

# ORIGINAL ARTICLE

## The Effect of an Exercise Package for Students with Intellectual Disability on Motor and Social Development

**How to Cite This Article:** Kashi A , Dawes H, Mansoubi M, Sarlak Z. The effect of an exercise package for students with Intellectual disability on motor and social development. *Iran J Child Neurol*. Spring 2023; 17 (2): 93-110

**Ali Kashi PhD<sup>1</sup>,**  
**Helen Dawes PhD<sup>2</sup>,**  
**Maedeh Mansoubi PhD<sup>2</sup>,**  
**Zahra Sarlak PhD<sup>4</sup>**

1. Department of Motor Learning and Control, Sport Science Research Institute, Tehran, Iran

2. College of Medicine and Health, University of Exeter, Centre for Movement, Occupational and Rehabilitation Science (MOReS), Oxford Brookes University; Oxford Institute of Nursing, Midwifery and Allied Health Research (OxINMAHR), Oxford, England

3. Department of Physical Education and Sport Science, Khodabandeh Branch, Islamic Azad University, Khodabandeh, Iran

### **Corresponding Author**

Kashi A. PhD  
Associate Professor,  
Department of Motor Learning

## **Abstract**

### **Objectives**

Physical activity and reducing inactivity improve health and well-being and benefit young people's social development with an intellectual disability (ID) lasting into adulthood. Therefore, given the importance of encouraging an active lifestyle in adolescents, researchers developed and evaluated the feasibility and potential effect of a novel "Sport Science Research Institute (SSRI) exercise package for young people with intellectual disability" to improve the motor and social development of these individuals.

### **Materials & Methods**

In a Randomised controlled trial between October 2019 to February-2020, Thirty-six 7-18-year-old students with mild intellectual disabilities who were studying in a special school in Tehran received the invitation to the study. Students were randomly divided into intervention (18 students) and control (18 students) groups. Before and after the exercise program, three sessions per week for 12 weeks, motor proficiency was measured using the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2), and social development was measured using the Vineland Social Maturity Scale (VSMS).

### **Results**

Pupils in the intervention group completed 92% of the sessions. The results of the ANCOVA test showed that the exercise program led to a statistically significant improvement in total motor proficiency ( $P < 0.01$ ) and total social maturity score ( $P < 0.015$ ).

and Control, Sport Science  
Research Institute, Tehran,  
Iran  
Email: [ssrc.kashi@gmail.com](mailto:ssrc.kashi@gmail.com)

Received: 04-Nov-2021  
Accepted: 03-Mar-2022  
Published: 15- Mar-2023

## Conclusion

According to this study, the SSRI training package achieved good adherence and increased physical activity and showed the potential to improve motor and social skills in young people with an intellectual disability.

**Keywords:** Intellectual disability; Exercise package; Psychomotor skills; Development

**DOI:** 10.22037/ijcn.v17i1.36644

## Introduction

The American Association on Intellectual and Developmental Disabilities (AAIDD) defines Intellectual Disability (ID) as a disability characterized by significant limitations in intellectual functioning and adaptive behavior, which affect a wide range of everyday social and practical skills and manifest before the age of 18. ID affects not only the individual but also the family and society (1). Given the prevalence of this disability, preparing the conditions for these individuals to have an acceptable quality of life, motivation, development, access to education, work, culture and leisure facilities, and appropriate level of physical health and fitness, including cardiovascular and respiratory health, muscle endurance, flexibility, and balance, is a challenging public responsibility with significant public health implications (2). Several researchers have globally studied the physical fitness of young people with intellectual disability and compared them in this respect with their non-disabled counterparts. Most of these studies have reported poor results for these individuals (3-5). Furthermore, young people with ID tend to have poorer and delayed motor development (6-8) and social development (9, 10) compared to their counterparts without ID.

Another common problem in young people with disabilities is high sedentary time (11). Furthermore, various studies on the level of physical activity in these individuals have shown that, on average, they are not as physically active as their healthy counterparts (12-14). One of the challenges for people with disability and their families is finding suitable recreational activities, as they cannot participate in all activities, and not enough programs are available for every group of disabled people. Therefore, these individuals tend not to participate in any particular activities, further isolating them and intensifying their social and health problems, consequently reducing their quality of life (15).

Children with ID and adolescents with low levels of physical activity are more likely to have cardiovascular problems, blood pressure, cancer, diabetes, and other conditions in adulthood (16, 17). Research has also shown that inactivity in young people with disabilities can have secondary consequences such as osteoporosis, osteoarthritis, loss of balance, strength, endurance, fitness, and flexibility, obesity, and depression (18-20). The fact that people with disabilities tend to be less physically healthy than their normal counterparts highlights the importance of developing physical

exercises and sports activities specifically for these individuals.

It is a well-established fact that physical activity benefits all people, disabled or not. However, for various reasons, people with disabilities tend to be less interested in participating in physical activities and have lower fitness than their healthy counterparts (21). Despite this inclination, children with disabilities can substantially benefit from regular physical activity in terms of body composition, skeletal health, mental health, and social participation (22, 23). Correspondingly, research has shown that physical activity positively affects physical and psychological well-being factors such as mood, life satisfaction, self-efficacy, and self-confidence of these individuals (24, 25).

