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The effect of aerobic exercise on the mental health of college students

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Abstract

Objective: This study seeks to explore how aerobic exercise can prevent and improve the impact of college students' mental health.

Methods: A total of 120 female students in the first and second grades of a university's general faculty were randomly selected, that is, a total of 240 research subjects. The subjects participated in an aerobic exercise 3 times a week for 4 weeks. Using the symptom self-rating scale SCL-90 as an evaluation tool, the study results compare the mental health status before and after the experiment.

Results: Research indicates, freshman girls have six factors of compulsion, interpersonal, depression, anxiety, hostility, terror, paranoia and psychosis/ Somatization was 1.49 before the experiment and 1.44 after the experiment, indicating was a significant difference. The state of mind of college students after the experiment was significantly better than that before the experiment.

Conclusion: The results showed that there were significant differences in the six factors of compulsion, interpersonal relationship, depression, anxiety, hostility, terror, paranoia and psychosis among female freshmen. The mood state of college students after the experiment is found to be better than before the experiment. Aerobic exercise is one of the new and vigorous sports items favored by a majority of students. It plays an irreplaceable role in promoting college students' physical and mental health, improving their physical well-being/fitness levels and improving their mental health.

Keywords: Aerobic exercise; mental health; college students

Introduction

Aerobic exercise is a physical exercise performed by the human body under the condition of sufficient oxygen supply (Akbari et al., 2020; Kitzman et al., 2016). The American College of Sports Medicine (ACSM, 1978, 1986, 1990) research shows that: Aerobic exercise lasts 15~60 min at a time, the intensity is 60%~90% of the maximum heart rate, 3~5 times a week, and it is believed that the intensity of 50% of the maximum heart rate and a short time (10min) can have a major impact on the exerciser's psychology, and can improve the executive function of the brain (McDonald et al., 2019). Aerobic exercise has various forms, exercise methods and exercise effects, which have flourished and been popularized across the country. It has become a popular sports event, and college students are even more enthusiastic about it. Before the experiment, the comparison of the scores of the SCL-90 factors of the freshman girls before the experiment and the national norm is shown in Table 1.

Students do not always adapt to new learning and living environments. When students reporting a poor psychological state encounter difficulties and failures, it is easy to run into issues of low self-esteem, withdrawing, avoiding, and stubbornness in communication. Before the experiment, the comparison of the scores of the SCL-90 factors of the sophomore girls with the national norm is shown in Table 2. Some sophomore girls behave self-righteously in their interpersonal relationships, or act in self-centered manner. When individuals are inconsistent with their own views and beliefs, they can't seek common ground while reserving differences, adopt stubborn tendencies and are unable to get along with others. It is important to investigate the reasons why girls in all grades feel poor during exercise, mainly as a result of depression, single training methods, and physical fatigue of the subjects. The comparison of SCL-90 factor scores of freshman girls before and after the experiment is shown in Table 3. The comparison of the scores of the SCL-90 factors of the sophomore girls before and after the experiment are shown in Table 4. It is important to note that an improvement in mood may be related to the characteristics of sports activities, so if a person engages in pleasant, non-competitive or rhythmic activities, it is possible to obtain a good emotional effect. After the experiment, the comparison of the scores of the SCL-90 factors of the freshman girls with the national norm is shown in Table 5; After the experiment, the comparison of the scores of the SCL-90 factors of the sophomore girls with the national norm is shown in Table 6. The scores of middle school girls are significantly lower than that of national relations factors, and they is also lower than that

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of girls of the same age in the country, and the difference is not significant. The study found that the mental health of female college students in the experimental group was significantly higher than that of ordinary female college students. The college stage is a period when students gradually mature physically and psychologically, but are still in a stage of psychological instability (McDonald et al., 2019). Aerobic exercise is one of the emerging, vital and popular sports or physical activities in terms of realizing the tasks and goals of school physical education, as it plays an irreplaceable role in promoting students' physical and mental health, improving their physical fitness, and improving their mental health (Soori et al., 2020). In the past, an experimental study has been conducted on the impact of aerobic exercise on the mental health of college students (Karaman et al., 2021).

