The Effect of Exercise on Anxiety of Adolescents with Intellectual Disability

Masoomeh Salehpoor [1], Mohsen Salesi [1], Ghorban Hemati Alamdarloo [2*]

1. Department of Physical Education, School of Education & Psychology, Shiraz University, Shiraz, Iran.
2. Department of Special Education, School of Education & Psychology, Shiraz University, Shiraz, Iran.

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ABSTRACT

Purpose: The present study aimed to investigate the effect of exercise on the anxiety of adolescents with intellectual disability.

Methods: Study method was quasi-experimental with pretest-posttest design and a control group. The study population included all secondary students with intellectual disability in Shiraz City in the academic year 2012-2013. The sample size consisted of 30 secondary students with intellectual disability selected by available sampling method. They were randomly divided into experimental and control groups (15 students in each group). Both groups took the pretest. The experimental group received exercise training in 8 sessions while control group did not. After completion of intervention period, the posttest was administered for both groups. The Zung self-rating anxiety scale was administered to assess the anxiety.

Results: The data analyses by analysis of covariance ANCOVA and multivariate analysis of covariance (MANCOVA) showed that the mean scores of anxiety and its subscales (emotional and physical signs of anxiety) were significantly lower in experimental group ($P<0.01$).

Conclusion: Findings indicated that exercise intervention leads to decrease in the anxiety. Therefore, we suggest designing and implementing exercise programs to decrease the anxiety of students with intellectual disability.

1. Introduction

Intellectual disability is a substantial limitation of mental functioning and adaptive behavior due to various reasons and circumstances [1]. Approximately 50% of people with intellectual disability show at least some psychological problems [2]. Anxiety is one of these problems, and people with intellectual disability often experience high levels of anxiety [3]. Anxiety is the source of too much concern in some aspects of life that are hardly controllable. It is associated with panic and confusion, feeling of stress, activation of the autonomic nervous system, and possibly detrimental effects on skills, performance, and functionality of these people [4].

Although anxiety is a motivational factor and to some extent necessary for self-defense, survival, and protection of the individual against risk factors, it can cause confusion and disintegration of the behavioral organization, and traumatic when surpasses a certain limit. Therefore, anxiety can cause a person to lose control over his or her behaviors and routines [5]. Evidence points anxiety as the cause of several behavioral problems of individuals with intellectual disability, including bed-wetting, nail biting, and thumb sucking; however,

*** Corresponding Author:**
Ghorban Hemati Alamdarloo, PhD
Address: *Department of Special Education, School of Education & Psychology, Shiraz University, Shiraz, Iran.*
Phone: *(+98) 7136134678*
E-mail: *ghemati@shirazu.ac.ir*

by reduction of anxiety and creation of a calm environment these problems tend to eliminate [6].

Anxiety symptoms can be divided into two categories: psychological and physical. Psychological symptoms of anxiety include unease, irritability, fear, aching, feeling of impending danger, touchiness, distress, inability to relax, difficulty in concentrating, and sleep problems. Physical symptoms of anxiety include dry mouth, reddening, nausea and vomiting, fainting, diarrhea, constipation, dizziness, muscle tension, frequent urination, excessive activity, sexual dysfunction, tremor, palpitations, irregular or rapid heart rate, sigh, fast respiration, perspiration, especially in palms, short breathing, paleness, and asphyxia.

According to Jones, psychological distress is the mental component of anxiety, and developed by negative evaluation of performance and implementation, while somatic anxiety is the physiological component of anxiety, associated with arousal of the autonomic nervous system [7].

Exercise and physical activity is one of the most effective interventions to relieve and treat anxiety [8]. It helps the children acquire the ability to learn and use tools, improve their general behavior, foster imagination, have faster movement, and gain mental peace in the course of activities and games [9]. Physical activity has been shown in a meta-analysis to help reduce levels of anxiety, not only by its impact on biological systems, but also by improving emotional status, especially when exercise gives people relief and time away from daily worries. Blick et al. found that routine fitness improves health and psychosocial well-being of individuals with intellectual and developmental disabilities. Their study participants aged from 11 to 92 years, with an average of 49 years. The study investigated the impact of physical fitness on quality of life by comparing individuals who maintain a physically active lifestyle with those who do not report exercising. They assessed several indicators of quality of life, including social participation; satisfaction with professional services, home life, and day activities; dignity, rights, and respect received from others; fear; choice and control; and family satisfaction [10].

