



The Effect of a Short-term Pilates Exercise Period on Static Balance in Trainable Intellectually Disabled Boy Children

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ABSTRACT: People with intellectual disability have special physiological and anatomic qualities. Generally, they possess a weaker physical and motor status as compared to their normal peer. These individuals tend to stay still and immotile. Balance is a key aspect of movement. In this study, the quasi-dynamic balance of trainable intellectually disabled boy children was examined.

First, participants' IQ was measured. Their Atlanto-Axial joint stability was reassured. Then, they were divided into two test and control groups. Stork test was carried out as a pretest. A short-term Pilates training was administered. Resulting data was analyzed using Kolmogorov-Smirnov test, as well as correlated and independent t-test. There was a significant difference between all statistic balance indices before and after intervention in the test group ($p < 0.000$). Yet, no significant difference was seen in any indices of the control group ($p < 0.189$). A significant difference was also observed between two groups regarding the static balance indices after the intervention ($p < 0.00$). Results indicate an increase of the participants' static balance after a period of Pilates training. This improvement is probably due to the promotion of proprioception and the increase of antigravity muscles strength.

Keywords: Intellectual Disability, Static Balance, Stork Test

INTRODUCTION

Mental and intellectual disability is a commonly extensive disorder and a chronic disease in a lifetime. Factors inducing this disease influence the structure and (or) extensive function of brain and (or) both. The impact can range from mild to severe.

As compared to normal children, children with trainable intellectual disability are more likely to suffer from visual and auditory problems as well as nervous disorders. Totally, these individuals are weaker than their normal peers regarding their physical and motion status (Woollacott and Shumway, 2002, Chow *et al.*, 2005). Due to the lack of brain development and weakness in central nervous and muscular system, they are slow. They are not well-balanced. They are practically motion-deprived. Numerous factors lead to the maintenance of posture and balance. Balance refers to ability to control body posture. This is a reflexive mechanism required to fulfill ordinary and sport physical activities. It is evaluated and analyzed in statistic, quasi-dynamic, and dynamic terms. Three vestibular, auditory, and sensory-motor systems are involved in reaching balance. Receiving data from these systems is finally integrated in the surface of brain stem and cerebellum.

The data affected by parietal and posterior cortex. It finally creates balance. Any weakness in each of these systems disrupts balance. For instance, people with sensory-motor deficiency are not able to recover balance (Werba *et al.*, 2006).

Disruption in balance can put an injury risk during activity. An intact strong balance control system is among the necessities of hindering injuries as well as improving performance during physical activities. Imbalance can increase energy consumption in muscular activities to maintain posture. It also enhances pressure on joints. Besides immobility, it brings about nervous disorders and malfunction of muscles and joints sensory-proprioceptive receptors. As a consequence, balance capability and motion control during walking will be seriously harmed. Imbalance and improperly walking will increase the probability of falling off the ground. This can lead to various injuries (Werba *et al.*, 2006, Chao-Chien *et al.*, 2011).

Among the consequences of this incidence are harms and disabilities including breakage and social and psychological problems such as slack of trust, low confidence, limited motion, and fear from falling, depression, and reduction of independence in daily activities.

An intact strong balance control system is among the necessities of hindering injuries as well as improving performance during physical activities. Generally, exercise is considered a major muscular activity. Its advantages for intellectually disabled people are beyond physical improvement. Attending sport activities stimulates confidence and promotes social acceptance. As one of the major, efficient tools, sport has a special status in disabled people's rehabilitation. Exercise is twice important for the disabled regarding their characteristics. It provides the possibility to resolve and remove the effects and consequences of disability (Lambert, *et al.*, 2001, Martin, 1991).

Pilates exercise is composed of a set of specialized sport exercises. These exercises involve body and mind so that the strength and endurance of all limbs increase. They target the deepest muscles of the body. In this method, muscles strength and endurance of all body limbs are simultaneously improved. Thus, Pilate's increases flexibility, strengthens muscles, increases balance, and enhances range of motion. It is regarded a rehabilitation period for these individuals (Betu *et al.*, 2007, Johnson *et al.*, 2007).

Physical education and motion activities plans show positive results concerning the improvement of motion adequacy in intellectually disabled people (Lemmer, 2000, Ahmadi *et al.*, 2012).