Children and adolescents with disabilities are more likely to be less active and overweight or obese and need more supported physical activity and sports to enable movement and physical activity and motivate and engage them to stay healthy. Indeed, exercise programs not only address specific movement problems of individuals but also improve their overall health and well-being (26) through their engagement in activities and games that improve both physical and psychological characteristics and help individuals learn positive aspects of social behaviors such as fair play, cooperation, and group participation. Undoubtedly, learning to move and moving to learn are vital complementary components of structured physical education and physical activity programs (27). In contrast, physical activity does not improve the IQ of these individuals, possibly, improving adaptive behaviors through regular physical activity. Physical activity also helps people with intellectual disabilities develop some skills for experiencing independent living, finding a job, and staying

healthy.

Since people with intellectual disabilities have higher rates of secondary disabilities and other health problems than the general population, these individuals need more specialized care, exercise, and physical education programs than the rest of the community (28).

Over the years, many reports have been available on the positive impacts of single-modality exercise programs, including strength, aerobic, muscle endurance, and flexibility on people with intellectual disability. In recent years, researchers have tried combining strength, balance, aerobic, and other types of exercise into a more comprehensive individualized training program for higher effectiveness (29-31). Extensive research in this field has shown that multi-modal exercises can be more effective than single-modality exercises in improving the functional abilities and physical fitness of people with an intellectual disability (32). Nevertheless, what physical education (PE) teachers and sports coaches need is a set of general instructions and guidelines based on the latest findings in this field to help them plan long-term exercise programs for people with an intellectual disability.

Considering the importance of physical activity for these young people and the stated need for evidenced instructions and guidelines, this study set out to develop and evaluate the feasibility of implementing the potential effect of the “SSRI exercise package for students with intellectual disability” on improving the motor and social development of these individuals. Upon the verification of the effectiveness of the program and its benefits for these individuals, it can serve as a guideline for researchers, PE teachers, sports coaches, parents, and caregivers to help them plan

exercises for students with intellectual disability.

## Materials & Methods

### Population, statistical sample, and sampling method:

The sample comprised individuals with an intellectual disability studying in the special schools of the Special Education Organization of Iran. After coordination with the Special Education Organization of Iran, the researchers chose one of the special schools in Tehran for implementing the program and identified the students in this school who met the inclusion criteria.

In a Randomised controlled trial between October 2019 to February-2020, Thirty-six 7-18-year-old students with mild intellectual disabilities received the invitation to the study. Students were randomly divided into intervention (18 students) and control (18 students) groups. Before conducting the research, the researcher obtained written consent from the students' parents and students' consent to participate. The sample was formed from eligible students willing to participate in the program.

**An exercise package for people with intellectual disability:** The development of exercise programs for people with special needs has been a subject of interest to many researchers worldwide, who have studied the impacts of different exercise methods and tried to combine them for higher efficacy. The critical point in designing these exercise programs is to pay attention to the etiology of each disorder and its symptoms and implications and to plan the program for the needs of participants. The decision of which exercises to use and how to combine them should be made based on the latest scientific findings with due attention to the theoretical principles of exercise science. The SSRI exercise training package for people with ID (Kashi practices for people with intellectual disability)

was developed based on the theoretical principles listed below and many past studies on the subject (33) (table 1: Preferred exercises for people with intellectual disability). The package is presented in the following three sections.

### Principles of exercise for people with intellectual disability

Listed below are the main principles for implementing exercise programs for people with an intellectual disability according to numerous studies conducted on this subject, which PE teachers and coaches should carefully consider and adhere to when planning exercises for these individuals.

Increasing physical activity is the key to the success of any sports rehabilitation program.

Improvement in physical fitness and motor development is a primary determinant of long-term commitment to the exercise program.

Perceptual motor and cognitive training should be the main focus of exercise training programs for people with intellectual disability.

Weight loss exercises contribute to improving people's well-being with intellectual disability.

Improving psychosocial abilities through physical activity and games is a way to increase social interaction.

Specialized sports serve as a means for people with intellectual disability to demonstrate their abilities. Group exercises with peers are better than home and individual exercises.

Parent-child exercises complement specialized rehabilitation exercises.

It is necessary to increase the motivation of people with intellectual disability to participate in physical activities to make sure they commit to exercise programs.

It is necessary to create unified sports and inclusive

education, exercise, and game to facilitate interactions between people with and without intellectual disabilities.

Special Olympics can serve as a complete package and a gateway for the social integration of people with intellectual disabilities.

Physical activity can alleviate the age-related health issues of the elderly with intellectual disability.

**a) Frequency of weekly sessions :** There must be at least 2-weekly sessions for muscle and balance exercises, three sessions for low to moderate-intensity cardiovascular endurance and muscular endurance exercises, and perception-action exercises. Besides, one session must be a combination of cardiovascular endurance, flexibility, perception-action and balance exercises, muscle function improvement exercises, and other exercises mentioned in the “type of exercise” section.

**b) Intensity of exercises:** Trainers can use multiple sets of 8-12 repetitions for strength exercises of each muscle and a few sets of twenty repetitions with intensities of up to 70% 1RM for muscle endurance. Aerobic exercises should start with light intensity and gradually transition to moderate intensity (50-70% of the maximum heart rate) according to the overload principle. Whereas many of these individuals can perform more intense aerobic exercises (70-85% of the maximum heart rate), considering the general inactivity of these individuals and the higher prevalence of metabolic and cardiovascular disorders in this population, trainers should be extremely cautious about using high-intensity exercises.

**c) Duration of exercise in each session (time):** This package recommends planning the exercises in 45 to 60 minutes per session.

