

Effects of 8-Week Maximal and Sub-Maximal Aerobic Exercises on High School Students' Anxiety**¹Ali Reza Khademi, ²Golamhosyn Rahimi**¹Department of Physical Education and Sport Sciences, Nahavand Higher Education Complex, Bu-Ali Sina University, Hamadan, Iran²Department of Physical Education and Sport Sciences of Malayer University

Ali Reza Khademi, Golamhosyn Rahimi: Effects of 8-Week Maximal and Sub-Maximal Aerobic Exercises on High School Students' Anxiety

ABSTRACT

The main purpose of this enquiry was to investigate effects of an 8-week maximal and sub-maximal selected aerobic exercise program on anxiety of female high school students. Anxiety sufferers have been reported to comprise 5 to 15 percent of the population in developing countries. To evaluate the effects of aerobic training programs and after screening for particular diseases almost 90 students were asked to participate in the study. participants were randomly assigned into experimental group No. 1 (EG1, n= 30, 8 weeks, 3 times per week, 3,200 m sub-maximal aerobic running), experimental group No. 2 (EG2, n= 30, 8 weeks, 3 times per week, 3,200 m maximal aerobic running); and the control (CG, n= 30, no participation). Illinois anxiety test (CSAI-2) was used to collect data. Results showed a significant decrease of students' anxiety in both EG1 and EG2 after 8-week of training ($P < 0.05$) compared to the control; while there was no significant difference between EG1 and EG2. In the control, no significant decrease in the somatic and cognitive anxiety was observed. It can be concluded that the effects of aerobic exercise program on the anxiety (maximum or below the maximum) does not depend on the type of training.

Key words: maximal; sub maximal; aerobic training ,somatic; cognitive; anxiety.**Introduction,**

Anxiety is an unpleasant feeling of restlessness. Anxiety and stress are increased as a result of stressful environmental demands. It is a perceived imbalance between environmental demands and person's ability [11]. Anxiety is a normal human emotion that everyone experiences at times. Many people feel anxious, or nervous, when faced with a problem at work, before taking a test, or making an important decision. Anxiety disorders, however, are different. They can cause such distress that it interferes with a person's ability to lead a normal life [12,19].

Anxiety consists of two subcomponents: cognitive and somatic anxiety, which influence performance [18]. The cognitive is the mental component, which is characterized by negative expectations about success or self-evaluation, negative self-talk, worries about performance, images of failure, inability to concentrate, and disrupted attention [18]. The somatic is the physiological element, which is related to autonomic arousals, negative symptoms such as feelings of nervousness, high blood pressure, dry throat,

muscular tension, rapid heart rate, sweaty palms and butterflies in the stomach [18]. Agitation, unrest and myelopathy, nervousness, palpitations, abnormalities in offal, and like them are signs of anxiety. Anxiety may be an internal source, such as circulatory failure or lack of oxygen or may be its origin outside the body [29].

Researchers have reported that over 50 percent of consultations among children at sport events were related to stress or anxiety problems [12]. People, who experience high levels of anxiety, are also more likely to withdraw from performances, suffer muscle pain, sickness and become aggressive during performances. Furthermore, they experience sleeping problems, injuries in sports and have very low self-confidence. Anxiety is a negative emotion that affects perceptions in sport competitions and other performances, and this leads to majority of children to consider anxiety to be debilitating towards performance, which may result in decreases in activity [26]. When anxiety is not managed appropriately, children lose control and performance levels decrease [18].

