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## The Effect of Eight Weeks of Tai-Chi Exercises on Status Parameters of Kyphosis and Balance among Educable Mentally Retarded Children

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### ABSTRACT

One of the most fragile stratum of every society is the people with certain disabilities, especially educable mentally retarded children. Some of the most tangible difficulties of these people are seen in their perceptual and motional abilities (coordination, balance, atmospheric awareness, time awareness, physical awareness and sense of direction). Overcoming these inabilities requires the integration of environmental information and decision making for performance of a special function. The objective of the present research is to investigate the effects of eight weeks of Tai-Chi exercises on status parameters of Kyphosis and balance among educable mentally retarded children. The research sample is consisted of 30 educable mentally retarded children suffering from Kyphosis abnormality. The sample individuals were selected from welfare centers of Tehran. After selection of samples, prior and post to execution of the protocol, the individuals were measured in terms of Kyphosis angle, chest expansion, coefficient of Delmas, spine extension and static and dynamic balances respectively through flexible rulers, tape measure, stoke test and Y test. The educable mentally retarded children were assigned to two 15 individual groups of experimental (age average of 11.6 years; average height of 142.30; average weight of 39.26kg) and control (age average of 11.06; height average of 139.83 and weight average of 35.86kg). The subjects of the experimental group were participated in an 8 week course of Tai-Chi exercises in three weekly 45 minute sessions. These exercises included a 10 minute warm-up, 30 minutes of Tai-Chi movements and 5 minutes of cool-down. During this time, the subjects of the control group were not incorporated into any exercise. By the use of the Shapiro-Wilk test, the normality of data distribution was investigated and approved. Also the Leon test was used for investigation of equality of the variances. Afterwards, descriptive statistics including average and standard deviation and inferential statistics including co-variance analysis were performed on the results. Tai-Chi exercises had been effective on improvement of Kyphosis angel, Delmas coefficient, chest expansion, spine extension and static and dynamic balances among the subjects of the experimental group. Tai-Chi exercises can have a significant effect on improvement of Kyphosis and other mentioned variables among educable mentally retarded children. These exercises can also be used with the aim of improving and increasing the presence of mentally retarded children in sports events and the society as well as encouragement of these children towards more activity.

**Keywords:** Tai-Chi exercises, mentally retarded, Kyphosis parameters, balance

## INTRODUCTION

Sports and healthy and purposeful activities are nowadays considered by almost every stratum of every society. Nowadays, sports are viewed as purposeful, pre-scheduled and pre-planned activities aimed at education and growth of the society. The best applicability of sports occurs when it has a solid plan and is consistent with needs and abilities of educable mentally retarded children.

In this regard, the society of mentally retarded children who are considered as a significant portion of every society require special supports in sports activities and are unable to take part in sports events like other normal children. In today's life, sports and physical activities are considered as the best ways of achieving a healthy life. On this basis, the issue of education with centrality of sports activities becomes interesting for children with insufficient mental abilities and their families. It also plays a very significant role in terms of enabling these children for taking steps towards an effective and beneficial life.

One of the most fragile stratum of every society is educable mentally retarded children. Other people with disabilities are still in control of their cognition and decision making and therefore, are able to take care of a major portion of their life and career requirements and needs. In contrast, mentally retarded people suffer from incomplete growth of brain and other brain disorders. Since the brain is the main commanding organ of the body, they are unable to supply their biological needs. One of the main and most observable problems of these people lies in their cognitive and motional abilities (coordination; balance; atmospheric, time and physical awareness and sense of direction). Overcoming these problems requires integration of environmental information and decision making for performance of a special act. It has been seen that the most important cause of these problems in life include insufficient or lack of movement [1].

Daily advances of the science of medicine, brain surgery and genetics not only have gradually explored the causes of retardation, but also have to some extent reduced the effects and improved the status of these patients. Even in some cases, occurrence of these extreme conditions has been avoided. Health status, feeding, emergence of anti-biotic and other drugs have all helped towards treatment of special illnesses which are the main causes for retardation. In addition, mortality rates have been significantly decreased among these people.

The spinal cord is one of the most important body parts and it has a unique structure for every individual. This uniqueness is resulted from inheritance and environmental situations [2]. In return for mechanical pressures that are imposed on the spinal cord through time, the spinal cord develops changes and alterations. Having a suitable physical status is necessary for everyone even a mentally retarded individual. Obtaining a suitable physics is realized under the light of science of corrective exercises [3].

