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The effect of selective physical and motor fitness exercises on the static and dynamic balance of mentally retarded female students

Khadijeh Irandoust (PhD)

Department of Physical education and sport sciences, Imam Khomeini International University, Qazvin, Iran

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ABSTRACT

Improving the motor fitness of mentally retarded children is of importance for their health. The aim of this study was to determine the effect of a chosen physical and motor fitness training program on the static and dynamic balance of mentally retarded female students. Thirty-eight high school students (average age 18.63 ± 1.3 years, average height 153.19 ± 6.98 cm, and average weight 58.95 ± 13.96 kg) attended this study, and were randomly divided into two groups: a control group with 21 students, and a training group with 17 students. Dynamic and static balances were measured by the Beam – walking test and Stork stand test, respectively. The training group underwent a combined chosen physical and motor fitness training program within 8 weeks, and 3 times a week. Covariance analysis test was applied to compare the variables of the two groups before and after the training programs. The results showed that there is a significant increase in dynamic balance through 8 weeks training in the training group (F=5.366, sig=0.027). But no significant difference between the two groups in static balance (F=2.751, sig=0.107) was observed. According to the result and findings of this study, it can be concluded that physical and motor fitness training can improve the dynamic balance level of mentally retarded students, while the same exercises have a poor effect on static balance. Generally, providing facilities for training programs in schools can improve the living conditions of mentally retarded female students.

KEY WORDS: mentally retarded; static balance; dynamic balance; physical fitness and motor fitness training.

INTRODUCTION

Many studies have discussed poor physical skills, poor quality and elegance in these skills, and also the lack of ability in maintaining body balance in mentally retarded persons compared with healthy ones (Fong, et.al, 2011; Sukoco, 2010). Body balance is controlled via a complicated muscular-neurotic process, including identification of body sensory movements and integration of physical-sensory data in the central nervous system (CNS), and via planning and executing proper muscular-neurotic responses as well (Hreljac, et.al 2000.). Posture control is often represented in two ways: static (attempt to maintain a position using least movement) and dynamic (attempt to preserve a fixed base while moving) (Wagner, et.al, 2009). Among the affective factors on balance are physical factors including gravity and base, and physiological factors including eyesight, vestibular and sensory systems together with psychological factors like fear and anxiety (Guyton, 2006).

Based on standardized criteria, people with an Intelligence Quotient of 70 or less are classified as mentally retarded persons (Sarimski, et.al 2008). Physical and motor fitness are determinant factors even in daily activities. The specific aims of training programs for these individuals consist of preparing proper situations for them to obtain successful experiences, increasing their self-confidence, making them more sociable, increasing their comprehending abilities via exercising frequently, increasing their concentration level (as they cannot maintain their concentration over a prolonged period of time), and also getting them accustomed to different kinds of tests, as they can hardly handle equipment used in these tests (Winnick, 2010). The researchers have investigated the effect of physical and athletic activities on motor skills, like balance, in both healthy and mentally retarded people. In this connection, Temple, frey and Stanish (2006) have reported that from any three Latin American mentally retarded adults, less than one individual is sufficiently active. On the whole, this research demonstrated that mentally retarded people face a lot of problems in physical activities, but that the mentally retarded elders who had regular physical activities during their childhood period, suffer less from poor motor skills now. Sukoco (2010) claim that the mentally retarded students need to be counseled constantly, and it is important to train the instructions practically. Also, many exercises and physical activities should be performed with their instructions very concise and clear. He believes that only one instruction at a time should be used in the training. Shephard (1990) has shown that physical fitness training is one of the most effective ways to overcome disability in disabled persons. In this way, they can improve their sensory-physical skills, their sociability and their self-esteem (Goodway, 2003). In their research highlighting the effect of motor skills intervention on growth of these skills in retarded preschool kids showed that the group participating in the intervention program had a better performance in moving and controlling objects. Holland (1987) investigated seven basic motor skills in two groups of normal and trainable retarded children ranging from 6 to 9 years old.

***Corresponding Author:** Khadijeh Irandoust (PhD), Department of Physical education and sport sciences, Imam Khomeini International University, Qazvin, Iran.