According to World Health Organization, the prevalence of mental illness in children and

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adolescents are developing and have been reported 5 to 15 percent in developing countries. About 20 percent of children in these communities are suffering from behavioral disorders. Mental disorders, especially anxiety is common in this century that is caused abnormal behaviors in society, anger and fled from the school [2]. In various societies, exercise therapy are used as one of the useful and effective methods in patients with mental disorders [2]. Aerobic activities such as jogging, soft, slow running and Cooper have been described as adjustment factors for stress, anxiety and depression [24]. Piri and colleagues [24] in the Ilam city on 60 high school students showed that 8-week maximal aerobic exercise, using session durations of at least 30 minutes and 50 to 60% of VO_{2max} , reduce anxiety and depression, significantly. Kim and colleagues [14] found aerobic (maximal and sub maximal) and non-aerobic exercise each altered sensations of anxiety. Participants were separated into four groups, two of which performed aerobic exercise while the other two participated in non-aerobic, body conditioning exercises. The individuals who took part in a single 40-minute aerobic routine reported increased feelings of positive well-being and decreased psychological stress, with no change in anxiety found within the non-aerobic group. Compared with aerobic exercise, non-aerobic activities commonly resulted in no difference, or even small increases, in anxiety [4]. Kim [14] specified that non-aerobic routines are not as effective at altering anxiety because individuals experience boredom and are not stimulated by the activity enough to distract themselves from their negative moods.

There are several theories about aerobic exercise, that reduces anxiety and psychological discomfort. Bartholomew and Linder (4) suggested that the effect of aerobic exercise on anxiety is due to the removal of stressful stimuli from the environment. Petruzzello and colleagues [23] believed that the presence of aerobic exercise creates an opportunity to feel successful in sport and relaxation in a person. They [23] expressed that the practice reduces several physiological factors related to stress, such as: muscle tension, rapid heart rate. Physical activity can be more effective than more anti-anxiety drug. Long and Stavel [17] believe that the exercise removed mind from problems and can be regulated emotional and physical reactions to stimuli during exercise and after exercise. Exercise and physical activity have long-term and desirable effects on self-confidence and positive self-image. All above mentioned, in regular and long-term effects of aerobic exercise. In cross-sectional and short-term exercise may does not reveal such effects. exercise training significantly reduced anxiety symptoms by a mean effect Δ of 0.29 (95% confidence interval, 0.23-0.36). Exercise training programs lasting no more than 12 weeks, using

session durations of at least 30 minutes, and an anxiety report time frame greater than the past week resulted in the largest anxiety improvements [17]. Berger and Motl [6] also indicated that aerobic exercise decreased feelings of state anxiety. This study concluded that exercise was conducive to anxiety reduction because it incorporates repetitive movements, did not involve competition with others, was a predictable activity and required a steady, relaxed breathing pattern. The repetitiveness and rhythm associated with aerobic exercise lessen anxiety because these movements do not require excessive attention. Berger and Motl [6] suggested that the lack of competition in aerobic exercise improved mood by letting the individual participate for enjoyment of the activity, leading to positive outcomes and less self-criticism. Raglin and Morgan [26] expressed self-regulation in speed and intensity of exercise is another factor to reduction of anxiety in aerobic exercises.

The researchers studied two groups (experimental and control group). Experimental group 1 choosed intensity and speed of exercise freely. Experimental group 2, were forced to raise the intensity of activity, gradually. Control group didn't participate in any intervention. Anxiety in the first group significantly decreased, but completely reversed in the second group and the anxiety has increased. The control group did not show any change in anxiety.

It is concluded that exercise and quiet rest have similar effects on somatic and cognitive anxiety, and both conditions are followed by a transitory reduction in blood pressure. These anti-anxiety effects, however, are sustained for a longer period following exercise [26].

Akander [1] studied the effect of exercise on women and men with anxiety. Results showed that anxiety levels decreased in both sexes. Pourranjbar and colleagues [25] found that both aerobic and anaerobic exercise can reduce anxiety. Other findings [5] have shown that moderate to intense aerobic exercise has a great impact on reducing depression and anxiety.

Existing meta-analysis shows that anti-anxiety effect of the exercise is effective when: 1 - aerobic exercise (such as swimming and cycling) 2 - long term of fitness program is high (between 10 and 15 weeks) 3 - at the start of sports, participants have more anxiety and lower physical fitness [16].