Aerobic Exercise and Mental Health

Aerobic exercise is any type of cardiovascular conditioning. It comprises actions like brisk walking activities, swimming activities, running activities, or cycling activities. By definition, aerobic exercise means "with oxygen" (Moleirinho-Alves et al., 2021). The inhaling and heart rate increase during aerobic actions. Aerobic exercise can be described as any physical exercise of low to high intensity that is based mainly on the aerobic energy-generating procedure. "Aerobic" can be defined as "relating to, connecting, or needful free oxygen", and denotes the utilization of oxygen to meet various energy demands during exercise via aerobic metabolism. Therefore, it is one many cardiovascular conditioning exercises that can help promote the required level of oxygen. On account of their impact on cardiovascular conditioning, aerobic exercises are a particularly important sport activity to study (Moleirinho-Alves et al., 2021). Aerobic exercise has a significant relationship with human health, as highlighted by several previous studies in the literature (Bennie et al., 2021; Boparai et al., 2021). Aerobic exercise has the ability to maintain an individual's fitness level by helping the body obtain required oxygen (In et al., 2021).

Aerobic exercise also has a relationship with the metal health. Mental health refers to an individual's state of emotional, psychological, and social well-being. It impacts how an individual thinks, feels, and acts. It also helps determine how an individual handles stress in relation to others and makes his or her choices. One's state of mental health is crucial at every stage of an individual's life, from childhood and adolescence through different stages of adulthood. Although, aerobic exercise has an important relationship with human health, it has a distinct and demonstrable effect on an individual mental state or well-being. Therefore, along with the effect of aerobic exercise on the physical body, it has a major effect on the mental health of people. As supported by previous investigations, aerobic exercise has a significant impact on people's mental health (Kandola et al., 2016; Seo et al., 2021; Shahrjerdi et al., 2010; Zopf et al., 2017). Individuals who are involved in routine based aerobic exercise activities generally have better mental health, while on the other hand, individuals having less, or no aerobic exercise activities have a low level of mental health. Therefore, to promote mental health, aerobic exercise is important. As this type of exercise builds the connection to oxygen supply to various parts of the human body it makes sure that proper oxygen supply is more important for the human body (including brain and the nervous system) which leads to better mental health. The connection between aerobic exercise and mental health is investigated by several previous studies which have identified that aerobic exercise and mental health have a significant relationship with each other (Xu et al., 2021). On the other hand, a study carried out by Yang and D'Arcy (2022), revealed that, aerobic exercise has the ability to decrease the level of pain in fibromyalgia, however, exercise cannot enhance the level of mental health. Furthermore, a study conducted by Obrusnikova et al. (2022) highlighted how aerobic exercises are involved in constructing balanced health-supporting exercise programs. Therefore, aerobic exercise actually have significant potential to influence the human health which may improve the overall health conditions of a human by enhancing physical health along with the mental health in a number of ways. Furthermore, a study carried out by Mohammad Rahimi et al. (2022) highlighted that while investigating mental health by Gilani and Feizabad (2019), proved that, aerobic exercise effectiveness on the mental health of T2DM patients does not lead to a significant progress in depression as well as social functioning despite increasing mental health. Therefore, Gilani and Feizabad (2019) highlighted that, aerobic exercise has no or minimum effect on depression as well as social functioning, however, it has an important effect on people's mental health. Thus, aerobic exercise has a significant effect on the mental health of humans which has a major role to play in all aspects of an individual's life. Similar with general people, health of students holds major importance in terms of achievement of higher grades. To get higher position in education, the students have better health which is significantly connected with the students' health.