The results showed that the quality and elegance of motor skills are significantly lower in trainable retarded children compared with normal ones. Hemayattalab and Movahedi (2010) claim that a combination of physical and mental training can lead to higher acquisition of motor skills. The effects of different exercises on balance have been specifically investigated. Kubilay, Yildirin, & Kara (2011) concluded in a research, that balance exercises have a significant effect on muscular strength and resistance. However, they did not observe any significant difference in flexibility parameters.

The literature shows that there is an evident shortcoming in the study of static and dynamic balance, and the effect of physical activities on them, especially in cases relating to mentally retarded female students with both disability and cultural-gender limitations in Iran.

Since the quality of life among exceptional population is vital and important in mentally retarded students, the appropriate intervention must be taken into consideration seriously (Safdari, et.al, 2013).

Accordingly, considering the significance of the role of balance in daily activities, and participating in different sports programs, also with respect to the necessity in promoting and improving balance potentials for acquiring and controlling motor skills, the author seeks to explore as to what extent the chosen physical and motor fitness training programs can be effective on static and dynamic balance in mentally retarded female students within 8 weeks and 3 times a week, and in case of being effective, whether it can highlight physical fitness activities as a necessity in their life or not.

MATERIAL AND METHODS

The selected community included all mentally retarded high school female students of Qazvin City in 2012-2013 educational year, ranging from 17 to 20 years old. On the basis of standardized criteria, people with an Intelligence Quotient of 70 or less are classified as mentally retarded persons. The total mentally retarded students in the related community were 38 individuals. Due to this small number of individuals in the community, all of them were involved in this research, among which 17 were allocated to the training group and 21 to the control group, randomly.

In this study, people with problems like mutilation, epilepsy, heart disease, limb deficiency and multiple disabilities were ignored. The testimonial papers were filled and handed in by the children's parents. Thereafter began the process of choosing the physical and motor fitness training programs. All stages of research and data gathering, and the methods, were approved by the education and training department for exceptional children and the Imam Khomeini International University. The training and testing instruments and methods, the testers, and all other conditions were equal for all participants.

Table1. Average and standard deviation of participants' traits of attendees in the two groups

	Age (year)	Height (cm)	Weight (kg)
training group	19.00 ± 1.06	151.73 ± 3.34	57.46 ± 12.23
Control group	18.26 ± 1.55	154.66 ± 10.62	60.44 ±15.69

Measurement

Dynamic balance test

To measure dynamic balance, first, arrangement to use Star Execution Balance Test was required, but as it was difficult for participants to undergo such a complicated test, the Beam – walking test was substituted (Seashore, H. G, 1947). This test has been approved by the experts in the education and training department for exceptional children. Reliability of this test was indicated as 0.81 in an initiatory test with 15 participants. The test involves walking slowly from one end of the balance Beam until reaching the other end, and then returning to the starting point after a 5-second pause. Scoring in this test is calculated based on the number of errors and number of times caught (Seashore, H. G, 1947). What is referred to as dynamic balance in this research, is the ability of participants to keep their balance while walking on a 3-meter the balance Beam, which is calculated by Static balance and the revised stork stand test (Khalsa, et.al 1988) has been used to measure static balance. In this test, keeping both hands by the sides of the body, allowing free movement, a participant stands on a flat surface on one foot and raises her free foot up to ankle level. The tester measures the maximum time the participant is able to stand on her one foot, and stops the timer as soon as she puts her raised foot on the ground. The test is then repeated with the feet exchanged, and the final highest time will be recorded. The maximum time in the test is 60 seconds (Khalsa, et.al 1988).

Intervention program

The training sessions were held for 40–45 min as follows:

- 10–15 min: warming up
- 20–25 min: selected exercises
- 5–10 min: cooling down

The selected exercises included physical and motor training, like dynamic and static balance exercises, power exercises, coordination exercises, stability exercises, different kinds of jumping, throwing, and so on, and to be entertaining and appealing, the training program was conducted like a game. Different objects, like strings, elastic, ropes, medium and large balls, treadmills, fixed bicycles, aerostats, dumbbells, and so on, were used in the intervention program.