Millions of students and people suffer from somatic and cognitive anxiety each year. Most anxious patients first seek treatment from their primary care providers. Generally, anxious patients treated in primary care settings receive pharmacologic therapy alone. There is evidence to suggest that the addition of cognitive-behavioral therapies, specifically exercise, can improve treatment outcomes for many patients. Exercise is a behavioral intervention that has shown great promise

in alleviating symptoms of anxiety. Physical education and sport culture not only prevent of diseases and social crimes, but only it is an efficient method for using of manpower. Therefore, it needs to be confirmed by researches in this field. The current study attempt to evaluate the effects of 8-week maximal and sub-maximal aerobic exercises on cognitive and somatic anxiety in female high school students in Boroujen that supports the efficacy of exercise as an adjunct treatment.

Methodology:

The study was conducted among female high school students in Boroujen. For this reason, high schools were divided into four regions and among regions, one region was selected randomly. According to the method and content of research and test, all of the volunteer students were measured. The medical history of students were investigated and the incomplete histories were referred to physician for

examination. The students that suffer from specific diseases such as asthma, diabetes, renal disease and cardiovascular disease were excluded from the study and finally 90 students were selected. After the well, the students were randomly assigned to experimental groups 1, 2 (EG 1, 2) and control groups (CG). Group 1 participated in 8-week sub-maximal aerobic exercise program, group 2 participated in 8-week maximal aerobic exercise program. Control group did not participate in any intervention. Training program for EG 1 included 8-week, 3 time at week, 3200 m sub maximal aerobic running. Training program for EG 2 included 8-week, 3 time at week, 3200 m maximal aerobic running (Cooper). For data analysis was used SPSS software, depended and independent T-test. For collection of data was used of CSAI-2. All of the statistical processes performed in 95% confidence interval.

Findings:

Table 1: Mean of age, weight, height, Cognitive and somatic anxiety in Experimental group 1, 2 and control group.

Groups	Age	Weight	Height	Test	Cognitive anxiety	Somatic anxiety
EG 1*	16±2	46±5	161±8	Pre test	22.33±4.38	18.13±4.68
EG 2**	16±2	47±6	160±9	Pre test	23.20±5.11	18.07±4.66
CG	16±2	47±6	160±9	Pre test	21.20±3.55	18.20±4.03
EG1				Post test	17.93±4.74	13.73±4.65
EG 2				Post test	17.13±4.67	17.13±4.67
CG				Post test	21.20±3.48	18.73±4.07

*Sub maximal aerobic training group

** maximal aerobic training group

Table 2: Mean of cognitive anxiety, in experimental group 1, experimental group 2 and control group in pre test and post test

Test	Subjects	Cognitive anxiety	P	T	Subject	Cognitive anxiety	P	T	Subject	Cognitive anxiety	P	T
Pre test	EG1	22.33± 4.38	0.00	11.3	EG2	23.20± 5.11	0.00	3.77	CG	21.20± 3.55	1.0	0.0
Post test		17.93± 4.74				17.13 ± 4.67				21.20± 3.48		

* P<0.05

Table 3: Mean of somatic anxiety, in experimental group 1, experimental group 2 and control group in pre test and post test.

Test	Subjects	Somatic anxiety	P	T	Subjects	Somatic anxiety	P	T	Subjects	Somatic anxiety	P	T
Pre test	EG1	18.13± 4.68	0.007*	3.1	EG2	18.07± 4.66	0.020*	2.6	CG	18.20± 4.03	0.59	-
Posttest		13.73± 4.65				13.67 ± 3.15				18.73± 4.07		0.54

* P<0.05

Table 4: Cognitive anxiety in experimental groups(1 and 2) after 8 weeks program training

Test	Subjects	Cognitive anxiety	P	T
Post test	EG 1	17.93 ± 4.47	0.645	0.465
	EG 2	17.13 ± 4.67		

Table 5: Somatic anxiety in experimental groups(1 and 2) after 8-week program training

Test	Subjects	Somatic anxiety	P	T
Post test	EG 1	13.73 ± 4.65	0.96	0.04
	EG 2	13.67 ± 3.15		