Naturally, mental health is = important for students at any level of education. Students attaining education among different colleges need a significant level of mental health to perform better in their courses. Generally, students having lower level of mental health & well-being may not

be able to deliver better performance in their academic career. On the other hand, students having better mental health may have better performance achievement in their career. Thus, a positive mental health state is most a crucial factor in the life of students. To promote mental health among students, various activities or initiatives are needed. Previous studies have also highlighted the importance of Aerobic exercise for students (Ertan & Özyol, 2020; Priscilla et al., 2018). Particularly, it is important for institutions to undertake concrete measures to promote various exercise related activities among their students to uplift the level of their mental health which can lead to a better performance in their grades. A study conducted by Petruzzello et al. (1991) after reviewing the findings of more than 124 research studies that had examined the impacts of acute as well as regular aerobic and anaerobic exercise on mental health, well-being, and anxiety, shows that only moderate-to high-intensity aerobic exercise had resulted in significant changes in self-reported anxiety symptoms. Therefore, aerobic exercise has a significant relationship with the mental health of students.

Research methods

Research objects

A random selection of 120 freshmen and 120 sophomore girls in a university's general faculties, that is, a total of 240 girls. Through the aerobics teaching of 80 students from grade 08 of the Department of Commerce and Industry in our college for one semester, two hours a week, the psychological status of the students before and after the semester was investigated using a questionnaire/ The resulting data is shown in Table 1.

Method

Measuring tools

The study uses the mental health scale SCL-90 (the Seft-Roport Symptom Inventory, SymptornCheck-List90) for testing. The SCL-90 scale contains 9 factors and 90 items, and the content involves physical symptoms, interpersonal relationships, emotional conditions, living habits, eating and sleeping, etc. It has high reliability and validity (0.73～0.91).

Self-made emotional experience scale. During the experiment, the self-made emotional experience questionnaire was used for testing. The scoring method of this scale is: 1 is very good, 2 is good, 3 is fair, 4 is bad, and 5 is very bad (Bock et al., 2020). After each exercise, the subjects were asked to indicate in the corresponding level, according to their own psychological experience. A total of 218 valid questionnaires were retrieved, with an effective rate of 91%.

Data processing

This study used SPSS11.0 to process the obtained data.

Research steps

Before the experiment, 240 freshmen and sophomore girls were tested on the SCL-90 scale to understand and gauge their mental health status.

The two experimental groups are organized by the main tester, 3 times a week, 1 hour each time, the exercise time is extracurricular activity time, over a total of 4 weeks. In the process of participating in aerobic exercise, a questionnaire test was conducted focusing on the emotional experience of female college students participating in exercise.

After the experiment, we retest the SCL-90 scale for freshmen and sophomore girls to understand their mental health status.

Results and discussion

Before the experiment, the SCL-90 factor scores of freshmen and sophomore girls were compared with the national norm.

Table 1

Comparison of SCL-90 factor scores of freshman girls before the experiment and the national norm

Factor	Big group(N =110)		Big group		t value
	M	SD	M	SD	
Somatization	1.48	0.40	1.33	0.44	3.83***
Force	2.16	0.42	1.68	0.60	11.70***
People	2.11	0.52	1.75	0.66	6.72***
Depression	1.88	0.45	1.56	0.60	7.29***
Depression	1.71	0.43	1.41	0.42	7.14***
Hostility	1.82	0.44	1.49	0.56	6.28***
Fear	1.57	0.37	1.32	0.46	6.89***
Paranoid	1.81	0.42	1.52	0.59	7.31***
Psychotic	1.82	0.35	1.36	0.46	13.68***

Note: * means P<0.05; ** means P<0.01; ** means P<0.001. The following table is the same.

Table 2

Comparison of SCL-90 factor scores of sophomore girls before the experiment with national norms

Factor	Big group(N =110)		Big group		t value
	M	SD	M	SD	
Somatization	1.43	0.33	1.33	1.45	3.05***
Force	1.97	0.40	1.69	0.60	7.34***
People	2.05	0.57	1.75	0.66	5.37***
Depression	1.95	0.49	1.56	0.60	8.10***
Depression	1.75	0.47	1.41	0.42	7.35***
Hostility	1.72	0.46	1.49	0.56	5.08***
Fear	1.56	0.34	1.32	0.46	7.12***
Paranoid	1.85	0.49	1.51	0.59	7.06***
Psychotic	1.72	0.50	1.35	0.16	7.53***