Statistical Analysis

Descriptive statistics was applied for measuring the average and standard deviation of participants' traits. Considering that the results of Kolmogorov-Smirnov test were not significant for any of the training and control groups neither in the pretest nor in the post-test results ($p > 0.05$), and the results of the Levene test also showed the homogeneity of variances in the two groups, covariance analysis was then applied for testing the hypothesis in which the values of pretest and post-test, and also the moderated values of balance after eliminating the values of pretest have been represented. The calculations were all done using Spss software, Version 20, with a significance level of $\alpha = 0.05$.

RESULTS

General characteristics of subjects can be seen in table 1. The results of a covariance analysis test showed no significant difference in static balance between the control and training groups (F1,31= 2.751, sig = 0.107). Table 2 shows the average and standard deviation of static balance, and also the moderated values.

Table 2.Average and standard deviation of static balance and also moderated values.

	Pre-test	Post-test	Moderated average	Average of raw changes
Training group	32.57 ± 25.00	44.42 ± 21.28*	45.89 ± 3.72	11.85 ± 17.01
Control group	36.42 ± 20.41	38.78 ± 20.72	37.61± 3.30	2.35 ± 14.86

As it can be seen in table 2, static balance has been improved. On the basis of the results obtained, it can be understood that in spite of more changes in the training group, the time in keeping static balance in post-test has been increased in both groups, and these differences have not been significant statistically. Accordingly, zero hypothesis will be approved while the opposite hypothesis, indicating that the chosen physical and motor fitness training is effective on the static balance of mentally retarded students, will be rejected. The results of the covariance analysis test showed a significant difference in time in keeping dynamic balance between the two groups ($F_{1,31}$= 5.366, sig = 0.027). Table 3 shows the average and standard deviation of dynamic balance and also moderated values.

Table 3.Average and standard deviation of dynamic balance and also moderated values.

	Pre-test	Post-test	Moderated average	Average of raw changes
Training group	28.33 ± 8.35	18.51 ± 5.35	24.11 ± 1.74	-9.82 ± 5.44
Control group	38.88 ± 17.67	34.11 ± 19.55	29.69 ± 1.54	-4.76 ± 7.14

On the basis of the results obtained, it can be understood that in spite of more number of changes in the training group, the time in keeping dynamic balance in post-test has been decreased in both groups, and these differences have not been significant statistically. Accordingly, zero hypothesis will be rejected while the opposite hypothesis, indicating that the chosen physical and motor fitness training is effective on the dynamic balance of mentally retarded students, will be approved. The results of the covariance analysis test showed a significant difference in the number of errors in dynamic balance between the two groups ($F_{1,31}$= 6.848, sig = 0.014). Table 4 shows the average and standard deviation of the number of errors in dynamic balance, and also the moderated values.

Table 4.Average and standard deviation of the number of errors in dynamic balance and also moderated values.

	Pre-test	Post-test	Moderated average	Average of raw changes
Training group	1.06 ± 1.27	0.6 ± 0. 98*	1.04 ± 0.34	-0.47 ± 0.52
Control group	2.21 ± 2.29	2.63 ± 2.31	2.28 ± 0.30	0.42 ± 1.83

As it can be seen in table 4, dynamic balance has been improved significantly specified in reducing the errors.

On the basis of the results obtained, it can be understood that the number of errors in dynamic balance has reduced in the training group, and increased slightly in the control group, and these differences have been significant statistically. Accordingly, zero hypothesis will be rejected, while the opposite hypothesis, indicating

that the chosen physical and motor fitness training is effective on dynamic balance of mentally retarded students, will be approved

DISCUSSION

The main purpose of this study was in investigating the effect of a course of chosen physical and motor fitness training programs on static and dynamic balance of mentally retarded female students in Iran. Two tests of Beam–walking test and Stork stand test were applied concerning the abilities of the statistical community (Lahtinen et.al, 2007; Seashore, 1947; Khalsa, et.al 1988). On the basis of the results of the study, the first hypothesis indicating that the chosen physical and motor fitness training is effective on the static balance of mentally retarded students is rejected. However, the second hypothesis indicating that the chosen physical and motor fitness training is effective on the dynamic balance of mentally retarded students, and the third one indicating that the chosen physical and motor fitness training is effective on the number of students' errors, are approved.

