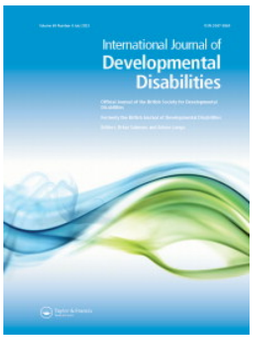

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International Journal of Developmental Disabilities

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/yjdd20

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To cite this article: Zekiye Özkan & Rasim Kale (2023) Investigation of the effects of physical education activities on motor skills and quality of life in children with intellectual disability, International Journal of Developmental Disabilities, 69:4, 578-592, DOI: 10.1080/20473869.2021.1978267

To link to this article: https://doi.org/10.1080/20473869.2021.1978267

Investigation of the effects of physical education activities on motor skills and quality of life in children with intellectual disability

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Aim: This study was carried out in order to examine whether there is a difference between the quality of life and motor skills of children with intellectual disability who participate in physical education activities and those who do not participate.

Method: This study was conducted with a total of 34 children with 16 children in the control group (8 girls, 8 boys) and 18 children in the experimental group (11 boys, 7 girls) using a pre-test, post-test and control group experimental design. A 14-week "Physical Education Activities Program" was applied to the children in the experimental group. Children in the control group did not participate in physical education activities. The Bruininks Oseretsky test of motor proficiency second edition brief form 2010 to measure the motor performance and "Pediatric Quality of Life Inventory (PedsQL)" developed by Varni *et al.* in 1999 were used for children with intellectual disability.

Findings: When the motor skill tests of the children with intellectual disability in the experimental group were evaluated, significant improvements were found in fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, speed and agility, upper limb coordination, strength tests and all dimension scores for quality of life compared to the pre-test ($p < 0.05$). In the control group, a statistically significant improvement was observed in the quality of life Physical Functioning score and fine motor integration, bilateral coordination, and upper limb coordination tests ($p < 0.05$). More significant improvement was observed in motor skills and quality of life in children with intellectual disability who participated in the 14-week physical education program compared to the control group.

Conclusion: Physical education activities contributed positively to improving the motor skills and quality of life of children with intellectual disability.

Keywords: motor skills, quality of life, intellectual disability, physical education, children produced from thesis

Produced from the first author's doctoral thesis:

Introduction

Disability is considered to be a health condition that causes disorders in body functions and structures, movement limitations and problems in social participation when personal and environmental factors are evaluated (Schalock *et al.* 2007). Intellectual disability manifests itself as significant limitations in both mental functioning and adaptive behavior, as expressed by conceptual, social and practical adaptation skills, and symptoms appear before the age of 18 (Schalock *et al.* 2007). Approximately 1-3% of individuals worldwide have intellectual disability (Garavand *et al.* 2018). Among those with intellectual disability (ID), physical activity and cognitive development levels are lower than those with normal development as a result of the limitation of intelligence and social compatibility (Geng *et al.* 2019). Children with ID have disadvantages in fulfilling their duties in society (Cavanaugh 2017). Individuals diagnosed with ID are generally known to have sedentary lifestyles (Bossink *et al.* 2017) and low physical activity levels (Bossink *et al.* 2017; Garavand *et al.* 2018; Collins and Staples 2017; Hsieh *et al.*

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Supplemental data for this article is available online at https://doi.org/10.1080/20473869.2021.1978267.

DOI 10.1080/20473869.2021.1978267

2017; Sutherland *et al.* 2021; Pierce and Maher 2020). Low physical activity negatively affects life expectancy and quality (Cabeza-Ruiz *et al.* 2020). In a study conducted by Simões and Santos (2016) with 1264 individuals, it was found that with ID have lower quality of life than without ID.