As can be seen from Table 1, compared with the national norm, there are significant differences in the mean values of SCL-90 factors of freshman girls. As shown in Table 2, the SCL-90 factors of sophomore girls also have significant differences compared with the national norm. The above results show that, the mental health of first- and second-year female college students is generally lower than the national norm. It is pertinent to note that freshmen are not adapted to the new learning and living environment, students with poor psychological quality are often prone to self-esteem and low self-esteem when encountering difficulties and failures, there are often phenomena of withdrawal, avoidance, and stubbornness in communication. Some sophomore girls appear to be self-righteous and self-centered in their interpersonal communication. This alludes to a situation where you are inconsistent with your own views and beliefs, and cannot seek common ground while reserving differences, but are stubborn and refuse or are incapable of living in peace with others (de Andrade Lage et al., 2020). Some students lose confidence in their ideals and pursuits, cannot face the reality, and have symptoms such as depression and anxiety. The main cause of hostility, paranoia, psychosis and other symptoms is that some college students are one-sided, psychologically stressed, and fatigued.

Comparison of the emotional experience of freshman and sophomore girls participating in aerobic exercise (see Figure 1).

The percentage of female first-graders who feel very good during exercise is 27%, good is 53%, generally 11.5%, and poor is 1.9%. The percentage of second-year girls who feel very good during exercise is 32%, the good is 40.8%, the general is 20.1%, the poor is 4.3%, and the poor is 2.8%. In the process of participating in aerobics exercises among girls of all grades, more than 80% of them have an overall good emotional experience. While investigating the reasons for the poor feeling of the girls in each grade during the exercise, the main reason is that the subjects themselves are depressed, the training methods are single, and the subjects are fatigued.

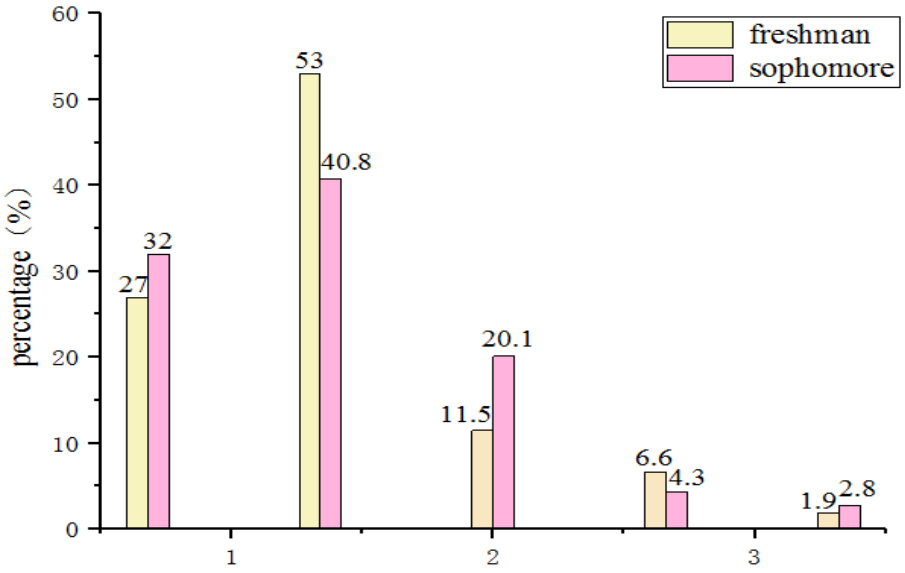

Figure. 1 Comparison of the emotional experience of freshman and sophomore girls participating in aerobic exercise.

Analyze these reasons, aerobics is a sport that combines gymnastics, music and dance, compared with other projects, the music emphasizes the excitement of the melody and the strong sense of rhythm; Its movements are generous and stretch, full of beauty, and a display of strong charisma and attractiveness. At the same time, because the exercise load and difficulty of aerobics can be adjusted according to the age, physical fitness and other characteristics of the practitioner, it is more easily agreeable to students (Kim, 2020). Therefore, against the exciting and cheerful music, the subject performs stretching and bodybuilding exercises, quickly integrating into it and experiencing a cheerful and unrestrained emotional experience (Joa et al., 2020).