Table 6: Cognitive anxiety between experimental and control groups after 8-week program training

Test	Subjects	Cognitive anxiety	P	T
Post test	EG 1	17.93± 4.74	0.041*	-2.14
	CG	21.20 ± 3.48		
	EG 2	17.13 ± 4.67	0.012*	-2.70
	CG	21.20 ± 3.48		

P<0.05*

Table 7: Somatic anxiety between experimental and control groups after 8-week program training

Test	Subjects	Somatic anxiety	P	T
Post test	EG 1	13.73± 4.65	0.004*	-3.13
	CG	18.73 ± 4.07		
	EG 2	13.67 ± 3.15	0.001*	-3.80
	CG	18.73 ± 4.07		

P<0.05*

Conclusion:

Results of study showed, in experimental group 1 after 8-week, cognitive anxiety decreased significantly (P <0.05). The results of this study is consistent with Peeri and colleagues [24]. Kim and colleagues [14] in their study on two groups of sub-maximal and maximal exercise showed that sub-maximal aerobic exercise for 40 minutes caused a significant decrease in anxiety in high school students. Regardless of the method, results of this study is consistent with Kim and colleagues.

Experimental group 1 after 8-week exercise program decreased somatic anxiety significantly (P <0.05). The results of this study is consistent with Harris [10]. Harris and colleagues [10] showed, aerobic exercises reduced somatic anxiety in individuals [7]. The overall results seen in reductions of average scores on somatic anxiety are similar to those found by Robin Ving research [27]. He used a similar procedure to that of the present study in analyzing anxiety related to female school students. Contrary to the present study's results, Stephen [29] found that the training in similar conditions and physical activity affect in reducing anxiety, but this reduction may not be significant [20]. The results of this study does not conform with current study regard to the level of significance.

Experimental group 2 after 8 weeks maximal aerobic exercise decreased cognitive and somatic anxiety as significantly (P <0.05). The present results is consistent by Taylor (31). He found that maximal activity reduced cognitive anxiety significantly. Raglin and Wilson [26] in their researches showed that a maximum aerobic exercise for 20 minutes on bicycle reduce cognitive anxiety significantly (P <0.05). Various studies conclude that exercise regimes must take place at least three times a week, for no less than 20 minutes at a time, for seven to eight weeks to be effective [23]. Knapen [15] showed that maximal aerobic exercise or physical activity for 20 minutes on ergometer reduce anxiety significantly. The overall results seen in reductions of average scores on cognitive anxiety are similar to those found by Petruzzello [23], Raglin [26] Wilson [26] and Knapen [15] researches.

There is no significant difference between groups 1 and 2 after 8weeks physical exercise on cognitive anxiety. There is not significant difference between maximal and sub maximal training in their effects on anxiety. Predictable condition and training by the subject is important issue in the sub maximal exercise and maximal aerobic activity. This creates good feelings and due to decrease anxiety in the subjects.

There was significant difference between experimental and control groups in reducing cognitive and somatic anxiety. There was not any significant difference in control group before and after the program. In support of predictions made and descriptive statistics found in the present study, previously discussed research by Kim [14], Bartholomew [4], and Berger [6] all show decreases in anxiety due to aerobic exercise routines compared with a control activity or other anxiety-reducing techniques. Sedentary lifestyle and lack of physical activity reduce feeling of well-being and increase mental illnesses and certain diseases such as, diabetes and cardiovascular diseases. There is significant correlation between low physical activity and anxiety [30].

