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The Effect Of Balance Training On Static And Dynamic Balance In Children With Intellectual Disability

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ABSTRACT

The purpose of this study was to assess the effect of balance training on static and dynamic balance in children with mild intellectual disability. To achieve this purpose, 22 healthy schools aged children (mean age = 10.23±1.43 years) with mild intellectual disability were selected as the sample by random sampling method from special primary schools in Turkey. Participants were randomly assigned either to an experimental group (n =11) or a control group (n =11). The experiment group attended a 10 week balance training intervention program consisting of 40-min sessions, while the control group followed the regular school schedule. Balance was assessed using balance subtest of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP). Wilcoxon Signed Rank Test was performed to compare the pre and post training measures of both groups separately. The Mann Whitney U Test was used to identify possible differences between the exercise and control groups. The results of the present study revealed significant difference between the pre-intervention mean values with that of the post- intervention of static balance and dynamic balance for study group (P=0.004 and 0.011 respectively).

1. INTRODUCTION

Physical exercise and various sports-related activities are necessary to promote health, fitness, and psychological development among children of school age. In general, the ability to play sports and exercise is lower for children with intellectual disabilities than in children without such disabilities [1]. Children with intellectual disabilities (ID) often have cognitive problems associated with carrying out exercise. Moreover, their experience of exercise is limited [2]. Intellectual disability (ID) affects all spheres of people's lives who suffer from it. It lowers the level of intellectual functioning, often stigmatizes, characteristically changing features, and decreases motor performance. Unfortunately, modern medicine cannot cure intellectual disability; however, there is a chance to improve the quality of life of people with mental retardation by means of physical exercises and by enhancing coordination, the quality of gait and efficiency in performing everyday activities [3]. Using the Intelligence Quotient (IQ), classification systems have identified four levels of intellectual disability: mild (IQ=50-70), moderate (IQ=35-49), severe (IQ=20-34) and profound (IQ≤20) [4].

Balance ability, a strategic component of coordination capacities [5] is subject to several factors [6]. Falls resulting in injury, are very common in individuals with ID [7] due to poor balance ability that may be interpreted as an indicator for incomplete development [8]. Balance and motor impairments are most evident among inactive individuals with ID that might be particularly susceptible to a loss of basic functioning and further limit the person's autonomy in activities of daily living [10]. Some studies have measured the balance in individuals with ID and shown a reduced ability compared to the general population [9]. However, these studies only measured balance in one single way (one or two subsystem) and in small populations of elderly people. It would be valuable to investigate if the reduced ability is existent already at a young age [11].

The purpose of this study was to examine the effect of balance training on static and dynamic balance in children with mild intellectual disability. The research hypothesis was that balance training could improve both static and dynamic balance in children with ID.

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2. METHODS

2.1. Participants

22 healthy children aged between 8 and 13 years (mean age = 10.23±1.43 years) with mild intellectual disability were selected as the sample by random sampling method from special primary schools in Turkey. Participants were randomly assigned either to an experimental group (n =11) or a control group (n =11), keeping an appropriate ratio between the number of females and males. The experiment group attended a 10 week balance training intervention program consisting of 40-min sessions, twice a week, while children of the control group followed the regular school schedule. All parents or legal guardians provided written informed consent prior participation,which was approved by an Institutional Review Board for use of Human subjects, allowing the children’s involvement in the program and access to relevant information. The intelligence quotients (IQ) of participants with intellectual disability was determined using the Weschler Intelligence Scale test. All participants had intelligence quotients (IQ) that were within the range for individuals with mild mental retardation.

Exclusion criteria for both groups were; general health problem or orthopedic problems, A self-reported medically diagnosed neurological disorder (i.e. Parkinson's disease, multiple sclerosis, head injury, peripheral neuropathy, stroke, vestibular disorder); sensory deficits in lower extremities (loss of sensibility, affected stretch reflexes or reduced strength in lower extremities), recent injury to lower extremities, impaired vision (visual acuity value >0.10), history of or ongoing vestibular neuritis, illness in the few days preceding the tests, a diagnosis of cerebral palsy and use of walking aids.

2.2. Testing procedures

The present study is a practical research, whose procedure is of semi-experimental type. The assessment of the level of basic somatic build characteristics, i.e. body weight and height, was conducted. Body weight was assessed on the Tanita scales to an accuracy of 0.1 kg, body height was measured within 1 mm by means of a calibrated anthropometer, and balance was assessed using balance subtest of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP). The BOTMP has been widely used to assess motor proficiency for children with mental retardation [12].Based on several studies in motor development using factor analysis, the BOTMP was also reported as being technically dependable and as presenting favorable construct validity [13]. According to the BOTMP, the first three items measure static balance with a total point score of 17 while the last five items measure dynamic balance with a total point score of 15. The participants were tested prior to the start and after the end of the 10-week period of the exercise intervention program.

2.3. Exercise protocol

The exercise program consisted of three components.1. Warming up phase: In this phase, ten minutes’ walk and stretching exercises were applied. 2. Exercises phase:In this phase balance exercises were repeatedly performed. Balance training consisted in toe-to-heel walk, walking on a line, side walking, reverse walking, zig–zag walking, longer strides, tandem standing, double-leg stance with feet apart and together and one-leg stance. These exercises were performed on the floor and on balance pads, with eyes opened and closed and at different elevations. 3. Cooling Phase:In this phase, the same stretching exercises in the warming up period, were applied.

