

# The effect of 8 weeks plyometric exercise on physical and motoric features of mental disabled

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## Abstract

### *Background and Study Aim*

Physical activity for disabled people is a long-debated issue. The number of studies examining the effects of alternative exercise programs on the physical and motor outcomes of people with intellectual disabilities is limited. For this reason, the purpose of this study is to investigate the effects of 8-week plyometric exercises on some physical and motor characteristics of mentally retarded people.

### *Material and Methods*

The method of this study is the experimental method, one of the quantitative research methods. The sample of the study consists of 24 moderately and mildly mentally retarded students aged 11-17 years old studying at a special vocational school. Participants completed a plyometric training program 3 days per week for 8 weeks. Before the training program, height, weight, BMI, vertical jump, sit and reach, standing long jump, circumference measurements, handgrip strength, shuttle test, leg strength, and back strength were compared with those after the training program. The SPSS 25 program was used for the statistical operations. The Wilcoxon test, one of the non-parametric tests, was used to compare the data.

### *Results*

As a result of statistical analysis, significant differences were found in height, weight, vertical jump, sit and reach, handgrip strength, shuttle test, leg strength, and back strength of the participants before and after the training program ( $p < 0.05$ ). There was no significant difference between the body circumference measurements and BMI results ( $p > 0.05$ ).

### *Conclusions*

When evaluating the results of the study, it was found that plyometric exercises have a positive effect on the physical and motor characteristics of the intellectually disabled people.

### **Keywords:**

physical activity, intellectual disability, plyometric exercise, motor characteristics

## Introduction

Intellectual disability is one of the important issues that belong to developmental disorders and should be treated in childhood: mental retardation; the child's general intellectual functioning is significantly below average [1, 2, 3, 4]. In addition, it is defined as inadequacy in two or more adaptive behaviors such as communication, self-care, home life, social skills, academic functioning, self-direction, health, safety, leisure, and work [3, 4, 5, 6, 7].

Mental retardation affects 3% of the total pediatric population [8]. According to the results of the Disability in Turkey study, the proportion of the disabled population in the normal population is 12.29%, and 15.5% of the disabled population is mentally disabled [9].

The human body has great potential to adapt both structurally and functionally to physical exercise. Achieving this harmony with exercises aimed at improving sport-specific performance has led to the development of various training techniques [10]. The application of various training techniques and programs to the disabled has led to changes in the goals of disability sports.

One of the most important concepts in disability sports is athletic success. In order to achieve a high level of success in sports, it is necessary to work systematically and based on training principles [11, 12, 13, 14]. The idea of raising athletic performance to a higher level has appeared day by day in disability sports, and various training programs have been introduced. Training models designed to improve athletic performance often consider exercises for power, strength, and speed [12, 13, 15, 16]. Numerous training methods can be found in the literature to improve general motor characteristics and athletic performance. Plyometric training programs are just some of them.

In order to improve the athlete's speed, a system was developed to activate the explosive response during the execution of explosive movements [17, 18]. This system is plyometric training, a fairly new method that improves jumping performance and facilitates muscle response. Many researchers have noted very important physiological and physical developments as a result of plyometric training [19, 20, 21]. There is strong evidence that plyometric training improves basic motor performance [22, 23, 24].

People with intellectual disabilities have some problems performing complex exercises. However, plyometric exercises are straightforward and easy

to perform. Reviewing the literature, one finds that the number of studies on the effect of alternative and applicable exercise programs for the mentally retarded is small. With this in mind, the aim of this study is to investigate the effects of 8 weeks plyometric exercises on the physical and motor characteristics of people with intellectual disabilities.

## Material and Methods

### Participants

The method of this research is the experimental method, one of the quantitative research methods [4, 14, 25]. The universe of this study consists of students with moderate and mild intellectual disabilities. WSSPAS: Web-Based Sample Size & Power Analysis Software [26], developed by İnönü University Faculty of Medicine, Department of Biostatistics and Medical Informatics, was used to determine the number of participants to be included in the study. After power analysis, it was determined that at least 20 participants should participate in the study. In this regard, the sample of our study consists of 24 (19 men, 5 women) students who aged 11-17 years, with moderate and mild intellectual disabilities. All participants were informed by the researcher about the possible risks and details of the study. Since the participants were under the age of majority, 'Voluntary Consent Form' was obtained from their parents. The study was approved by the Istanbul Esenyurt University Health Sciences Institute Ethics Committee. The research was conducted in accordance with the criteria of the Declaration of Helsinki.

### Research Design

Anthropometric measurements and test batteries

were performed on the volunteers who participated in the study. In this context, the height, weight, and BMI values of the participants were determined. Vertical jump test, sit and reach test, standing long jump test, handgrip strength, shuttle test, and back strength and leg strength test were also performed. Body circumference was measured and recorded on the right side of the participants using a tape measure. The participants were given the necessary information about the test, the test equipment was presented, and the necessary motivation was provided during the test. Information about the general health of the participants was obtained. Before starting the test, participants were given a trial to understand the tests. To evaluate the tests, each application was performed 2 times after the trial and the best score was noted.

### Statistical Analysis

The SPSS 25 program was used for the statistical analysis in this study. The mean ( $\bar{X}$ ) and standard deviation (sd) of all subjects were calculated. In the analysis of normality between groups, the values of kurtosis and skewness (between +1.5 and -1.5) were checked. The study found that the data had a normal distribution. To compare the groups, the 'Paired-Samples T Test', one of the parametric tests, was performed. The study set a significance level of  $p < 0.05$ .

## Results

When Table 1 is examined, a significant difference was found in the height and weight of the participants ( $p < 0.05$ ), but no significant difference was found in BMI ( $p > 0.05$ ).