Comparison of scores of SCL-90 factors between freshman and sophomore girls before and after the experiment

A pre and post-experiment comparison of SCL-90 scores of freshmen and sophomore girls can be seen in Table 3. Freshman girls have six factors of compulsion, interpersonal, depression, anxiety, hostility, terror, paranoia and psychosis; somatization was 1.49 before the experiment and 1.44 after the experiment, showing a significant difference. As can be seen from Table 4,

sophomore girls report on six factors of compulsion, interpersonal, depression, hostility, paranoia, and anxiety, and there are significant differences found before and after the experiment. The score of SCL-90 factor after the experiment was significantly better than that before the experiment. Research indicates that aerobic exercise can obviously promote the mental health of freshmen and sophomore female college students.

Table 3

Comparison of the scores of SCL-90 factors of freshman girls before and after the experiment

Factor	Before the experiment(N =110)		After the experiment(N =110)		t value	Sig.
	M	SD	M	SD		
Somatization	1.48	0.40	1.43	0.32	0.56	0.56
Force	2.16	0.42	1.72	0.46	3.57	0.001
People	2.09	0.52	1.71	0.46	3.13	0.003
Depression	1.88	0.45	1.55	0.32	3.13	0.003
Depression	1.71	0.43	1.54	0.29	2.09	0.044
Hostility	1.82	0.54	1.54	0.36	2.43	0.022
Fear	1.57	0.38	1.54	0.48	0.20	0.82
Paranoid	1.81	1.42	1.53	0.40	2.59	0.014
Psychotic	1.82	0.35	1.52	0.59	2.24	0.031

Note: Sig. represents the significance value of the factors before and after the experiment; the same as the table below.

Table 4

Comparison of scores of SCL-90 factors of sophomore girls before and after the experiment

Factor	Before the experiment(N =110)		After the experiment(N =110)		t value	Sig.
	M	SD	M	SD		
Somatization	1.43	0.33	1.43	0.28	0.057	0.983
Force	1.97	0.40	1.68	0.37	2.55	0.015
People	2.05	0.57	1.59	0.36	3.77	0.001
Depression	1.95	0.49	1.62	0.32	3.08	0.003
Depression	1.75	0.47	1.48	0.32	3.41	0.001
Hostility	1.72	0.46	1.45	0.33	2.66	0.0011
Fear	1.56	0.34	1.53	0.29	0.32	0.741
Paranoid	1.85	0.49	1.53	0.34	2.71	0.011
Psychotic	1.72	0.50	1.49	0.28	1.86	0.071

It can be seen from Table 3 and Table 4 that aerobic exercise has no obvious effect on the two factors of somatization and terror, therefore, the scores of the two factors after the experiment are the same as before the experiment, which is significantly higher than the national norm. Although the scores of anxieties and psychotic factors decreased significantly from before the experiment, but it is still higher than the national norm. Analyzing the reasons, some studies have shown that the SCL-90 scale for male and female college students is different in some factors. The above 4 factors have higher scores, and these may potentially be related to the gender characteristics of girls, girls are perceived to be more timid and sentimental. The above research shows that, emotional improvement may be related to the characteristics of exercise activities. If an individual is engaged in pleasurable, non-competitive or rhythmic activities, he may experience a good emotional effect (Bagheri et al., 2020). Characteristically, aerobic exercise is different from activities of daily living, participants don't have to resort to language media, it relies more on physical communication, it provides a place to socialize for those female college students who are introverted and not good at communication/speech. In exercise activities, sometimes it is necessary to help each other learn from each other and cooperate collectively, leading to the establishment of harmonious interpersonal relationships and reducing hostility. More and more studies have shown that exercise is closely related to a change in mental state. Such as after exercise, increased blood flow and oxygen uptake, it has a good physiological effect on the central nervous system (Li et al., 2020). Exercise changes the autonomic nervous system, as the secretion level of certain glands increases, slowing down negative and melancholic emotions. After exercise, the

myoelectric activity decreases or calms down, so as to reduce the muscle tension in the stress effect, thus, symptoms of psychosis, compulsion, paranoia, and hostility are alleviated.

