

The influence of exercising on the negative emotions of high school students

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Abstract. Middle school students are often affected by negative emotions, which significantly harm their physical and mental health. Physical exercise may be an effective form of relief. This study discusses the alleviating effect of basketball training on high school students' bad emotions. This study recruited 62 high school students and divided them into 2 groups. The control group didn't do any basketball-related training, and the basketball training group did regular basketball training. We gather the statistics by sending out questionnaires about whether they are training or not and their anxiety score. The statistical results show that the anxiety level of the exercise group was significantly lower than that of the control group. This showed that basketball training is an effective way to relieve the bad emotions of high school students.

Keywords: Negative emotions; exercise; High school students; Basketball.

1. Introduction

Negative emotions could be defined as miserable feelings such as anger, stress, and anxiety (Günavdi et al., 2020). High school students nowadays face a considerable number of negative emotions due to various kinds of factors. Academic demands are one of them (Pascoe et al., 2020). Final grades, excessive homework, term papers, examinations, and studying for examinations were the most stressful for them (Kohn & Frazer, 1986). Moreover, those students who unfortunately faced bullying during high school were more likely to have depression and suicide later (Klomek et al., 2011). Covid 19 is a new and severer one. To slow down the spreading of the virus, countries imposed various restrictions: students were asked to study online or closed at school. A study had shown that students were much more stressed when dealing with problems during online studying, and were anxious about their future careers. (Aristovnik et al., 2020). Moreover, another study in one of the first and hardest regions directly pointed out that a significant number of students suffer from various kinds of negative emotions, and even a significant proportion of students might require psychological support (Essadek & Rabeyron, 2020).

High levels of negative emotions will bring significant negative influences to students in various ways. One study showed that negative emotions could bring problems to our health by affecting our immune system (Kiecolt-Glaser et al., 2002). Another study had shown that mental problems derived from negative emotions were related to withdrawing from school (Van Ameringen et al., 2003). Anxiety (which is a kind of negative emotion) tended to make people less likely to socialize with others (Wu et al., 2013) was suggested by another study. To those students who were athletes, negative emotions including cognitive anxiety will make athletes perform poorly (Kais & Raudsepp, 2005). Moreover, bad mental conditions will lead to a long-term passive effect. A study showed that having poor mental health around the teenage age is likely to have more problems with their future employment and more reliance on government welfare (Pascoe et al., 2020).

To reduce those bad effects of negative emotions, scientists had done various research. A study showed that regular exercise can change people's feelings from negative to positive without having any side effects on their mental and physical functioning (Al Sudani, 2015). An experiment done at an American university suggested that all of the participants who had different gender and did different types of sports gained the same levels of happiness after exercising (Morris et al., 2009). High-intensity aerobic exercise was tested to be useful to reduce fear of anxiety-related bodily sensations (Broman-Fulks et al., 2004). Also lung-cancer patients were found to have significant improvements in their anxiety and depression levels after 3 weeks of a regular moderate-intensity walking training program (Narazaki et al., 2009). Because basketball is an easily accessed sport and

a popular sport in North America and worldwide (Trojian et al., 2013), and it included a lot of running, jumping, and walking which are all aerobic exercises (Narazaki et al., 2009), we chose it as a representative of exercises. Even though there aren't many studies directly testing the relationship between basketball training and the reduction of negative emotions, basketball should have been an effective way to fulfill it. Nevertheless, a study done at another university showed different exercise methods have desperate therapeutic when treating depression and anxiety disorder (Wang et al., 2019). In addition, based on these studies further understanding of the effectiveness of exercise in directly reducing negative emotions towards high school students is not concluded. By asking high school students to fill out questionnaires including questions about basic information about their basketball playing habit and their emotional state, we could test our hypothesis about exercise being an effective way to reduce negative emotions.

2. Methods

2.1 participant

The minimum sample size was 36, calculated according to G* Power software (T-test, Effect size = 0.5, Power = 0.8, $\alpha=0.05$). We recruited 62 high school students, 38 of whom do not regularly play basketball (10 male, mean age=16.83, age range =15-19), 35 of whom play basketball regularly (26 male, mean age=16.75 age range =15-19, average beginning age: 12.79, average training age: 5.21). Because of abnormal anxiety scores or not finishing all of the questions, subjects were excluded. 24 qualified responses ended up in the basketball players group and 30 qualified responses ended up in none basketballers group.

2.2 materials

A questionnaire included questions about whether the participants played basketball regularly. The participants who played basketball were also asked to answer when they started to play basketball and how long had they played basketball regularly. In addition, both the participants who played basketball and the participant who didn't were asked to fill out the Beck Anxiety Inventory to test the levels of their negative emotions.

The Beck Anxiety Inventory (BAI; Beck et al, 1988) is a self-report inventory for measuring the severity of anxiety in psychiatric populations. One scale consists of 21 items, each describing a common symptom of anxiety. The participants were asked to rate how much he or she has been bothered by each symptom over the past week on a 4-point scale: the participants who didn't have any symptoms scored 0, have mild symptoms but were not bothered scored 1, have symptoms but tolerable scored 2, have symptoms that were so severe that they can barely tolerate score 3. Every score added up to get the final total score. The higher the final score was, the more anxious the participants were.