Considering that Kyphosis is prevalent in some mental retardations and people with kyphosis problem are faced with difficulty in terms of grabbing and processing information, therefore we need methods which can be used for treatment of this phenomenon. If this disorder is not diagnosed and treated in time, it will be followed by irreparable consequences [4] and also it will impose undesirable effects on the individual's body's physiological performance. For instance it could be referred to the effect of thoracic kyphosis on the respiratory system. It also can be followed by mental and social consequences as well. For instance, it can be pointed to the relation that has been observed between kyphosis and depression [5].

Kyphosis or increase in curvature of back spines is a dominant postural deformity at the sagittal level which may move the body's center of mass towards front and affect balance [6].

In contrast to normal children, educable mentally retarded children possess lower levels of muscular strength, stamina, rapidness, reaction time and balance [7]. Mental retardation delays motor development and reduces balance of the body as a result. In a recent research researchers in addition to investigating physical status and physical readiness among mentally retarded individuals, obtained clues of a significant relation between cardiovascular readiness, muscular strength, static balance, dynamic balance and back kyphosis among the aforementioned people [8].

Balance is defined as the ability of maintaining conditional equilibrium during performance of functional activities. Maintaining balance is a complex motional skill which describes body's postures' dynamicity in prevention of

falling down. Balance is a basic need for performance of daily routine activities and plays a significant role in dynamic and static activities as well as sports skills [9].

From another point of view, problems and difficulties faced by disabled people, especially children with mental retardation include lack of access to sports facilities, transportation issues, costs related to hiring coaches, necessity for elaborating on low-cost sports. In this context, propagation of the Tai-Chi sport which is a low-cost and easily performed activity and requires a small space and little equipment is advised. In fact, this sport is significantly strategic and effective for children with mental retardation. The Tai-Chi sport possesses several special and unique benefits and characteristics and is considered as a treasure in Chinese medicine. The Tai-Chi-Chuan sport is based on the fundamental principles of acupuncture and herbal therapies of China. Tai-Chi is consisted of a series of physical movements, respiratory technics and cognitive instruments aimed at strengthening the body, calming the body and mind and etc.

In this regard, previous studies have shown that sports such as Yoga, Aerobics or Tai-Chi have had been effective in treatment of special physical problems and symptoms [10].

As a result of being unable to fulfill the expectations of their family and their society, educable mentally retarded children are continuously left behind from their counterparts and resultantly, they repeatedly feel failed and desperate. As a result, occurrence of the withdrawal behavior is dominant among these people. Having a feeling of anxiety and depression in addition to reduced in-group talking and insufficiency of movement compared to normal children can be related to a permanent inner-sense of insufficiency. Following these behaviors, the educable mentally retarded child becomes isolated and suffers from motional poverty. As a result, the context becomes prone to occurrence of several structural abnormalities and illnesses.

Mental disability is a usual abnormality or disorder which has always been happening through the life. Causes of this illness impact the performance of the brain [11]. Mentally retarded people consist 3 percent of the total population of mankind and among them, almost 80 to 90 percent suffer from slight mental disabilities and are educable [10]. Sports play a very important role in lives of educable mentally retarded children. An educable mentally retarded child requires the help of others. As a result, experts of sports and coaches should make use of every resource to help this stratum of the society.

One of the sport fields which have several beneficial effects in terms of empowerment of mentally retarded children is the Tai-Chi sport. Tai-Chi is an ancient Chinese martial art that is displayed with controlled slow movements, slow deep breathing and appropriate physical condition along being focused and aware. Since movements of its sports field are performed with the aim of improvement of balance and health and life length, this field seems very effective for mentally retarded children. However, as a result of the fact that this martial art is a newly introduced practicing method in therapy, only a few researches have been performed regarding it. On this basis, discussing and investigating the effects of Tai-Chi exercises on Kyphosis and Balance among different people seems necessary. As a result, the author of this study was motivated towards investigating the effects of an 8 weeks program of Tai-Chi sports on status parameters of Kyphosis and balance among educable mentally retarded children.

Elaborating on sports such as Tai-Chi is of essential importance for mentally retarded children. This necessity is debatable from two perspectives: 1) preventing and controlling deformities with respect to sense of isolation, motional poverty, abundance of overweight and etc. 2) prescription of empowerment exercises with the aim of empowerment of educable mentally retarded children for having an independent life.