The endogenous opioids seem likely to be assigned a significant role in the integrated hormonal and metabolic response to exercise. Most studies [3] have demonstrated that serum concentrations of endogenous opioids, in particular beta-endorphin and beta-lipotrophin, increase in response to both aerobic exercise and training programmes. Elevated serum beta-endorphin concentrations induced by exercise have been linked to several psychological and physiological changes, including mood state changes and 'exercise-induced euphoria', altered pain perception, menstrual disturbances in female athletes, and the stress responses of numerous hormones (growth hormone, ACTH, prolactin, catecholamines and cortisol). Many reports [3] have described a role for the endorphin response as seen during exercise and have used the opioid receptor antagonist, naloxone, to investigate and verify the degree of involvement of the opioids. However, whether the observed increases in peripheral endorphin concentrations are sufficient to cause immediate mood changes, create menstrual cycle dysfunction or

alter pain perception is still not resolved. A relatively new implication for the endorphins and associated changes with exercise is in ventilatory regulation. A number of studies [3] have suggested that endogenous opioids depress ventilation and may, therefore, play a role in ventilatory regulation by carbon dioxide, hypoxia and exercise. It may also be possible that during exercise, the perception of fatigue is modulated by an increase of endogenous opioids [3]. During exercise, your heart rate shoots up, but over time, as your fitness level improves, your heart begins to work more efficiently. As a result, your resting heart rate between exercise sessions eventually becomes slower. Improved heart and lung function due to regular aerobic activity are often associated with a greater sense of overall well-being, which can help offset feelings of anxiety [12]. The thermogenic hypothesis suggests that a rise in core body temperature following exercise is responsible for the reduction in symptoms of anxiety [28]. Increases in temperature of specific brain regions, such as the brain stem, can lead to an overall feeling of relaxation and reduction in muscular tension [28].

The distraction hypothesis suggests that physical activity serves as a distraction from worries and depressing thoughts. In general, the use of distracting activities as a means of coping with depression has been shown to have a more positive influence on the management of anxiety and to result in a greater reduction in anxiety than the use of more self-focused or introspective activities such as journal keeping or identifying positive and negative adjectives that describe one's current mood [28]. Exercise has been compared with other distracting activities such as relaxation, assertiveness training, health education, and social contact. Results [28] have been inconclusive, with exercise being more effective than some activities and similar to others in its ability to aid in the reduction of anxiety. However, exercise is known to increase positive affect, which is diminished in anxious patients and is not augmented by distraction activities [28]. Factors of success and failure in previous activities, fear of failure, eating, lack of rest, inadequate nutrition and loss of energy in the body are effective to increase stress. Caffeine and sugar can increase anxiety. Caffeine half-life is longer in patients anxious. Caffeine in the body can increase intensity of anxiety symptoms. Caffeine causes release noradrenaline more, that could be aggravated anxiety. According to physiological aspect, aerobic training by effect on physical fitness, nervous translator, decreasing stress hormones and muscular tension, can be had anti anxiety effects [28]. In terms of psychological, aerobic training, by increasing level of activity and positive reinforcement [5] and providing background of self confidence can decrease anxiety [22]. The exhilaration and depression, genetic, physiological and mental status, physical condition and stresses,

mental-neural factors, hereditary, anxiety, obsessions and fears, health problems and disabilities, un appearance of internal factors reduce amount of confidence and enhance cognitive and somatic anxiety. Mastery of skills, demonstration of ability, social support, environmental comfort, and other factors affect on self confidence [20]. Intensity of sub maximum and maximal aerobic activity predicted by the subjects during 8 weeks and there was not competition between individuals in these exercise training. Students in this study with any feel discomfort participated in activities and were not concerned that you are responsible for these activities or not. These students were participated in this exercise program, with the knowledge of type of the activity and predictable exercise sessions. Anxiety responses in aerobic activity, do not influence by type of activity (maximum or sub maximum). Self choosing exercise intensity [15] can cause positive changes in somatic and cognitive anxiety.

In the present study, it is clear that several problems need to be addressed concerning where the effects on anxiety exist in relation to aerobic exercise. Future research should direct at determining the differences between regular exercisers, non-exercisers and resistance exercisers as this data is inconsistent within this study and throughout the literature on anxiety. An important element in exercise interventions, that was not included in the present study, is the use of a sample that exhibits mild to severe levels of anxiety. Finally, further research should focus on examining aerobic exercise's influence on other, related mood states.

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