In this context, Gould and Weinberg suggested that exercise not only exerts a positive effect on cognitive stability, self-control, and mental function but also reduces anger, anxiety, hostility and stress. In fact, most researchers believe that regular physical activity is associated with positive effects, including improved function of cardiac and respiratory muscles, reduced risk of coronary artery disease, decreased anxiety and depression, and improved efficiency [11]. In a study on 24 persons with mild intellectual disability divided into 3 groups of aerobic exercise, recreational activities, and control; Carmeli et al. concluded that anxiety level decreased in the exercise and recreational activity groups after 6 months [12]. Consistent with the above findings, Carraro and Gobbi in a study on 27 (16 men and 11 women) people with intellectual disability assessed the effect of an exercise program on their anxiety for 12 weeks. The participants' ages ranged from 31 to 49 years.

The training program involved working with ropes, balls, dumbbells, and playing games. They observed that the level of anxiety significantly reduced in the experimental group compared with the control group [13]. Hardoy et al. studied the benefits of mini-tennis in people with intellectual disability. In this study, 24 individuals with intellectual disability aged 18-40 years played mini-tennis for 6 months (2 sessions per week 3 hours each session). Mini-tennis program consisted of 3 stages of introducing ball and racket to participants, development of dynamic balance and coordination skills, and learning basic tennis techniques. The results showed that anxiety significantly reduced in the study group [14].

Regular physical activity (PA) is associated with improved emotional well-being, decreased mortality risk, and symptomatic benefit in many psychiatric disorders. Higher levels of PA are inversely correlated with risk of developing mood disorders across the age range. PA is a broad term to describe bodily movements produced by the contraction of skeletal muscles that increases energy expenditure above a basal level [15].

While physical activity can indirectly improve subjective well-being and life quality by keeping disease and premature death away, there has recently been an increasing interest in its direct role in the prevention and treatment of mental health problems [16].

Khademi and Rahimi on a study of 90 female high school students found that aerobic (maximal and submaximal) and non-aerobic exercise each altered sensations of anxiety. Participants were divided into 3 groups, 2 of them performed aerobic exercise while the other one participated in non-aerobic, body conditioning exercises.

Results showed a significant decrease in students' anxiety in both groups after 8 weeks of training compared to the control. In the control group, no significant decrease in the somatic and cognitive anxiety was observed [17].

Herman and colleagues studied the comparison of anxiety as reported by older people with intellectual disabilities and by older people with normal intelligence. A total of 154 healthy old participants and mild or moderate intellectually disabled (IQ<70), aged 55-85 years were studied. Older peo-

ple with ID reported more symptoms of anxiety compared to their counterparts with normal intelligence [18].

More than half of older people with intellectual disability report such symptoms as tense feelings and worrying, which especially calls for more attention [19]. Millions of students and people suffer from somatic and cognitive anxiety each year. Most anxious patients initially seek treatment from their primary care providers. Generally, anxious patients treated in primary care settings receive medications alone. There is evidence suggesting that the addition of cognitive-behavioral therapies, specifically exercise, can improve treatment outcomes in many patients. Exercise is a behavioral intervention that has shown great promise in alleviating symptoms of anxiety [17].

Physical exercise is used as a method of reducing anxiety in many countries, but it has been ignored in Iran, especially for those with intellectual disability. Lack of specialists in physical education for children with intellectual disability who know methods of interaction with such children as well as shortage of sports facilities in these schools are among reasons for neglecting sports activities for these children in Iran.

Providing physical and mental health for these children needs due attention to their improvement, treatment, and rehabilitation in national health plans. Treatment strategies can assist parents and educators in rehabilitation of these children, which involves consideration of the role of exercise in improving and treatment of behavioral disorders [14]. Thus, it is essential to assess the effectiveness of exercise on anxiety in students with intellectual disability to fill the gap in research and take steps to improve their mental health. Hence, the present study sought to examine the effect of exercise intervention on anxiety of the students with intellectual disability. The results of this study improve our knowledge of rehabilitation. And they can be used by exercise physiologists, rehabilitation specialists, pediatric psychologists, and teachers of schools for children with special needs to help children with intellectual disability.