The results obtained in this study are compatible with the ones by Kubilay, Yildirin and Kara (2011), Carmeli et al. (2002) and Temple, Frey and Stanish (2006). They have all reported the positive effect of physical activities and other fitness factors on healthy, disabled and mentally retarded persons. The ability of controlling balance depends on sensory, interior, eyesight and vestibular inputs(Blackburn, et.al 2000; Nashner, 1997).

In the case of the first hypothesis about static balance, the base is fixed in the related test, and the obtained data for preserving balance is received via sensory-corporeal receptors, including interior receptors, mechanical sensibility, dermic and hypodermic tissues(Blackburn, et.al 2000). However, in the dynamic balance test in which the environment is fixed but the base is moving, the eyesight and vestibular systems play a more significant role in providing data for preserving balance (Blackburn, et.al 2000). It is worth mentioning that in any kind of balance, all the above-mentioned systems, though with different shares, are involved in preserving balance. It may be due to these differences that the physical and motor fitness trainings are more effective on dynamic balance in comparison with a static one. In other words, different systems with different effects are in charge of preserving different balances.

The observed changes in students' balance in this research can be likely proof indicating the poor functioning of the educational system in Iran in providing necessary equipment and tools for disabled students, especially the mentally retarded, in order to promote their physical and motor fitness; because this was the first time that the students participating in this research could utilize such equipment and tests. Not having enough time for the obtained results through the static test to be significant may be one reason for the related poor results. For another reason, the small number of motor units requested for the students to perform can be justifiable. With performing more motor units, the muscles' contractions will be more sensitive. As the environment does not change constantly, in order to preserve balance, the CNS should become compatible with sensory data received from different areas (Hytönen, et.al, 1993). The students in the training group were different in respect of muscle strength, muscle stability, body structure, and many other body characteristics, hence, the intensity of exercises given were of medium level, so that the pressure of the related exercises can be reduced and everybody can cope with them. The 8-week period of training may have been effective for some of the students, but no effective for others in the dynamic and static tests. Different parts of the CNS are involved in posture control. Three systems of myotatic stretch reflex, long-loop reflex, and functional stretch reflex, are involved in balance control. Reflexes are compatible (Punakallio, A 2005). The reflexive responses can be learned by more and more practice. Among the most important reasons of the effectiveness of the intervention program on dynamic balance and decreasing its errors, the positive effect of these trainings on reflexive responses involved in balance control and muscle reinforcement through exercises can be the most likely ones. Physical and motor fitness training are the most effective ways through which disabled persons can overcome their disabilities (Kubilay, et.al 2011). Goodway & Branta (2003) showed that a number of mentally retarded students participating in the intervention program performed much better in moving and controlling objects after the post-test. Physical and motor activities, and also balance training can lead to reinforcement of motor-sensory organs, muscles, and also the mental concentration of mentally retarded ,persons and the reinforcement of dynamic balance as a result. The present study showed that mentally retarded female students are in a low range of dynamic and static balances, namely, they are in danger of falling and getting hurt. The mentally retarded children have less motor experience in comparison with the healthy ones. Accordingly, they do not have enough motivation to reform, and they do not have a proper understanding of their body balance and condition. The weakness in the lower limbs is another result of little or no mobility in these individuals, and can cause atrophy in the related limbs which will directly affect their balance. This issue may be somehow relevant to the obtained results in the static balance test. Conclusively, Balance is one of the important factors in physical and motor fitness in all students, especially the mentally retarded. It can play a significant role in their life to prevent injury and to let them perform their daily activities independently of others. With respect to the results obtained in this study, it is recommended that the physical and motor activities be trained in the guise of games, together with

applying the necessary equipment and tools to perform such activities in the different educational periods, as balance training is a long-term process in the case of these students. Variety in the play times, and using proper equipment can motivate them to perform the activities more often and better. Therefore, the principals and the staff of schools are recommended to provide the respective tools, material and equipment to help the students exercise and reinforce their balance.

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