Balance is a main ability part in intellectually disabled people. It is almost involved in any form of activity. The significance of posture and balance discussed by scholars regarding independence in activities like seating, standing, and walking is undeniable. In 2012, Enkelaar *et al* reviewed 84 articles. Finally, they showed that balance and walking are trainable in these individuals. It was also said that it is possible to prevent from their fall through involving special exercises.

In a study, Ebrahimi *et al.* (2006) stated that balance exercises are used as a suitable technique for strengthening joints ligaments, improving balance, and hindering ligaments problems. Some research indicates the positive effect of sport exercises on static balance. Pilates exercises have durable advantages for an individual by making interior muscles strong and flexible. These exercises can prevent from posture problems and injuries. Pilates exercises are designed for the whole body health. Pilates stimulates the use of body and mind. It will help you with reaching muscles control as well as coordination and ease of movement. Today, Pilates is not only used as a sport and leisure but also in scientific research and fulfillment of rehabilitation protocols. It enhances flexibility, strengthens muscles, and increases balance and range of motion (Johnson *et al.*, 2007, Emery *et al.*, 2010).

Generally, balance, posture, and properly walking are important to people with intellectual disability.

Sometimes, lacking these factors can result in falling off and dying. Despite the significance of this issue, it is barely studied.

The present research examined the effect of one period of Pilate's exercises on static balance in boys with intellectual disability. We hope that the results of this study improve these children's motion efficiency and help them overcome the consequences of motion poverty besides allowing them to enjoy playing experiences.

METHODOLOGY

Twenty six boys with intellectual disability participated in this study. They ranged between 7 and 14 years of age (mean age=11.115 & SD=2.122). They participated voluntarily by obtaining the consent of welfare officials. They had only one problem; that is, low IQ. They were classified among children with trainable intellectual disability (borderline and mild). First, 26 children were selected as the study sample. They were randomly divided into two test and control groups.

Tools: Pretest was carried out using stork test.

Procedure: Static balance was measured using stork test, as follows: the participant stood on the sole of a foot while positioning another next to the knee of the first foot. Hands were placed beside waist. When asked to start, he tried to stay in balance state as far as possible without any change in the above conditions. This exercise was performed three times. This test was scored regarding maximum time (s) between standing on a foot and losing balance. The best score was recorded after fulfilling this motion for triplet. The participant could not use open hands to maintain balance. If balance ruined at the beginning, he would be given another chance (Lemmer, 2000).

All through the test, the participants used appropriate sport cloths. All of them were tested and scored individually. The scores were recorded on the sheets considered for the participants in advance. To completely reassure, all participants exercised once ahead of the test. Then, they underwent the test.

For test group, Pilate's exercises were administered for four weeks (three sessions a week) including 45min for the first two weeks and 60min for the second two weeks. Training plan for one session comprised 15min warm-up and cooling. Posttest conditions were exactly the same as the pretest conditions.

Training Plan: Exercises included lifting arms in front and sides, the flexion and extension of spinal column, opening chest, lifting legs in sleeping state, Shoulder Bridge, cobra movement, cat movement, snail shell, star movement, saw movement, flex-point, spinal column screw, and rolling down and up.

Statistical Methods: Results were examined using inferential and descriptive statistics techniques by SPSS22. Data distribution normality was determined by Kolmogorov-Smirnov test. Paired T-test was conducted for correlated groups and independent T-test for comparing between test and control groups. It must be noted that level of significance was taken P 0.05.

RESEARCH RESULTS AND FINDINGS

Table 1 shows descriptive statistics of age, high, and weight variables of 2 studied groups.

Using Kolmogorov-Smirnov test, level of significance was >0.05 for all balance indices. As a result, all balance indices have normal distribution.

Based on Table 2, paired t-test results show that there is no significant difference between mean balance indices scores in control group before and after exercise. Based on Table 4, paired t-test results show a significant difference in the mean balance indices scores of all groups before and after exercise. Comparing the mean scores of balance indices in test group, it is seen that all of considerably increased after exercise.

In this section, after-exercise balance scores were examined using independent t-test to study the effect of a period of Pialtes exercises on the balance of intellectually disabled children.

Table 1: Table 1: Mean and SD of anthropometrical markers of studied groups.