2. Materials & Methods

Study procedure was quasi-experimental with pretest-posttest design with a control group.

The study population and sample

The study population consisted of all students with intellectual disability enrolled in academic year 2012-13 in special high schools of Shiraz for students with intellectual disability. Study subjects included 30 girls of Motahari High School students with mild intellectual disability (IQ:55-70). The participants' ages ranged from 15 to 21 years. They were selected by available sampling method and randomly divided into experimental (n=15) and control (n=15) groups.

Research tool

We used Persian version of Zung self-rating anxiety scale to assess participants' anxiety. This scale was developed by William Zung in 1997. It was translated by Karami in 2012 and has 20 multiple-choice questions in 2 dimensions: Cognitive symptoms of anxiety and physical symptoms of anxiety. Grading of scale is as follows: in positive questions, 1=never or rarely, 2=occasionally, 3=more often, and 4=permanently or almost always. The scoring of negative questions is the inverse of scoring for positive questions. The reliability of this scale has been reported as 0.84 using Cronbach α and its validity as 0.71 by calculation of correlation between the score of Zung self-rating anxiety scale and Hamilton anxiety scale [19]. Lindsay and Michei have reported the reliability of Zung self-rating anxiety scale as 0.69 using Cronbach α and its reliability as 0.59 using correlation with general health questionnaire [20]. The questionnaire was submitted to each subject who was asked to study it carefully and mark one of the four choices. They would be aided if required help or did not understand the questions. If a student had trouble reading, the questions were read for her one by one and the responses were checked.

Intervention

Independent variable in this research was exercise activities for the students in the experimental group, the effect of which was studied on the dependent variable (i.e. anxiety in high school students with intellectual disability). The experimental group did exercise activities for 8 weeks, 3 sessions per week in 60-minute sessions. Exercise activities comprised aerobic activities and resistance exercises such as working with dumbbells, rope, and ball. Subjects started warm-up step with gentle running and stretching movements for 10 minutes, and then rhythmic aerobic exercises were performed for 20 minutes. After completing this exercise, the participants worked with dumbbells, rope and basketball and finally cool-down step was performed with stretching exercises for 10 minutes.

Method

After receiving permission from Office of Special Education, formalities were coordinated with the desired high schools. Subjects were randomly assigned to two groups of 15 subjects in experimental and control groups, and the anxiety questionnaire was submitted to both groups as pretest. Then, the experimental group performed exercise activities

for 8 weeks, 3 sessions per week, each session lasted 60 minutes. The control group did not perform any exercise. After 8 weeks of exercise (24 sessions), anxiety questionnaire was again submitted to both groups. The questionnaire was submitted to subjects and they were asked to read it carefully and tick one of the four options, and they were assisted wherever they needed help or did not understand the questions. If a student had trouble reading, the questions would be read for her one by one and the answers were marked.

Data analyses

Data analyses was performed by analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANCOVA) analysis method using SPSS software version 16.

3. Results

In this section, the descriptive data of subjects were first presented and then the results of ANCOVA and MANCOVA are shown to examine the effect of exercise intervention on the anxiety of adolescents with intellectual disability.

It is worth noting that before ANCOVA, its assumptions such as homogeneity of regression slope, homogeneity of variances, and normal distribution of data were evaluated. The results of homogeneity of regression slope showed that the calculated F value ($P<0.05$, $F<0.24$) is not significant for interaction between the group and pilot at the significance level (lower than 0.05). So the data did not support the hypothesis of homogeneity of regression slopes; This hypothesis was accepted and covariance analysis could be implemented. In addition, assessment of homogeneity of variances using Levene's test showed that the resulting significance level was higher than 0.05, so the assumption of homogeneity of variances is confirmed. Furthermore, the assumption of normal distribution of data using Kolmogorov-Simonov test showed that given the significance level higher than 0.05 in this test, there is no significant difference between distribution of scores and normal distribution. The normal distribution assumption has therefore been met and it is possible to use analysis of covariance.

As it can be seen in Table 1, means in the experimental and control groups are not significantly different in pretest, but a significant decrease in anxiety is observed in the experimental group in the posttest. ANCOVA has been used to determine the significance of the changes, and the results can be observed in the following Table.