ID causes limitations in various individual functions and often manifests as delayed motor and intellectual growth, low academic performance, and poor social communication skills (Baghande *et al.* 2019). International evidence shows that children and young individuals with ID are less active than children of the same age without ID (Frey *et al.* 2017). Physical fitness level affects motor and mental development (Skowroński *et al.* 2018). In the transition from childhood to adolescence, the relationship between physical activity and motor skills becomes more important and stronger. Higher motor skill level provides more opportunities for physical, sports and game activities (Goodway *et al.* 2019). Motor development is the continuous change in motor behavior throughout the life cycle (Gallahue *et al.* 2012). Children with ID have delays in fine motor skills when compared to children of the same age without ID (Budury *et al.* 2020). Many researchers state that children with ID perform less well in standard fitness tests and also have problems with balance and strength (Garavand *et al.* 2018). Klavina *et al.* (2017) found that the levels of gross motor skills of primary school children diagnosed with ID were not at the level required by their age. Klavina *et al.* (2017) found that 50% of the participants scored lower for locomotor skills and 62% for object control skills in the performance scores required by chronological age. While the performance age level for these parameters was 9.6, it was determined as 6.3 for children with ID.

Children and adults with ID have lower levels of physical development, gross motor skills and fine motor skills compared to children of the same age without ID. These deficiencies in motor skills are mostly seen in balance and related movements, complex coordination areas, and manipulative manual skills (Bruininks 1974). Balance and motor skills problems in sedentary children with ID limit the activities of daily living and limit the freedom of acting individually and independently (Giagazoglou *et al.* 2013).

Limited motor coordination movements due to ID and difficulties in learning a new activity reduce the level of motor development and negatively affect an individual's life. In addition, individuals with ID are less successful in performing movements that result from the combination of the two activities. (Fallah *et al.* 2014; Jankowicz Szymanska *et al.* 2012). Distancing themselves from society due to factors associated with this causes them to experience acceptance problems (Jankowicz Szymanska *et al.* 2012). Studies conducted for many years reveal that professional practice and developments in the field and improvements in the physical functions of individuals with ID play an important role in the quality of life of these individuals (Buntinx and Schalock 2010). Aristotle defined quality of life as "the meaning and purpose of life is the whole purpose and end of human existence" (Schippers 2010). Standard views are that disability has a very negative effect on the quality of life of individuals. This idea is advocated by individuals without disability in both popular and academic culture. (Amundson 2005). Many factors and problems are encountered that affect the quality of life of individuals with disability. These problems are accessibility, transportation, participation in sports, awareness, financial problems, physical and cognitive problems (Diaz *et al.* 2019). In addition, factors related to the health status of individuals with disability may cause difficulties in achieving a good quality of life. The quality of life of individuals with disability is particularly effective in terms of their personal roles in life, their responsibilities and reaching their determined goals (Glover-Graf, 2012).

Measurement of the quality of life in individuals with ID is made by subjective and objective methods (Brown *et al.* 2013). Objective measurements are observable and independently evaluated reliable methods (Brown *et al.* 2013). It is stated that children with ID score lower on physical fitness tests than children with normal development. This shows that there is a relationship between mental functions and physical fitness (Golubovic *et al.* 2012). Poor locomotor performance also affects low cognitive abilities (Shieh *et al.* 2020). In addition, individuals with ID it is seen that an inactive lifestyle and not participating in a planned exercise (Stanisic 2012) or not doing enough exercise (Shilpa and Reeta 2012) as well as unbalanced nutrition trigger obesity, heart diseases and health problems (Bryl *et al.* 2013). There is evidence that exercise not only prevents the occurrence of new diseases or the progression of existing diseases, but also increases physical functionality with beneficial effects on general health status, quality of life and life expectancy (Apolone and Mosconi 2007).