**d) Total duration of the exercise program (volume):** Since physical variables (e.g., strength, muscle endurance, and body composition) can be improved faster than variables that involve nervous system function (e.g., balance and psychological and neurological characteristics), the total duration of the program should be increased if the goal is to improve the latter variables. Notably, many effects of the exercise program will be temporary and gradually disappear once the person stops participating.

**e) Progression of the exercise program:** To achieve the desired psychological, physiological, and social impacts, the intensity, duration, and repetition of exercises should be increased based on the overload principle, i.e., to apply increasingly heavier loads on participants to challenge their physiological and psychological systems and improve their adaptability. Given the vast individual differences in this population, trainers should start the exercises at a low-intensity level without putting much pressure on participants and gradually increase the difficulty (intensity) of exercises as their capabilities grow. In this process, it is critically important to keep participants motivated and ensure that they still enjoy the exercises, even the vigorous ones. To do so, even hard exercises should be accompanied by games, and fun and motivational techniques must be used effectively to achieve the abovementioned goal. One of the most effective motivation techniques is to create the conditions for participants to be successful, to become champions, and to have their abilities admired (33).

#### **Control Group**

The control group followed their routine educational programs at school (The program included classroom and regular physical education

classes).

### **Intervention group**

The intervention group participated in the exercise sessions specified in the package, 3-weekly sessions for 12 weeks. Pre-and post-tests were performed on both groups.

### **Outcome Measures**

Motor skill development was measured using the Bruininks Oseretsky Test of Motor Proficiency (BOTMP). Many studies have used this test to assess the perceptual-motor skills of healthy children and children with intellectual disability aged 4.5 to 14 years (33, 34). The reliability and sensitivity of BOTMP in measuring motor skill development of children with intellectual disabilities have been investigated and validated by Wuang and Su in 2009 (34).

Adaptive behaviors were measured by the Vineland Social Maturity Scale (VSMS), which consists of 8 subscales: Self-help General (SHG), Self-help Eating (SHE), Self-help Dressing (SHD), Self-direction (SD), Occupation (OCC), Communication (COM), Locomotion (LOM), and Socialization (SOC) skills (35).

### **Data analysis method**

Given that the research design contained within-subjects factors (pre-test and post-test scores) as well as between-subjects factors (intervention and control groups), the analysis of covariance (ANCOVA) was used to test the hypotheses. Demographic and event data were described using point estimates and 95% CI. Data was analysed in SPSS softwer (version 16).

## **Results**

The sample consisted of thirty-six students out of a possible forty with an intellectual disability investigated in the chosen school in the academic

year 2019-2020. These students were in the age range of 7 -18 years and ranged from 1st graders to 10th graders. Of these thirty-six students, 18 were randomly assigned to the intervention group and 18 to the control group. Overall, the sample had a mean age of  $13.89\pm 2.48$ . The mean age in the intervention group was  $14.22\pm 1.93$ , and the control group was  $13.55\pm 2.95$  with 100 % male. Some other information about the participants is listed in Table 2.

### **Evaluation of the effectiveness of the exercise program**

**Scores of BOT-2 and its subscales:** The total motor proficiency score of the control group changed from  $24.67\pm 6.47$  in the pre-test to  $27.000\pm 6.068$  in the post-test. The total motor proficiency score in the intervention group increased from  $30.67\pm 6.83$  in the pre-test to  $40.22\pm 7.28$  in the post-test (Table 3, figure 1). In this score, the researcher found a substantial improvement in the intervention group, probably due to the implementation of the exercise program, and some improvement in the control group, probably because of attending the routine programs of the special school as well as growth and aging. The results of ANCOVA showed a significant difference between the two groups in terms of this score ( $P<0.001$ ). The results indicated that the exercises could explain 61% of the variability in the total motor proficiency score, 54% of the variability in the fine motor proficiency score, 52% of the variability in the gross motor proficiency score, and 49% of the variability in the upper limb coordination score. The analysis of the subscales of BOT-2 showed that after controlling for pre-test scores, there were significant differences between the post-test scores of the two groups in terms of fine Motor Integration ( $P=0.045$ ), running speed and agility ( $P=0.025$ ), balance ( $P<0.001$ ),

bilateral coordination ( $P=0.007$ ), strength ( $P<0.001$ ), Upper-Limb Coordination ( $P=0.011$ ), and manual dexterity ( $P<0.001$ ), but not in terms of fine motor precision ( $P=0.099$ ). These results revealed that among the subscales of BOTMP, those most affected by the exercise.

**Scores of VSMS and its subscales:** The total VSMS score in the control group changed from  $74.67\pm 9.25$  in the pre-test to  $76.33\pm 8.99$  in the post-test, and in the intervention group changed from  $76.28\pm 12.47$  in the pre-test to  $82.22\pm 9.79$  in the post-test (Table 4, figure 2). The results of ANCOVA showed that after controlling for pre-

test scores, there was a significant difference between the post-test VSMS scores of the two groups ( $P=0.001$ ). Further analysis showed significant ( $P<0.05$ ) differences between the two groups in terms of self-help eating ( $P=0.039$ ), self-help dressing ( $P=0.048$ ), self-direction ( $P=0.027$ ), communication ( $P=0.008$ ) and locomotion ( $P=0.030$ ) subscales of VSMS but not in terms of Self-help General ( $P=0.270$ ), occupation skills ( $P=0.081$ ), and socialization skills ( $P=0.058$ ) subscales. The results indicated that the exercises could explain 29% of the variability in the total VSMS score of students with intellectual disability who participated in the program.