Table 1 shows that with regard to the pretest scores, exercise intervention has resulted in significant difference between the experimental and control groups with regard to anxiety ($F=14.26$, $P<0.01$, $\eta^2=0.35$). As η^2 shows, the effect of the intervention was 0.34, i.e. 0.34% of the posttest variance was explained by the intervention. In other words, 34% of the difference between experimental and control groups was due to the independent variable.

The results of 4 multivariable analysis of covariance tests in Table 2 showed that the groups were significantly different in at least one of the two subscales of anxiety ($P<0.01$). In order to evaluate this difference, we used single variable analysis of covariance. Table 3 presents the results.

Table 1. Mean and standard deviation of anxiety and results of ANCOVA test of the experimental and control groups in pretest and posttest.

Variable	Group	Stage	Mean	SD	F	Level of significance	η^2
Anxiety	Experimental	Pretest	43.15	0.96	14.26	0.001	0.346
		Posttest	36.60	1.10			
	Control	Pretest	43.75	1.19			
		Posttest	45.91	1.46			

PHYSICAL TREATMENTS

Table 2. The result of multivariate analysis of covariance for anxiety subscales.

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group	Pillai's trace	0.457	11.37	2	27	0.0001	0.457
	Wilks's lambda	0.543	11.37	2	27	0.0001	0.457
	Hotelling's trace	0.843	11.37	2	27	0.0001	0.457
	Roy's largest root	0.843	11.37	2	27	0.0001	0.457

PHYSICAL TREATMENTS

Table 3. Multivariate analysis of covariance results for anxiety dimension.

Source	Variable	Group	Stage	Mean	SD	F	Level of significance	η^2
Group	Cognitive dimension	Experimental	Pretest	8.87	1.25	5.39	0.028	0.16
			Posttest	7.67	0.98			
		Control	Pretest	9.13	1.77			
			Posttest	9.91	1.49			
	Physical dimension	Experimental	Pretest	26.4	2.8	23.05	0.0001	0.45
			Posttest	22.13	3.33			
		Control	Pretest	26.4	3.29			
			Posttest	27	3.89			

PHYSICAL TREATMENTS

As Table 3 shows, means in the experimental and control groups are not significantly different in pretest for cognitive dimension and physical dimension of anxiety, but a significant reduction in cognitive dimension and physical dimension of anxiety are observed in the experimental group in posttest by comparison of means. MANCOVA was used to determine the significance of the changes, and the results can be seen in the following Table.

Table 3 shows that with regard to pretest scores, exercise intervention has resulted in a significant difference between the experimental and control groups in terms of cognitive dimension of anxiety ($F=5.39$, $P<0.05$, $\eta^2=0.16$). As η^2 shows, the effect of the intervention was 0.16, i.e. 0.16% of the posttest variance was explained by the intervention. In other words, 16% of the difference between experimental and control groups was caused by the independent variable. Exercise intervention also has resulted in a significant difference between the experimental and control groups in terms of physical dimension of anxiety ($F=23.05$, $P<0.01$, $\eta^2=0.45$). As η^2 shows, the effect of intervention was 0.45, i.e. 0.45% of the posttest variance was explained by the intervention. In other words, 45% of the difference between experimental and control groups in posttest was caused by the independent variable.

4. Discussion

The results of this study showed that exercise significantly reduced anxiety in children with intellectual disability. The findings of our study were consistent with findings of Carmeli et al. [12], Carraro and Gobbi [13], and Khademi and Rahimi [17].

The present study reported that a short-term exercise program could reduce anxiety states in people with intellectual disability more than a sedentary activity. Results also support the notion that exercise could be a valid strategy to promote mental health in people with intellectual disability.

The impact of exercise remains for a long time, resulting in decreased arousal and mental confusion. In this study, a combination of factors including physical intervention, skill improvement experience, and muscle relaxation could implicate the reduced anxiety. Anxiety is caused by psychological and biological factors, thus understanding the mechanism leading to beneficial effects of exercise on anxiety is very complicated. As anxiety has a biochemical basis in the brain, exercise can reduce anxiety-related biological changes. Despite increase in several biochemical compounds (catecholamines, serotonin) and other neuropeptides after long-standing practice, endorphins have been the focus of attention in relation to anxiety reduction following exercise.