2.4. Statistical analysis

All data were analyzed using the SPSS 16.0 statistical package. Wilcoxon Signed Rank Test was performed to compare the pre and post training measures of both groups separately. The Mann Whitney U Test was used to identify possible differences between the experiment and control groups. Differences a significance level (p) less than 0.05 were considered significant.

3. RESULTS

Table1 shows the mean and SD of the age, height and weight for each group.

Table1. Physical characteristics of participants

Physical characteristics			
	All participants(N=22)	**Experimental group(N=11)**	**Control group (N=11)**
Age	10.23±1.43	10.30±1.76	10.14±0.89
Height	134.88±8.47	135.80±9.47	133.57±7.32
Weight	33.03±6.61	33.43±6.99	32.47±6.52

The results of the present study revealed significant difference between the pre-intervention mean values with that of the post- intervention of static balance and dynamic balance for experimental group (P=0.004 and 0.011 respectively). Table 2 shows the mean of the pre-test and post-test measures for Static balance and Dynamic balance, for each group.

Table2. Static balance and dynamic balance test means and SD values PRE and POST training for experimental and control Group.

	Experimental group (n=11)			Control group (n=11)		
	PRE	POST	p-value	PRE	POST	p-value
Static balance	9.20±9.32	13.30±4.29	0.004*	10.14±4.25	10.57±5.19	0.447
Dynamic balance	10.20±4.80	12.80±2.89	0.011*	11.57±3.35	11.71±3.19	1.000

* P< .05 PRE to POST test SD: Standard Deviation

When comparing the pre-intervention mean values of static and dynamic balance for the experimental group with that for the control group by using Mann Whitney U test, the results revealed non-significant difference (*p*=0.536 and 0.669 respectively). On the other hand, when comparing the pre-intervention mean values of static and dynamic balance for the experimental group with post-intervention by using Wilcoxon test, the results revealed significant difference (*p*=0.004 and 0.011).

4. DISCUSSION ANDCONCLUSIONS

Individuals with intellectual disability often experience balance problems and these problems are reflected in their reduced motor capacity. Therefore, it is essential to establish whether balance capacities in persons with ID can be improved by proper training. The results of the present study showed a significant improvement in the participants' ability to balance after the exercise intervention.

Positive influence of physical exercises on the level of balance in people with mild mental retardation was also confirmed by the research of other authors [14,15]. Ahmadi & Daneshmandi (2013) studied the effects of core stability exercises program on physical fitness of children with mental retardation. Static balance test results showed that children with MR in Training group improved significantly in the static balance test after intervention [16]. Giagazoglou et al (2012) assessed the effects of a hippotherapy program on static balance and strength in adolescents with intellectual disability (ID). The hippotherapy intervention program resulted in significant improvements in strength parameters, and on the more complex balance task (i.e. standing on one leg) [17]. Jankowicz-Szymanska et al (2012) studied the effect of physical training on static balance in young people with intellectual disability. Their results lead to a conclusion that exercises with the use of unstable surfaces improve deep sensibility in people with mild mental retardation[3].Oviedo et al (2014) investigated the effect of a combined physical activityprogram (CPAP) utilizing aerobic, strength and balance training on cardiovascular fitness, strength, balance and functional measures in a controlled clinical trial. Adults with mild to moderate ID were assigned into either the intervention group or the control group. The intervention group increased cardiovascular fitness, handgrip strength, leg strength, and balance following the training period. The control group showed no changes in any parameter. These results suggested a combined aerobic, strength and balance exercise training program is beneficial among individuals with ID [18].

Disturbances in the process of controlling the stability of the body in static and dynamic positions, irrespective of the cause, affect not only the motor but also mental sphere of functioning of the disabled [3]. The feeling of uncertainty of posture and gait, as well as the fear of falling and getting hurt, make persons with mental handicap have greater tendency to sedentary way of life than healthy people [19], which – in turn – can contribute to more frequent occurrence of overweight and obesity in this population [20].

Properly selected physical activity creates favorable conditions to increase muscle strength, especially isokinetic resistance and improve agility and coordination of intellectually disabled people [21,22 and 23]. Balance improvements are very important for individuals with mental retardation, since they can produce greater stability while performing activities of daily living or work related tasks and thus, decreasing the occurrence of accidents or falls resulting in a lower incidence of injuries [24].

Horvat and Franklin (2001) suggest that children with mental retardation should be provided with more opportunities for different physical activities. Moreover, they emphasize that sedentary life styles, such as inactivity and reduced participation in games and physical activity, should not be tolerated for children with MR [25]. Instead, physical activity should be encouraged to develop healthier life style habits [16].

Systematic rehabilitation exercises increase effectiveness of performing self-management activities and elevate the mood also in children suffering at the same time from intellectual and motor disability [26]. Therefore, children with intellectual disability should be encouraged to participate in exercises. In conclusion participation in exercise programs is a key strategy for improving motor performance and could significantly improve daily activities [27].

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