Preferred exercises for people with intellectual disability

Table 1. An exercise training package for people with intellectual disability (generalities and exercises related to each part)

Muscle function development	Perceptual-action and cognitive exercises	Aerobic exercises	Psychosocial skills development	Balance exercises
<p>1. Climbing Swedish ladder, sit-ups, V-ups (while lying on the back, raising the arms and legs up to the midline of the body at the same time), push-ups on Swedish ladder or on the ground.</p> <p>2. Knee flexion and extension, wrist plantarflexion, thigh extension and abduction, trunk flexion and extension</p>	<p>1. Playing with balls, balloons, straps, handkerchiefs and adhesives to diversify movement exercises and also activities such as rolling, pressing, pulling, lifting, catching and throwing balls and objects in each session</p> <p>2. Exercising with tennis ball, volleyball, soccer ball, and basketball with adapted methods of throwing and catching.</p> <p>3. Exercising with different balls (tennis, volleyball, basketball and beach sports balls) with different types of walking and running with ball, different sets of developmental exercises with ball (stationary, moving, in pairs, with ball in sitting position, in pairs in sitting position), exercises that involve perceiving visual, auditory and tactile stimuli and giving appropriate response, exercises that increase the reaction speed</p>	<p>1. Circular exercises, aerobic dance and adaptive sports activities</p> <p>2. Fast walking, jogging or cycling</p> <p>3. Going up and down the stairs, using aerobic exercise machines such as treadmills or ergometers, sit-ups and consecutive jumping with both feet</p> <p>4. Any rhythmic movement that lasts for about 10 minutes, long-term physical activities in which the heart rate is at least 50% of the maximum heart rate, various types of running such as jogging, interval, etc., games in which running is a main component</p>	<p>Exercising with peers, group exercises and parent-child exercises for developing psychological skills including emotional self-control and social interaction through games and exercises such as hopping/jumping, ball throwing and catching, sensory control games, games that improve sensory control, interactive and educational adventure computer games to improve language and memory abilities, billiards, crossing over pool, crossing obstacle courses, games that involve interactions such as moving, buying and selling resources such as water, food, etc. to develop sensory control, team management and leadership, exercises to increase interaction with and sense of belonging to group</p>	<p>1. Static and dynamic balance exercises (2. Lying down with abdomen/back on a rehabilitation ball and swinging forward and backward, leaning on arms while lying down on a rehabilitation ball, assuming the all-fours position on a rehabilitation pillow, trying to maintain balance while alternately raising the upper right and left limbs to the horizon level, maintaining a proper sitting position on a rehabilitation ball, maintaining pelvic balance on the sagittal axis when sitting on the ball, maintaining pelvic balance on the frontal level while alternately raising the left and right legs off the ground, Standing on two feet on a rehabilitation pillow, trying to bend the knee while standing on a rehabilitation pillow, walking barefoot on a sticky mat, walking barefoot on a 10cm thick exercise mat, walking along the edge of the gym, and walking on rehabilitation pillows of different thicknesses.</p>

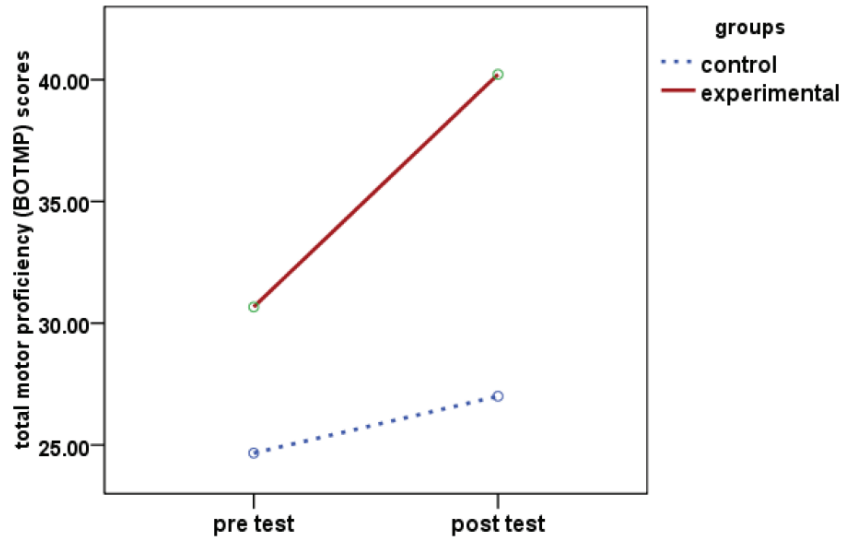
Muscle function development	Perceptual-action and cognitive exercises	Aerobic exercises	Psychosocial skills development	Balance exercises
<p>3. Machine chest press, machine leg extension, machine lat pull-down, cable curl, standing machine leg curl, machine tricep extension, standing machine calfraise, standing dumbbell front raise, and abdominal exercises</p> <p>4. Elliptical squats (simple squats only with body weight), jump squats, straight-leg sit-ups, bent knee sit-ups, straight-leg scissor kicks (slightly sitting backward).</p> <p>5. Upper and lower limb resistance exercises with body weight, bodybuilding machines, weights and Swedish movements, TRX exercises, medicine ball exercises, exercise with resistance bands</p>				<p>3. Hopping with both feet on soft foam, hopping with one foot to the sides, knee tuck jumping, long hopping with both feet, hopping with one foot, standing on one foot, jumping with both feet side-to-side, running on stairs while alternating feet, jumping on stairs with both feet. 4. Toe-heel walking, standing in a row, walking sideways and walking backward with eyes open/closed.</p> <p>5. Exercising with a BOSU ball. 6. Exercising with wheeled equipment such as bicycles, scooters and skates. 7. Walking and running on a balance beam or foam.</p>