After the experiment, the comparison of the SCL-90 factor scores of freshmen and sophomore girls with the national norm

As can be seen from Table 5, after the experiment, freshman girls show significant differences in the scores of the four factors of somatization, anxiety, horror and psychosis, as compared with the national norm. It can be seen from Table 6 that sophomore girls also have significant differences in the scores of the four factors of somatization, anxiety, horror, and psychosis compared with the national norm. Sophomore girls' scores on the interpersonal relationship factor are significantly lower than the national norm. In terms of the interpersonal relationship and melancholy factors of freshman girls, although the sophomore girl's hostile factor score is lower than the national norm, the difference is not significant. Research shows, the mental health level of female college students in the experimental group was significantly higher than that of ordinary female college students.

Table 5

Comparison of SCL-90 factor scores of freshman girls after the experiment with the national norm

Factor	Big group(N =110)		National norm		t value
	M	SD	M	SD	
Somatization	1.43	0.32	1.33	0.44	3.17**
Force	1.72	0.46	1.68	0.60	0.88
People	1.71	0.42	1.75	0.66	-0.97
Depression	1.55	0.32	1.56	0.60	-0.31
Depression	1.54	0.29	1.41	0.42	4.53***
Hostility	1.54	0.36	1.49	0.56	1.41
Fear	1.54	0.48	1.32	0.46	4.70***
Paranoid	1.53	0.40	1.51	0.59	0.50
Psychotic	1.52	0.59	1.35	0.46	2.96**

Table 6

Comparison of the SCL-90 factor scores of sophomore girls after the experiment with the national norm

Factor	Big group(N =110)		National norm		t value
	M	SD	M	SD	
Somatization	1.44	0.28	1.34	0.44	3.57***
Force	1.68	0.37	1.68	0.60	0
People	1.59	0.36	0.75	0.66	-4.48***
Depression	1.42	0.32	1.56	0.60	1.88
Depression	1.48	0.32	1.41	0.42	2.19*
Hostility	1.45	0.33	1.48	0.56	-1.21
Fear	1.53	0.29	1.32	0.46	7.26***
Paranoid	1.53	0.34	1.51	0.59	0.58
Psychotic	1.49	0.28	1.35	0.46	5.01***

Conclusion

College is the last stop to receive systematic physical education in life, as well as the key period to improve physical abilities and cultivate fitness awareness. Through their school, students participate in physical exercise motivation, sports, sports time, affected factors and other aspects of the investigation. For college students, mental illnesses can have potentially serious and far-reaching effects on their health than just physical illnesses. From the practical experience of sports, short-term physical exercise can temporarily regulate people's bad emotions, the long-term appropriate number of sports can improve the cultivation of people's psychological quality. Aerobic exercise plays an important role in cultivating students' mental health, as it can help college students establish mental health awareness, enhance psychological adjustment ability, encourage them to understand themselves correctly, enhance individual levels of self-confidence, learn to cooperate, and compete, inculcate the psychological quality of optimism, improve the ability to deal with setbacks, adapt to society, and promote the sound development of college students' personality.

On account of its inherent characteristics, aerobic exercise can improve the psychological condition of college students compared with anaerobic exercise. College students should choose appropriate projects to exercise according to their own interests and psychological state and stick to it for a long time.

Implications of the Study

This study carries a number of important implications based for theory as well as practice. Theoretically, this study contains valuable implications because this study examines the role of aerobic exercise in mental health. The relationship between aerobic exercise and mental health has been rarely explored in the context of college students. Although, a few studies have examined the role of aerobic exercise with respect to mental health, for the most part, literature has ignored or downplayed the role of aerobic exercise in affecting the mental health of college students. Additionally, this study considered various factors such as somatization, force, people, depression, hostility, fear, paranoid, and psychotic which have been rarely focused by previous studies. Hence, the current study has several unique aspects which have vital implications for theory. Furthermore, along with theoretical contribution, this study also offers practical insights. The results of the current study can be helpful for formulating various strategies to enhance college students' mental health which, in turn, will potentially positively impact on their academic performance.

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