Variables	Control group	Experimental group
Age (year)	10.86 ± 2.197	11.6 ± 2.011
Height (cm)	157.2 ± 13.8	144.2 ± 8.6
Weight (kg)	48.1 ± 7.9	51.7 ± 8.2

Table 2: Pre and post-training of balance indexes of control group (M ± SD).

Index	Time	M - SD	t	Degrees of freedom	sig
Right stork test	Pre-tes	5.39 ± 6.198	- 0.534	9	0.606
	Post-test	5.95 ± 6.095			
Left stork test	Pre-test	7.20 ± 6.011	- 1.084	9	0.306
	Post-test	8.31 ± 5.88			

Table 3: Pre and post-training of balance indexes of experimental group (M ± SD).

Index	Time	M - SD	t	Degrees of freedom	sig
Right stork test	Pre-tes	7.16 ± 4.46	- 3.464	15	0.003
	Post-test	12.67 ± 7.34			
Left stork test	Pre-test	7.53 ± 7.41	- 4.826	15	0.000
	Post-test	9.15 ± 16.07			

Table 4: The comparison of mean and SD of balance indexes of 2 groups after intervention.

Index	Time	M ± SD	t	Degrees of freedom	sig
Right stork test	Control	5.95 ± 6.095	- 2.413	24	0.024
	Experimental	12.67 ± 7.343			
Left stork test	Control	8.31 ± 5.88	- 2.379	24	0.026
	Experimental	46.07 ± 9.154			

DISCUSSION AND CONCLUSION

Results indicate the effect of a period of Pialtes exercises on the static balance of children with trainable intellectual disability. No change was seen in the participants' static balance in control group. Pilates

exercise affected the static balance in test group after a period of training. Again, there was a significant difference between the test and control groups' static balance after a period of Pilates exercise.

It indicates the positive effect of this exercise on static balance. This improvement can be resulted from strengthening shank front and back muscles. During exercise movements, the participant increases and enhances the involved (active-agonist) muscles strength by focusing on and extending his muscles and body. This increase also makes other (passive-antagonist) muscles stable. It also struggles to promote respiratory capacity and cardiovascular efficiency via deep inhale and exhale. It also brings about muscular relaxation for a person. During exercises, the participant's blood pressure increases. It will enhance blood circulation and feeding in the involved muscles and tissues. Following muscles are strengthened during Pilates exercises: Gastrocnemius, soleus, peroneus tertius, peroneus longus, peroneus brevis, flexor digitorum longus, flexor hallucis longus, peroneus longus, and tibialis posterior and anterior muscles. Strengthening these muscles will stimulate and improve proprioception. The ability to close gravity center to the ground and strengthen central muscles is also a cause to explain the participants' dynamic balance increase. It seems that Pilates exercises plays a role in maintaining balance by activating a major muscular patterns (i.e. antigravity muscles playing a role in maintaining static balance). It is assumed that participants' balance improvement was due to repeating movements in several sessions as well as proprioception enhancement.

Results of this study correlate with the results reported by Jankowicz *et al.* (2012). They indicated the improvement of proprioception in individuals with Dawn Syndrome. Enkelaar *et al.* reviewed 84 articles. They concluded that balance and walking can be trained in intellectually disabled individuals. Tsimaras *et al.* (2012) carried out a study, "the effect of traditional dance training plans on dynamic balance in people with mental retardation". They concluded that base score in intellectual disabled people (test group) was improved during treatment. Control group did not show any improvement in two measurements. As a result, disabled people might be able to improve their dynamic balance by fulfilling a well-designed Greek traditional dance plan. Kloubec (2010) studies, "Pilates for improving muscular strength, flexibility, balance, and posture", obtained different results in determining the effects of Pilates exercises on abdominal muscles endurance, hamstring muscle flexibility, muscular endurance of upper limb, posture, and balance. As compared to control group, participants did not show a significant improvement in posture or balance. Lack of correlation between these results and the findings of the present study is probably due to personal differences.

They can affect the improvement of muscular endurance and flexibility.

Pilates exercises improves quasi-dynamic balance in trainable intellectual disabled children. This can be useful in preventing from falling and the consequences of imbalance. Yet, it must be noted that the results must cautiously be generalized due to the size of the sample. It is recommended that similar studies with total probability sampling from various populations can obtain more complete and reliable data in this field. We hope that we can play a more effective role in the improvement and maintenance of these people's health by using Pilates exercises.

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