Flexibility exercises	Weight loss exercises	Increase physical activity	Specialized sports	Physical fitness and motor skill development
Stretching exercise of different muscles to increase flexibility, passive stretching exercises, assisted active stretching exercises followed by active stretching exercises with at least 30 seconds of stretching in each movement, yoga exercises	Aerobic exercises and physical activities to increase energy consumption mainly in exercise sessions that last more than 30 minutes, speed interval exercise for 10 minutes	Increasing physical activity in sports training programs, daily activities, entertainment and leisure activities, participating in sports activities based on interest	Water exercises, swimming, sports exercises in the form of common organized sports games such as basketball, cycling, badminton, soccer, and other ball sports depending on the available facilities	<ol style="list-style-type: none"> <li>Swimming exercises with the health improvement approach, massage, powerlifting, horseback riding</li> <li>Acrobatic activities, running, dancing, walking and climbing stairs</li> <li>Variety of ball-based game interventions</li> <li>Improving sports-related motor skills and using bodybuilding machines</li> </ol>

Table 2: Demographic information of the intervention and control groups

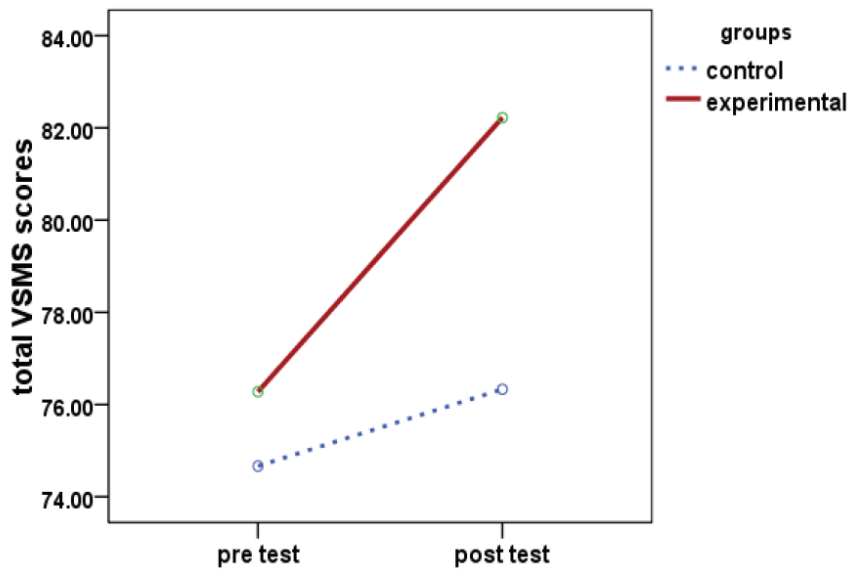
variable	Control group		Intervention group	
	Pre test	Post test	Pre test	Post test
number	18	18	18	18
height	152.05±14.92	152.31±15.13	160.71±9.92	160.99±11.02
weight	55.22±18.73	55.67±18.73	64.28±19.89	63.06±18.45
BMI	23.88±4.30	23.99±4.34	24.88±5.09	24.32±4.87

**Pre- and post-test total motor proficiency (BOTMP) scores of the intervention and control groups**



*Figure 1: pre-and post-test total motor proficiency (BOTMP) scores of the intervention and control groups*

**Pre- and post-test total VSMS scores of the intervention and control groups**



*Figure 2: pre-and post-test total VSMS scores of the intervention and control groups*

**The Effect of an Exercise Package for Students with Intellectual Disability on Motor and Social Development**

**Table 3.** The effect of the exercise program on motor proficiency of the intervention and control groups

variables	test	Sum of squares	df	Mean square	f	sig	Partial Eta Squared	Observed power
mean total BOTMP score	Pre test	1246.725	1	1246.725	146.733	0.000		
	variable	445.838	1	445.838	52.473	0.000		
running speed and agility	Pre test	29.725	1	29.725	85.317	0.000	0.721	1
	variable	1.912	1	1.912	5.489	0.025	0.143	0.623
balance	Pre test	87.363	1	87.363	125814	0.000	0.792	1
	variable	15.356	1	15.356	22.114	0.000	0.401	0.995
bilateral coordination	Pre test	18.326	1	18.326	132.531	0.000	0.801	1
	variable	1.142	1	1.142	8.258	0.007	0.200	0.797
strength	Pre test	59.062	1	59.062	16.495	0.000	0.333	0.976
	variable	68.024	1	68.024	18.998	0.000	0.365	0.988
Fine Motor Precision	Pre test	71.994	1	71.994	56.852	0.000	0.945	1
	variable	0.370	1	0.370	2.887	0.099	0.080	0.378
Upper-Limb Coordination	Pre test	2.235	1	2.235	200.215	0.000	0.858	1
	variable	10.196	1	10.196	7.234	0.011	0.180	0.742
manual dexterity	Pre test	128.552	1	128.552	149.124	0.000	0.819	1
	variable	21.983	1	21.983	25.501	0.000	0.436	0.998