This phenomenon is already under investigation in advanced countries. In this regard, the Tai-Chi sport amplifies the performance of the cardiovascular system, respiratory system, flexibility, strength, muscular power, balance, mental health and self-esteem and also improves social interactions. Regular performance of the Tai-chi sport's activities has been recommended for people with different illnesses [10]. Performance of this sport can make desirable changes in an individual's lifestyle [12].

Several researches have shown the significant effects of this sport on the quality of life among different people including elders, people who suffer from cancer, people who suffer from diabetes, cardiovascular illnesses, respiratory illnesses and etc. [13]. Since one of the main restrictions and problems of educable mentally retarded children is lack of sufficient balance as a result of a defect between three main systems of visuals, sensing and

motional outputs in joints. Tai-Chi improves body balance and according to research findings, it prevents falling down. In addition, physical abnormalities including Kyphosis resulted from sense of isolation, lack of self-confidence, self-esteem and motional poverty. As results of its very beneficial effects which will be elaborated on in the next chapter, the Tai-chi sport is highly beneficial for educable mentally retarded children. Different and various studies have shown that Tai-Chi may be also beneficial for muscular strength of the spinal cord [14]. If these claims are verified, they can be a good reason for using these exercises for physical empowerment and improvement of physical readiness among retarded people who suffer from kyphosis.

Experts of sport, coaches and even parents of educable mentally retarded children can make use of the Tai-Chi sport in order to fulfill the motional requirements of their children in addition to preventing the consequences of motional poverty. Therefore, these children's' problems and disabilities are fulfilled to a great extent.

### MATERIALS AND METHODS

This research is a semi-experimental study and is also considered as an applied research. This research is based on a pretest posttest design and includes two groups of experimental and control. The population of research is consisted of the entire educable mentally retarded children of Tehran who suffer from nonstructural Kyphosis disorder. The research sample is however consisted of 30 individuals (with a Kyphosis angle of more than 36 degrees).

After selection of the samples, the educable mentally retarded children were randomly assigned to either of the control or experimental groups each of which contained 15 subjects. While the experimental group's subjects (age average of 11.6 years; average height of 142.30; average weight of 39.26kg) took part in 8 weeks of tai-Chi sport sessions for three sessions a week, the children assigned to the control, group (age average of 11.06; height average of 139.83 and weight average of 35.86kg) did not participated in any sports activities.

After selection of samples, prior and post to execution of the protocol, the individuals were measured in terms of Kyphosis angle, chest expansion, coefficient of Delmas, spine extension and static and dynamic balances respectively through flexible rulers, tape measure, stoke test and Y test. By the use of the Shapiro-Wilk test, the normality of data distribution was investigated and approved. Also the Leon test was used for investigation of equality of the variances. Afterwards, descriptive statistics including average and standard deviation and inferential statistics including co-variance analysis were performed on the results. It is worth mentioning that the entire statistical operations were performed using the SPSS v.22.0 software.

### RESULTS

The Subjects evaluated in pretest and posttest, were subjected to analyses in terms of age, weight and height. It was turned out that in the pretest of the experimental group subjects, the minimum age was 9 and the maximum age was 14 years. Also in terms of height, the minimum was 131.5 and the maximum was 152.5. In addition, in terms of weight, the maximum was 58kgs and the minimum was 25.5kgs. In the pretest of the control group, the minimum age was 8 and the maximum age was 13years. Also in terms of height the maximum was 154 and the minimum was 120 centimeters. Additionally, the maximum weight was 45 and the minimum was 25.5kgs. In the posttest of the experimental group, the average weight was 39.43kgs. Also in the pretest of the same group the measured average was 39.26kgs. Furthermore, in the control group's posttest, the average for weight was 36.06 and in the pretest, this average was measured as 35.86. Additionally, average height of the experimental group's posttest was 143.55 centimeters while the measured pretest value for this average was 142.30. Nevertheless, in the control group's posttest, the average height was 140.00.

**Table 1: Results of co-variance analysis**

variable	F	F.D	Sig.
Static balance	81.137	14	0.000

With respect to table 1, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of height.

**Table 2:Results of co-variance analysis**

variable	F	F.D	Sig.
Static balance	8.64	14	0.007

With respect to table 2, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of spinal cord extension.

