-generated random-number sequence was prepared in advance and sealed in opaque, consecutively numbered envelopes by an independent researcher. Once the envelope was drawn, it was put aside and not returned to the ballot box again.

2.2 Measurement and Tools

Negative emotional states

The depression, anxiety, and stress scales (DASS) was used to assess participants' negative emotional states. This questionnaire consists of three dimensions: 1) depression (items 3, 5, 10, 13, 16, 17 & 21); 2) anxiety (items 2, 4, 7, 9, 15, 19 & 20); 3) stress (items 1, 6, 8, 11, 12, 14 & 18) (Lovibond & Lovibond, 1995). The items are scored from 21 to 84, in which 21 indicate the worst condition and 84 represents the best. In the present study, a score below 52.5 was defined as low emotional state.

Intervention: the Swimming Training Program

The swimming training program was performed for 16 sessions once in a week. Each training session lasted one and a half hour. In this regard, two experts were responsible for measuring the level of negative emotional states before and after the intervention program.

Control Condition

To control possible effects of social interaction with other participants or study personnel, the participants assigned to the control group. During this time, they could talk to each other. Additionally, they were

asked to maintain their current daily physical activity levels and to refrain from additional exercises during the sixteen week intervention period. During this period, it was ensured that none of the participants in the control group participated in the swimming training program. It should be noted that during the study, there were no restrictions or changes in the daily life routine of participants in these two groups. They could continue their previous regular activities and programs of personal life.

2.3 Statistical Analysis

All calculations were done by the SPSS software version 24. After data collection, the Shapiro-Wilk test was conducted to check the normality of data distribution. Then, using Levene's test, the homogeneity of the variables was investigated in the two groups. One-way analysis of covariance (ANCOVA) was performed to identify and compare the effects of the swimming training program on each dependent variable, given that the influence of pre-intervention values on post-intervention ones was controlled in this study. In all the statistical tests, a P-value of 0.05 was considered indicative of significance. The effect size for ANCOVA was calculated using partial eta square (ηp2), with $0.01 \geq \eta p2 \geq 0.059$ indicating small effect, $0.06 \geq \eta p2 \geq 0.139$ indicating medium effect, and $\eta p2 \geq 0.14$ indicating large effect sizes (Lakens, 2013).

3 Results

Table 1. Mean and SD of negative emotions in the experimental and control groups in the pre-test and post-test

Group	Test	Depression M/SD	Anxiety M/SD	Stress M/SD	Negative emotions M/SD
Experimental	pre-test	51.4 ± 0.29	50.6 ± 0.46	48.8 ± 0.40	50.6 ± 0.29
	post-test	72.7 ± 0.33	73.8 ± 0.31	69.05 ± 0.44	73.8 ± 0.21
Control	pre-test	51.5 ± 0.40	49.3 ± 0.38	50.3 ± 0.72	50.6 ± 0.13
	post-test	56.7 ± 0.37	53.4 ± 0.49	58.4 ± 0.33	55.8 ± 0.36

Legend: M = Mean; SD = Standard Deviation

As can be seen in Table 1, the mean of depression, anxiety, and stress in the experimental group improved significantly in the post-test. Also, the mean of depression, anxiety, and stress in the control group improved in the post-test, but this improvement was not significant.

Table 2. ANCOVA for negative emotional states between the groups at the different stage of the study

Variables	Source of changes	Sum of squares	DF	F	Sig.	ES
Depression	pre-test	3.323	1	3.123	0.01	0.195
	group	4.662	1	4.532	0.03	0.163
Anxiety	pre-test	4.163	1	2.535	0.01	0.196
	group	5.796	1	3.863	0.02	0.173
Stress	pre-test	3.887	1	3.132	0.04	0.186
	group	4.552	1	4.265	0.01	0.215
Negative emotions	pre-test	6.886	1	3.131	0.03	0.186
	group	5.469	1	4.752	0.02	0.202

Legend: DF = Degree of freedom; F = Fischer; Sig. = p-value; ES = Effect Size

The ANCOVA results in Table 2 show that swimming training had a significant effect on improving depression (P<0.05), anxiety (P<0.05), stress (P<0.05), and generally negative emotional states in male university students (P<0.05). Also, as can be seen in the pre-test section, the assumption of linear correlation between the covariate (control) variable and the independent variable has been met (P<0.05).