When Table 2 is examined, a significant difference was found in the vertical jump, sit and

**Table 1.** Comparison of Wilcoxon test results for anthropometric characteristics

Parameters	Pre-Study $\bar{X} \pm SS$	Post-Study $\bar{X} \pm SS$	Z	p
Weight (kg)	60.43 $\pm$ 17.71	61.29 $\pm$ 17.18	-2.701	.007*
Height (cm)	165.12 $\pm$ 16.46	166.83 $\pm$ 16.44	-3.646	.000*
BMI (kg/m <sup>2</sup> )	28.39 $\pm$ 29.73	22.03 $\pm$ 5.39	-3.646	.377

\*Significance level was determined as  $p < 0.05$ .

**Table 2.** Comparison of Wilcoxon test results of participants' motoric characteristics

Parameters	Pre-Study $\bar{X} \pm SS$	Post-Study $\bar{X} \pm SS$	Z	p
Vertical Jump (cm)	11.70 $\pm$ 7.41	15.91 $\pm$ 8.41	-4.223	.000*
Sit and Reach (cm)	13.37 $\pm$ 6.98	115.45 $\pm$ 7.04	-4.367	.000*
Standing Long Jump (cm)	90.20 $\pm$ 33.50	100.20 $\pm$ 34.37	-3.919	.000*
Handgrip (kg)	23.99 $\pm$ 11.01	25.76 $\pm$ 10.82	-3.302	.001*
Shuttle Test (no)	10.20 $\pm$ 4.42	13.16 $\pm$ 4.46	-4.233	.000*
Back Strenght (kg)	50.37 $\pm$ 29.16	53.91 $\pm$ 29.10	-4.322	.000*
Leg Strenght (kg)	43.50 $\pm$ 21.41	47.70 $\pm$ 22.50	-4.305	.000*

\*Significance level was determined as  $p < 0.05$ .

**Table 3.** Comparison of Wilcoxon test results of participants' body circumference

Parameters	Pre-Study $\bar{X} \pm SS$	Post-Study $\bar{X} \pm SS$	Z	p
Shoulder Circumference (cm)	97.87 ± 12.79	98.54 ± 12.60	-1.492	.136
Chest Circumference (cm)	84.00 ± 10.57	83.91 ± 10.32	-.154	.878
Abdominal Circumference (cm)	78.37 ± 14.82	78.16 ± 15.36	-.211	.833
Hip Circumference (cm)	89.83 ± 14.76	89.54 ± 14.17	-.847	.397
Upper Leg Circumference (cm)	42.91 ± 5.62	42.54 ± 5.74	-.545	.586
Lower Leg Circumference (cm)	32.70 ± 4.63	33.37 ± 4.86	-1.948	.051

\*Significance level was determined as  $p < 0.05$ .

reach, standing long jump, hand grip, shuttle test, back and leg strength of the participants ( $p < 0.05$ ).

When Table 3 was examined, it was found that the body circumference measurements of the participants did not change significantly after the training program ( $p > 0.05$ ).

### Discussion

The purpose and type of exercise training for people with disabilities has long been a debated topic. There are shortcomings in the literature regarding which exercises provide the most benefit for different disability groups. The motor and physical development deficits caused by the disability should be well known, and care should be taken to select exercises that are not too difficult for the disabled person to use. Reviewing the literature, it was found that plyometric exercises have positive effects on physiological and motor characteristics [27, 28, 29].

In the literature, it has been determined that the motoric development of the mentally handicapped is not sufficient, and it has been observed that the strength training applied to these individuals produces positive developments in their motoric properties [1, 2, 12, 13, 15]. When examined in this context, in the study conducted by Ates [30], in addition to the football training, there were significant differences in the results of vertical jump, leg and back strength, right hand grip strength, and sit-up test results in the football players who underwent plyometric training 2 days per week compared to the control group. Bavlı [31] concluded that plyometric training in combination with basketball training has a positive effect on motor characteristics. In the study conducted by Palandino and Barriuso [32], it was found that plyometric exercises and eccentric exercises had a positive effect on the jumping and balance performance of football players. Bedoya et al. [33] concluded in the literature review that football-specific skills such as jumping and agility improved significantly.

Kurt et al. [34], which examined the effects of speed training and plyometric training on speed, jumping, and anaerobic performance in hearing-impaired individuals, found that these training

methods had a positive effect. In his study, Elnaggar [19], found that plyometric training has a positive effect on balance performance in children with cerebral palsy (CP). He concluded that plyometric training promotes physical rehabilitation and muscle activation in CP. Hammami et al [35] concluded that plyometric exercises increase the level of physical fitness in junior male handball players. In studies conducted with different sample groups, plyometric exercise has been shown to cause physiological changes as well as physical and motoric effects [19, 30, 31, 35, 36].

This study showed similar results with studies in the literature. It is thought that well-planned plyometric training programs will also show positive results in individuals with other disabilities.

Whether for rehabilitation or performance improvement, plyometric training is a training method that should be included in training programs.

#### Study Limitations

This study was planned for more participants, but the number of participants was limited due to the pandemic. The study can be repeated by increasing the number of participants.

### Conclusions

The result of this study: since plyometric exercises do not involve complex exercises, physical and motor characteristics were found to improve when applied to individuals with moderate and mild mental disabilities. The results of our study will provide guidance to trainer, teachers and families working with individuals with intellectual disabilities. It is thought that plyometric exercises can be applied to the mentally handicapped in physical education and sports activities. The effect on mentally disabled people can be studied by using easy to perform exercises, such as Calisthenic Exercise, Functional Exercise or Core Exercise.

### Conflict of interest

The authors claim that there is no conflict of interest.

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