**Table 3:Results of co-variance analysis**

variable	F	F.D	Sig.
Static balance	91.20	14	0.000

With respect to table 3, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of chest expansion.

**Table 4:Results of co-variance analysis**

variable	F	F.D	Sig.
Static balance	6.78	14	0.015

With respect to table 4, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of Delmas coefficient.

**Table 5:Results of co-variance analysis**

variable	F	F.D	Sig.
Static balance	8.76	14	0.006

With respect to table 5, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of static balance.

**Table 6:Results of co-variance analysis**

Sig.	F	phase	variable
0.000	150.74	pace	Dynamic balance
0.000	638.98	Inner invert direction	
0.000	611.69	Outer invert direction	

With respect to table 6, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of dynamic balance in all three directions.

**Table 7:Results of co-variance analysis**

variable	F	F.D	Sig.
Kyphosis	88.29	14	0.000

With respect to table 7, results of the covariance analysis indicate that significance is smaller than 0.05. Therefore, the null hypothesis is rejected. In other words, the Tai-Chi sport leaves a significant effect on the variable of kyphosis.

## DISCUSSION AND CONCLUSIONS

The objective of this research was to investigate the effects of eight weeks of Tai-Chi sport on status parameters of Kyphosis and balance among educable mentally retarded children. With respect to the fact that any incident on the back of spinal cord results in an alteration in variables of expansion of chest, height and Delmas coefficient;

therefore the discussion goes around parameters related to kyphosis. Regarding the effects of Tai-Chi exercises on parameters related to chest kyphosis, results of this research are consistent with studies performed by Mashhadi (2012), Mohammadi et al (2013), Kale et al (2012), Lorena et al (2014) Salvador Israel et al (2015) and Yang Chou et al. (2014). Since Tai-Chi exercises include flexibility movements, and since stretching plays the role of an important mechanical element in terms of lengthening, therefore by repeating the practical cycles Tai-Chi, these can be effective. These exercises result in empowerment of back muscles and improve overall stretching. Correcting the kyphosis disorder results in a change in expansion of chest, the Delmas coefficient and extension of spinal cord and also changes the height of the individual. According to studies performed by Sokhanguie et al (2009) and Herman et al (2005), improvement of the Kyphosis disorder results in a change in expansion of chest. In fact, it improves the expansion of chest. Also in the present study, it was revealed that Tai-Chi exercises have been effective on the variable of chest expansion in a statistically significant fashion. Extension of the spinal cord which improves the expansion of chest through altering the back kyphosis results in motioning of back spines and provides the context for stretching the muscles. This former effect is influential on the length of the spinal cord and also the Delmas coefficient depends on the length of the spinal cord. Considering this content, imposing a change in the back kyphosis can result in a change in variables of chest expansion, Delmas coefficient, extension of spinal cord and height. In addition to this, it can be claimed that correcting the kyphosis disorder can also improve balance.

Regarding the effects of the Tai-Chi sport on balance (static and dynamic) the results of this research are consistent Tai-Chi exercises require activation and coordination of various groups of muscles at the same time. This sport is aimed at improvement of human body's general flexibility and health. The emphasis of this sport is on empowerment of the body, improvement of conditioning status of the body and coordination of respiration with body movements. Tai-Chi exercises improve the integrity of the nervous system in terms of controlling the body. In addition, this sport leaves significant effects on the central part of the body. The central part of the body is in fact of crucial importance because this area is an anatomic part of the body which contains the center of gravity and movements are sourced from this area as well. This area reacts by the use of the muscular structure against disorders in dynamic stability. For this reason it seems that empowerment and strengthening the body's central muscles lead to improvement of the nervous-muscular system and reduces body fluctuations. Maintaining the postural balance during functional activities is among the many tasks of the central portion of the body which help avoiding from formation of inappropriate and incorrect habits. A desirable central part maintains the natural relation of length-stress between agonist and antagonist muscles. This leads to formation of a desirable system along the wrist and hip while performing functional movements. With respect to effectiveness of Tai-Chi exercises on the central portion of the body, it is expected that these exercises can improve both the dynamic and static balances. With respect to the results of this research, tai-Chi exercises with variable cycles can lead to improvement of Kyphosis parameters (Kyphosis angle, Delmas Coefficient, spinal cord extension and height) and balance.

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