Endorphins are not likely to affect the brain directly, since the blood-brain barrier is impermeable to plasma endorphins. However, plasma endorphins can create their effects on human and animal behavior, which is known as public behavioral peace [20]. Moreover, the heart rate rises during exercise, individual willingness level is improved, and the heart pumps more effectively. The resting heart rate decreases between training sessions. An improved function of heart and lung due to regular activities is often associated with feeling of well-being, which can help compensate for feeling of anxiety.

Aerobic exercise can also exert anti-anxiety effects by affecting physical fitness and neurotransmitters, reducing stress hormones, and muscle tension as well as providing self-confidence. Moreover, the biological pathways pro-

posed for this mechanism include increased norepinephrine neurotransmitters in the central cortex, changes in hypothalamic-adrenal system, increased secretion of natriuretic peptide, catecholamine metabolites as well as synthesis and metabolism of serotonin and beta-endorphins [16].

One of the psychological mechanisms is the mastery hypothesis. It maintains that exercise exerts its effects on anxiety and depression through the sense of accomplishment or apparent increase in self-efficacy experienced after engaging in exercise. This rise in self-efficacy will result in a renewed sense of control over or ability to cope with one's environment [21]. Another proposed psychological explanation.

That has received much attention is the distraction hypothesis. This hypothesis suggests that the time out or break from one's stress (or from thoughts about one's stress) caused by engaging in exercise leads to a reduction in anxiety or depression [22].

The results showed significant reduction in cognitive dimension of anxiety but in physical dimension of anxiety, the results were not significant, which was consistent with findings of Khalaji [23], and Keshavarzi and Aryapooran [24].

Physical activity will highly contribute to mental and social security for individuals and communities as well as provision of health, hygiene, and healthy life. The effect of sensory motor skills and physical activity on cognitive and mental functions is such that many psychologists and education experts believe that such activities should be primarily considered as obligatory curriculum.

Familiarity of students and pupils with different programs and methods of sensory and motor activities not only improves their mental functions but also enables mental freshness and vitality and boosts self-confidence and mental health in them [25].

Exercise facilitates oxygen transport and its use in brain and other body tissues. This increase in cerebral oxygen leads to improvement of psychological functioning. Oxygen is directly required for synthesis and modification of dopamine, norepinephrine, and serotonin, which function as neurotransmitters conducting electrical signals between neurons. Production of amino acids is facilitated by regular aerobic activity, indicating the psychological benefits due to biochemical changes during exercise [26]. Regular exercise also gives an insight to the individual through a sense of competence and mastery with several advantages. Increased self-concept, positive feelings and recognition, increased self-esteem and self-worth of the individual are among the positive effects of exercise mentioned by researchers. Perhaps the emergence of such abilities and emotions enable the individual to face the internal and external pressures, including cognitive dimension of anxiety [23].

In general, exercise can reduce anxiety with increasing the activity level followed by increased positive strengthening, enabling a condition deviating the individual from menacing and stressful actions and providing the ground for boosting self-confidence and self-empowerment sense [24].

In the proposed exercise intervention a combination of factors (e.g. physical involvement, experience of skills improvement, muscular relaxation and social relationships mediated by the body) could have induced an anxiety-reducing effect. Also exercise can induce biological changes associated with anxiety reduction. However, the mechanisms that are involved in anxiety responses must be investigated further in order to better adapt the type and duration of the proper exercises in people with intellectual disability.

This study only limits to mentally retarded and educable girls, so we should be careful to extend its results to boys. In addition, since we used the available sampling method in this research, we should be cautious in generalizing the results obtained from the sample to the whole community.

Some other factors limit its results too. These factors are as follows: Lack of similar research activities on these individuals, especially in compound exercise background, absence of proper sports facilities, genetic variations between subjects, no control on nutritional status of subjects, loneliness and fear of individuals from injuries due to ignorance as well as wrong mentalities in their memory from physical activity. All these shortages result in lower tendency to participate in exercises in the beginning of the intervention.

According to the findings of this research and other studies, exercise activities are suggested for individuals with intellectual disability. Teachers, educators, and therapists with profound bonds with children with intellectual disability who play an important role in their education can contribute to their health status. We also suggest that comparison of the effect of exercise on mental factors be conducted in individuals with intellectual disability with and without Down syndrome.

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