**Table 4.** The effect of the exercise program on Scores of VSMS and its subscales of the intervention and control groups

variables	test	Sum of squares	df	Mean square	f	sig	Partial Eta Squared	Observed power
Self-Help General	Pre test	229.022	1	229.022	85.312	0.000	0.721	1
	variable	3.383	1	3.383	1.260	0.270	0.037	0.193
Self-Help Eating	Pre test	11.063	1	11.063	57.707	0.000	0.136	1
	variable	0.884	1	0.884	4.612	0.039	0.123	0.550
Self-Help Dressing	Pre test	31.650	1	31.650	163.041	0.000	0.832	1
	variable	0.820	1	0.820	4.222	0.048	0.113	0.514
Self-Direction	Pre test	100.771	1	100.771	127.054	0.000	0.794	1
	variable	4.233	1	4.233	5.324	0.027	0.139	0.610

## The Effect of an Exercise Package for Students with Intellectual Disability on Motor and Social Development

variables	test	Sum of squares	df	Mean square	f	sig	Partial Eta Squared	Observed power
Occupation Skills	Pre test	75.677	1	75.677	26.047	0.000	0.441	0.999
	variable	9.418	1	9.418	3.242	0.081	0.089	0.416
Communication	Pre test	4.177	1	4.177	35.538	0.000	0.519	1
	variable	0.947	1	0.947	8.061	0.008	0.196	0.787
Locomotion	Pre test	142.639	1	142.639	300.998	0.000	0.901	1
	variable	2.434	1	2.434	5.135	0.030	0.135	0.595
Socialization Skills	Pre test	25.201	1	25.201	42.968	0.000	0.566	1
	variable	2.253	1	2.253	3.824	0.058	0.104	0.447
Total VSMS Score	Pre test	252.744	1	252.744	172.724	0.000	0.840	1
	variable	192.594	1	192.594	13.176	0.001	0.285	0.941

### Discussion

The present study found outstanding engagement with the program and proper adherence to sessions, with most pupils attending 92%. The students who participated in the exercise program showed significant improvement in total motor proficiency (BOTMP), gross motor proficiency, fine motor proficiency, and upper limb coordination scores (although the control group also showed minor improvement in this area, which was possibly due to attending the routine programs of the school and changes due to growth and aging). This research also observed changes in the social maturity (VSMS) and many of its subscales, including self-help eating, self-help dressing, self-direction, communication skills, and locomotion skills, although not in terms of self-help general ability, occupation skills, and socialization skills subscales. The obtained findings are significant as they demonstrate that people with intellectual disability can significantly improve their motor and social skills by participating in the xxx exercise program.

This study's findings now need replicating in a larger group and people with different levels of intellectual impairment.

In this study, motor skills development was chosen as one of the top priorities of the exercise program. Therefore, various basic motor skills exercises were placed in a coherent chain throughout every session to improve the students' motor skills over the course of the program. The results showed that the exercises were able to explain 61% of the variability in the total motor proficiency score, 54% of the variability in the fine motor proficiency score, 52% of the variability in the gross motor proficiency score, and 49% of the variability in the upper limb coordination score. Accordingly, these results are relatively acceptable and suggest that the program can produce significant outcomes in this area if continued over more extended periods. Effect of the physical exercise package on the social maturity of the students with intellectual disability: Depending on the culture of the place where they live, people with disabilities may face

social and environmental barriers that push them toward isolation and undermine their emotional and social development. According to Lyons et al. (2009), many disabled people are socially isolated because they cannot participate in recreational activities appropriate to their age (15). In a meta-analysis of studies on the social influence, physical activity, and social cognition of people with physical disabilities, Stapleton et al. (2017) reported that more than 50% of people with physical disabilities have less physical activity than their peers and that social issues stemming from this disability constitute a significant factor that further restricts their physical activity and their presence in the society (36). A study by Latimer, Ginis, and Craven (2004) on the leisure time of people with spinal cord injuries showed that such disabilities lead to reduced physical activity levels even during leisure (37). Evidently, adaptive behaviors and social development in disabled people are not the same as in normal people.

According to experts in sports science, early interventions can play a crucial role in helping the emotional and social development of children with an intellectual disability. Therefore, PE interventions should also teach these children to show the right emotional responses in everyday situations. Indicatively, structured physical activity programs can gradually improve psychosocial behaviors and lead to enhanced self-control, respect for the rights and feelings of others, participation and effort, helpfulness, and management of personal behaviors. Proposedly, children can also learn multiple aspects of positive social behaviors while learning basic movements through games and exercises, as these types of activities have not only physical benefits but also involve interaction with peers, whereby children can experience multiple

relationships and develop various emotional and social skills (27).

In the present study, the results of ANCOVA showed a significant difference between the intervention group and the control groups in terms of post-test scores of social maturity (VSMS) and many of its subscales, including self-help eating, self-help dressing, self-direction, communication skills, and locomotion skills, but not in terms of self-help general ability, occupation skills, and socialization skills subscales (after controlling for the pre-test scores). These results showed that overall the exercises could explain 29% of the variability in the VSMS scores of the participating students. This study's results suggest that even a short-term exercise planned to improve social development can make a change —although small—in this development aspect in people with intellectual disability. Therefore, such interventions can succeed more in this area if implemented persistently and purposefully over more extended periods.