2.3 procedure

Participants finished the basic question based on their personal experiences and the BAI included in the questionnaire based on their behavior and feeling during the past week.

2.4 statistical analysis

First, descriptive statistics were made on the anxiety levels of the two groups, and then the independent sample T-test was used to examine the possible differences in the anxiety levels of the two groups. All data were analyzed using SPSS 22.0, $\alpha = 0.05$, and effect sizes were reported using d along with t values.

3. Results

3.1 Descriptive statistics

The age of the control group was (M=17.5, SD=3.05), and the anxiety score was (M=9.5, SD=8.16). The age of the basketball training group was (M=22.2, SD=9.33), and the anxiety score was (M=3.93, SD=3.29), as shown in Table 1.

Table 1. Descriptive statistical information on each index of the two groups of participants

Measure	Training group (N=24)	Control group (N=30)
Ages	22.2(9.33)	17.5(3.05)
Anxiety score	3.93(3.29)	9.5 (8.16)

3.2 Anxiety levels between two groups

Independent sample T-test results showed significant differences in anxiety levels between the two groups: the anxiety level of exercise group (M=3.9333, SD=3.29) was significantly lower than that of control group (M=9.50, SD=8.16), $t(52) = -3.412$, $P < 0.05$, 95%CI = [2.29, 8.84], $d = 0.90$. See Figure 1.

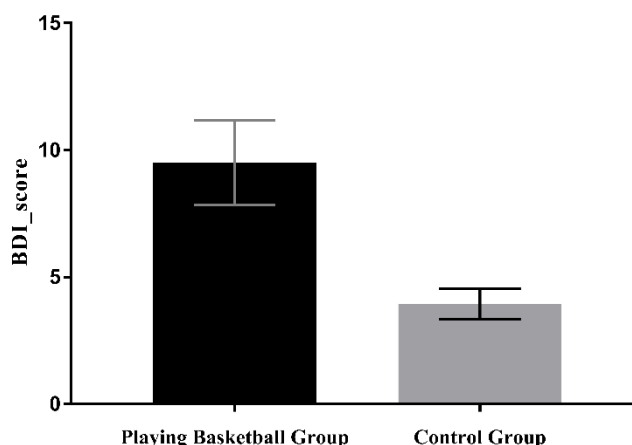


Figure1. T-test results of anxiety scores in both groups

4. Discussion

We hand out questionnaires online to high school students to research how long they persist playing basketball and their corresponding anxiety score. Based on the statistical results obtained from the questionnaire, basketball training among high school students could reduce negative emotions, especially anxiety. This result was consistent with other studies (Taylor, Sallis, & Needle, 1985; Bahrke & Morgan, 1978), which showed that exercise could reduce anxiety tested by directly controlled experiments. Other negative emotions were tested to be reduced by exercising, too. Exercise is useful for stress management. (Jackson, 2013). Anger and depression are other negative emotions that were tested to be decreased after regular exercise.(Hassmén et al., 2000). Moreover, from a cross-sectional study in America, scientists found out that popular team sports improve mental health better than other kinds of sports. This study put more credit on our study, since basketball is included in the group of popular team sports. Therefore, regular basketball training is an available method for managing high school students' negative emotions.

The mechanism behind exercise reducing negative emotions could be the increase in happiness after exercise. A study determined that exercise led to the most significant increase in happiness among a few entertainments, using the Oxford Happiness Inventory. (Hills & Argyle, 1998). Since the lack of happiness is very likely to result in depression (Kristin Layous, 2011), increasing happiness will be an efficient way to reduce negative emotions. The mechanism behind happiness is brain substances -- endorphin and dopamine. Some experiments showed that exercise could increase

a specific kind of endorphin level (Goldfarb & Jamurtas, 199), and dopamine levels also increase after exercising (Sutoo & Akiyama, 2003). Moreover, neuroscience studies showed that neurotransmitters including dopamine and endorphin control happiness (Dfarhud et al., 2014). Therefore, shedding light on reducing negative emotions and bringing happiness by exercising.

Nevertheless, (1) our present study didn't do any direct-controlled experiment (dividing participants into a control group and a basketball playing group and trained regularly for a period of time) because of time and space limitations brought by covid19 restrictions. (2) We only investigate the role of basketball training on high school students' negative emotions. Further study can include more kinds of exercise that have different functions behind, for example: strength training as a representative of anaerobic training and tennis as a representative of individual exercise. (3) our explanation of the mechanism behind basketball, which dopamine and endorphin produced by exercises can turn negative emotions into positive ones, was not straightforwardly proved by any experiments or statistics. More studies from neuroscientists or other experts in this field should be done. (4) The research participants are mainly high school students in a certain area, which have great homogeneities. Therefore, the extrapolation validity of the research conclusion still needs to be tested.

5. Conclusion

Basketball exercise is one of the effective ways to reduce negative emotions among high school students.

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