Table 3. Results of the Sidak test to examine the difference in negative emotions in the two experimental and control groups in the post-test

Variables	Group	MD	Standard Error	Sig.
Depression	Experimental Control	16.0	0.77	0.01
Anxiety	Experimental Control	20.4	0.65	0.002
Stress	Experimental Control	10.65	0.75	0.001
Negative emotions	Experimental Control	18.0	1.14	0.03

Legend: MD = Mean Difference; Sig. = p-value

According to Table 3, the results of the Sidak test show that depression, anxiety, stress, and generally negative emotional states are significantly different between the experimental and control groups (P<0.05). Therefore, it can be said that swimming training had a significant impact on improving depression, anxiety, stress and generally negative emotions in male university students.

5. Discussion and Conclusion

In the present study, the impact of swimming training on negative emotional states of male university students was examined.

The results show that swimming training had a significant impact on improving depression in male university students (P<0.05).

In this regard, Taslimi et al. (2015) stated that the effectiveness of swimming training on general self-efficacy and two social and emotional domains has been confirmed with very strong probability. Sun et al. (2023) found that negative emotions play an important mediating role between education-sports conflict and the life satisfaction of university athletes, and individuals with high semantic motivations experienced fewer negative emotions in conditions of moderate and weak conflict. Also, Ligeza et al. (2023) found that exercise improved self-reported mood in the depressed group. Also, in both groups, exercise-induced changes in emotional reactivity were associated with the severity of depressive symptoms, and the effectiveness of exercise in improving emotional reactivity decreased with the severity of depressive symptoms. Samelko et al. (2018) also stated that swimmers experienced the strongest positive emotions and the lowest levels of negative emotions. Also, the lower the level of negative mood (such as depression) and the higher the level of positive mood (such as cheerfulness and kindness), the better the results achieved by swimmers.

Considering this finding, it can be stated that swimming training can improve depression in swimmers, and the participants after this training stated that they can now experience good emotions and feelings, it has become easier for them to take the initiative in doing things, they feel that something is waiting for them and their hope in life has increased, their feelings of discouragement and heartbreak have improved,

they are now able to show enthusiasm about many issues, they value themselves as a human being more than before, and life has become meaningful to them.

Furthermore, the results showed that swimming training had a significant impact on improving anxiety in male university students ($P<0.05$).

Shaheen (2022) stated that anxiety negatively affected the learning of swimming in non-swimmer students and delayed their learning. Ning et al. (2023) also found that the anxiety level of college swimmers decreased significantly after the intervention. Vacher et al. (2017), examining changes in swimmers' emotional states during preparation for a national championship, found that emotional states were characterized by distinct trajectories during the training period before a major competition. Also, significant positive linear effects of time and negative quadratic effects of time on anxiety were observed.

Therefore, according to this finding, it can be stated that swimming training can improve anxiety levels in individuals, and the participants after this training stated that physical symptoms such as dry mouth decreased, they could breathe more easily, the feeling of trembling in their body decreased, and trait symptoms such as their concern about feeling afraid in some situations and making mistakes decreased, their sense of feeling afraid and panic in the moment decreased, their cardiovascular function improved during rest, and they no longer felt afraid and panic for no specific reason.

Also, the results showed that swimming training had a significant impact on improving stress in male university students ($P<0.05$).

In this regard, Samadi et al. (2022), by examining the effectiveness of sports activities on perceived psychological stress, stated that there was a significant difference between perceived physiological stress, inflexible emotional regulation strategies, and psychological toughness in athletes and non-athletes. Köroğlu & Yiğiter (2016) found that a swimming training program was effective in reducing stress in 11- to 13-year-old students.

Therefore, based on this finding, it can be stated that swimming training improved stress levels in individuals, and the participants after this training stated that they can more easily achieve peace, do not overreact to the situations they face, consume less mental energy, feel less distracted and confused, it has become easier for them to be calm and peaceful, and their patience and tolerance have increased.

Furthermore, the results showed that swimming training had a significant impact on improving negative emotional states in male university students ($P<0.05$).

Taslimi et al. (2015) stated that the effectiveness of swimming training on the two social and emotional domains has been confirmed with very strong probability. Ligeza et al. (2023) also stated that in the healthy control group, exercise improved self-reported mood. In the depressed group, exercise improved self-reported mood, and the effectiveness of exercise in improving emotional response decreases with the severity of depressive symptoms. Köroğlu & Yiğiter (2016), also examined the effect of swimming training on students' stress levels and found that there was a significant difference between the pre-test and post-test of the experimental group. There was no significant difference between the pre-test and post-test of the control group. It was also found that the swimming training program was effective in reducing students' stress.

Therefore, considering this finding, it can be stated that engaging in sports and physical activities, especially swimming, among students and young people can improve negative emotional states such as depression, anxiety, and stress in these individuals and reduce their concerns about their education, job, and future.

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