Despite the remarkable improvement of education and health systems for people with an intellectual disability across the world, many of these individuals still have little physical activity, and many teachers and trainers are still poorly informed about the exercises that are more suitable for this section of the population and simply lack the necessary knowledge to plan exercises for these individuals. In many countries, the Special Olympics, the organization responsible for promoting public sports for people with intellectual disabilities, is not yet sufficiently developed to have a meaningful impact. Thus, families and caregivers are confused about what exercises to give these individuals. Many sports coaches think that people with intellectual disability require special exercises that fall outside

the scope of their expertise and therefore refuse to accept them into public exercise classes, which leads to further isolation of these individuals. Likewise, since no specific lesson plan exists for training these individuals in schools, PE teachers may need help to give them the right exercises or create the right condition for their participation in PE classes—even though they decide to refuse to have them in classes on the ground that they lack the necessary knowledge to use appropriate exercise methods. These issues highlight the need for more accessible scientific content about sports exercises for people with intellectual disabilities. Therefore, more research is necessary to develop and publish exercise planning guidelines for these individuals. In this study, researchers tried to contribute to this cause by developing an exercise package and a series of exercise guidelines for students with intellectual disabilities.

### **In Conclusion**

Therefore, this research's goal in developing an SSRI exercise training package was to give PE teachers and sports coaches a framework for them to use their knowledge of sports science and relevant expertise to plan a round of exercise sessions for students with intellectual disabilities based on their understanding of the characteristics and capabilities of each student. By developing an exercise package for students with intellectual disabilities and evaluating its effectiveness in improving their motor and social development, this paper introduced a somewhat practical initial guideline for exercise planning for these students. Hopefully, the other researchers will address the shortcomings of these guidelines and provide new and more comprehensive versions for international use.

### **Acknowledgement**

We would like to express my deep gratitude to Iran National Science Foundation (INSF), the Research project sponsor and the Special Education Organization of Iran, who gave permission to enter exceptional schools and made the necessary coordination for the implementation of exercises. The training coach in this research was Hossein KakeJani, whose efforts are appreciated. Also, Zahra Ranjbar cooperated with us in collecting the background of the research. They are also appreciated. Pirouzi Exceptional Children's School was the place of the exercises. We are grateful to the colleagues of this school.

Research project sponsor: Iran National Science Foundation (INSF).

**Code of ethics:** The research proposal was submitted in advance to the National Committee for Ethics in Biomedical Research at the Ministry of Health and Medical Education of Iran and SSRI and received permission with the code IR.SSRC.REC.1398.030

### **Author's Contribution**

Ali Kashi conceived of the presented idea. Helen Dawes and Maedeh Mansoubi developed the theoretical framework, Ali Kashi directed and supervised the project. Zahra Sarlak performed the examination. Ali Kashi performed the analysis of data. All authors have read and approved the manuscript.

### **Conflict of interest**

None

## References

1. Shree A, Shukla P. Intellectual Disability: definition, classification, causes and characteristics. *Learning Community-An International Journal of Educational and Social Development*. 2016;7(1):9-20.
2. Chow BC, Huang WY, Choi PH, Pan C-y. Design and methods of a multi-component physical activity program for adults with intellectual disabilities living in group homes. *Journal of Exercise Science & Fitness*. 2016;14(1):35-40.
3. Cuesta-Vargas AI, Paz-Lourido B, Rodriguez A. Physical fitness profile in adults with intellectual disabilities: differences between levels of sport practice. *Research in Developmental Disabilities*. 2011;32(2):788-94.
4. Graham A, Reid G. Physical fitness of adults with an intellectual disability: A 13-year follow-up study. *Research quarterly for exercise and sport*. 2000;71(2):152-61.
5. Salaun L, Berthouze-Aranda SE. Physical fitness and fatness in adolescents with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*. 2012;25(3):231-9.
6. Kane KJ, Staples KL. A group motor skills program for children with coordination difficulties: Effect on fundamental movement skills and physical activity participation. *Physical & occupational therapy in pediatrics*. 2016;36(1):28-45.
7. Stodden DF, Goodway JD, Langendorfer SJ, Roberton MA, Rudisill ME, Garcia C, et al. A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest*. 2008;60(2):290-306.
8. Vuijk PJ, Hartman E, Scherder E, Visscher C. Motor performance of children with mild intellectual disability and borderline intellectual functioning. *Journal of intellectual disability research*. 2010;54(11):955-65.
9. Huettig C, Auxter D, Pyfer J. *Gross Motor Activities for Young Children with Special Needs: A Supplement To: Auxter/Pfyer/Huettig, Principles and Methods of Adapted Physical Education and Recreation Tenth Edition: McGraw-Hill; 2005: 7-64.*
10. Seok S, DaCosta B. Digital literacy of youth and young adults with intellectual disability predicted by support needs and social maturity. *Assistive Technology*. 2017;29(3):123-30.
11. Oviedo GR, Tamulevicius N, Guerra-Balic M. Physical activity and sedentary time in active and non-active adults with intellectual disability: a comparative study. *International journal of environmental research and public health*. 2019;16(10):1761.
12. Einarsson IÓ, Ólafsson Á, Hinriksdóttir G, Jóhannsson E, Daly D, Arngrímsson SA. Differences in physical activity among youth with and without intellectual disability. *Med Sci Sports Exerc*. 2015;47(2):411-8.
13. Hinckson EA, Curtis A. Measuring physical activity in children and youth living with intellectual disabilities: a systematic review. *Research in developmental disabilities*. 2013;34(1):72-86.
14. Jung J, Leung W, Schram BM, Yun J. Meta-analysis of physical activity levels in youth with and without disabilities. *Adapted Physical Activity Quarterly*. 2018;35(4):381-402.
15. Lyons S, Corneille D, Coker P, Ellis C. A miracle in the outfield: The benefits of participation in organized baseball leagues for children with mental and physical disabilities. *Therapeutic Recreation Journal*. 2009;43(3):41-8.

16. Hsieh K, Rimmer J, Heller T. Obesity and associated factors in adults with intellectual disability. *Journal of Intellectual Disability Research*. 2014;58(9):851-63.
17. Sohler N, Lubetkin E, Levy J, Soghomonian C, Rimmerman A. Factors associated with obesity and coronary heart disease in people with intellectual disabilities. *Social Work in Health Care*. 2009;48(1):76-89.
18. Draheim CC, McCubbin JA, Williams DP. Differences in cardiovascular disease risk between nondiabetic adults with mental retardation with and without Down syndrome. *American Journal on Mental Retardation*. 2002;107(3):201-11.
19. Rimmer JH, Vanderbom KA, Bandini LG, Drum CE, Luken K, Suarez-Balcazar Y, et al. GRAIDs: a framework for closing the gap in the availability of health promotion programs and interventions for people with disabilities. *Implementation Science*. 2014;9(1):1-9.
20. Yamaki K. Body weight status among adults with intellectual disability in the community. *Mental retardation*. 2005;43(1):1-10.
21. Prevention OoD, Promotion H. *Physical activity guidelines for Americans*. Washington, DC: US Department of Health and Human Services. 2008: 1-12.
22. Jobling A, Cuskelly M. Young people with Down syndrome: A preliminary investigation of health knowledge and associated behaviours. *Journal of Intellectual and Developmental Disability*. 2006;31(4):210-8.
23. Merrick J, Bachar A, Carmeli E, Kodesh E. Effects of aerobic exercise on body composition and muscle strength in over-weight to obese old women with intellectual disability: a pilot study. *The Open Rehabilitation Journal*. 2013;6(1).
24. Carmeli E, Zinger-Vaknin T, Morad M, Merrick J. Can physical training have an effect on well-being in adults with mild intellectual disability? Mechanisms of ageing and development. 2005;126(2):299-304.
25. Johnson CC. The benefits of physical activity for youth with developmental disabilities: a systematic review. *American journal of health promotion*. 2009;23(3):157-67.
26. Shields N, Dodd KJ, Abblitt C. Do children with Down syndrome perform sufficient physical activity to maintain good health? A pilot study. *Adapted Physical Activity Quarterly*. 2009;26(4):307-20.
27. Choi PHN, Cheung SY. Effects of an 8-week structured physical activity program on psychosocial behaviors of children with intellectual disabilities. *Adapted Physical Activity Quarterly*. 2016;33(1):1-14.
28. Moore G, Durstine JL, Painter P, Medicine ACoS. Acsm's exercise management for persons with chronic diseases and disabilities, 4E: *Human Kinetics*; 2016: 12-72.
29. Oviedo GR, Guerra-Balic M, Baynard T, Javierre C. Effects of aerobic, resistance and balance training in adults with intellectual disabilities. *Research in developmental disabilities*. 2014;35(11):2624-34.
30. Wu W-L, Yang Y-F, Chu I-H, Hsu H-T, Tsai F-H, Liang J-M. Effectiveness of a cross-circuit exercise training program in improving the fitness of overweight or obese adolescents with intellectual disability enrolled in special education schools. *Research in Developmental Disabilities*. 2017;60:83-95.
31. Yan Z, Finn K, Corcoran M. Using peer education to promote balance, fitness, and physical activity among individuals with

- intellectual disabilities. *American Journal of Health Studies*. 2015;30(4).
32. Calders P, Elmahgoub S, de Mettelinge TR, Vandebroek C, Dewandele I, Rombaut L, et al. Effect of combined exercise training on physical and metabolic fitness in adults with intellectual disability: a controlled trial. *Clinical rehabilitation*. 2011;25(12):1097-108.
33. Kashi A, Sarlak Z. The edition of SSRI exercise training package for people with intellectual disability. Tehran, Iran Sport Science Research Institute (SSRI); 2020: 132-170.
34. Wang Y-P, Su C-Y. Reliability and responsiveness of the Bruininks-Oseretsky Test of Motor Proficiency-in children with intellectual disability. *Research in developmental disabilities*. 2009;30(5):847-55.
35. Saulnier MD. Vineland Adaptive Behavior Scales. Slides; 2016: 1-10.
36. Stapleton JN, Mack DE, Ginis KAM. Social influence, physical activity, and social cognitions among adults with physical disability: A meta-analysis. *Kinesiology Review*. 2017;6(3):271-85.
37. Latimer AE, Ginis KAM, Craven BC. Psychosocial predictors and exercise intentions and behavior among individuals with spinal cord injury. *Adapted Physical Activity Quarterly*. 2004;21(1):71-85.

---

Copyright © 2023 The Authors. Published by Shahid Beheshti University of Medical Sciences.

This work is published as an open access article distributed under the terms of the Creative Commons Attribution 4.0 License

(<http://creativecommons.org/licenses/by-nc/4>). Non-commercial uses of the work are permitted, provided the original work is properly cited.