For people with ID, physical activity is important for physical and social development. Since it protects the general health of the body, it can contribute to many areas (Bryl *et al.* 2013). Since increasing physical activity has positive effects on cardiovascular and psychosocial health, it is extremely important to determine effective interventions for use in daily life (Michalsen *et al.* 2020). In addition, it is effective to improve physical health, circulatory problems, chronic diseases especially depression, anxiety, coping with stress, being emotionally positive, increasing communication, learning advanced cognitive functions and increasing self-confidence (McConkey 2016). It also benefits quality of life (Pestana *et al.* 2018; Nemček 2016). Sports-based programs strongly affect the physical, motor skills of

individuals with ID (Zurita-Ortega *et al.* 2020). In individuals with ID, motor problems and limitations are clearly seen in the performance levels related to sports skills, and these difficulties can also be affected while affecting cognitive, social and emotional areas (Bechar and Grosu 2016). Human development is often categorized in motor, cognitive, emotional, and physical domains. The motor field refers to human movement. The cognitive field refers to the intellectual changes in people, while the affective field refers to socio-emotional change. These areas are in constant interaction (Payne and Isaacs 2012). Various activity programs consist of physical education, motor skills, physical fitness, and individual and team sports (Elliott *et al.* 2016). Group sports and recreation programs are a very important part of childhood and growing up. Participation in these programs can teach children much more than playing skills (Block *et al.* 2016). Different types of exercise have a positive effect on physical health (Xu *et al.* 2020). Researchers state that education with game models improves the basic motor skills of individuals with ID (Kesumawati *et al.* 2020). Practice for motor development areas are therapeutic and rehabilitative (Bechar and Grosu 2016). Therefore, an important goal of all physical education programs is to help children acquire skills and behaviors (Block *et al.* 2016). Many researchers state that physical education and sports activities and regular exercise are effective in the development of motor skills of individuals with ID (Baghande *et al.* 2019; Malekpour *et al.* 2012; Garavand *et al.* 2018; Jaydari *et al.* 2016; Stojanović *et al.* 2018; Korkusuz and Top 2019; Mehralitabar *et al.* 2015 Ashori *et al.* 2018; Giagazoglou *et al.* 2013). In addition, literature studies show that different exercises affect quality of life positively. In the study conducted by (Eshaghi and Ghasemi 2021), 30 boys between the ages of 7-11 with an IQ level of 50 to 70 performed three single-leg squatting exercises for 8 weeks for 60 min improve static and dynamic balance and this positively affected their quality of life. In the literature review, there are almost no studies examining the effects of sports activities on the motor skills and quality of life of individuals with ID. For this reason, this research is thought to contribute to the areas of ID, physical education activities and quality of life. The aim of the study is to examine whether there is a difference between quality of life and motor skills of children with ID who participate in physical education activities for14 weeks and those who do not.

Method

Research model

An experimental design with pre-test, post-test and control groups was used. The dependent variable in the pattern is the motor skills and quality of life of children with ID, and the independent variable is the Physical Education Activities program, with effects on dependent variables examined. The research was carried out with a 2×2 mixed design (experimental and control groups x pre-test post-test). In mixed designs, the effect of at least two independent variables on the dependent variable is examined. While one of these variables defines the different experimental procedure conditions created by the unbiased groups, the other refers to the repeated measurements (pre-test and post-test) of the subjects at different times (Büyüköztürk 2015; Dimitrov and Rumrill 2003). In this study, the variables between groups were experimental (participating in physical education activities) and control (without any intervention) groups, and the within-groups variable is met by pre-test and post-test measurements.

Participants

Children aged 8-12 years who were diagnosed with ID according to the criteria of The Diagnostic and Statistical Manual of Mental Disorders (DSM-V) by specialist physicians working in the child psychiatry clinic of a state hospital affiliated to the Ministry of Health, participated in this study. According to DSM-5, the following three criteria must be met for the diagnosis of ID.

1. Deficiencies in intellectual functions such as reasoning, problem solving, designing, abstract thinking, judgment, learning at school and learning from their experiences, confirmed by both clinical assessment and an accepted measure of intelligence applied to the individual.
2. Deficiencies in adaptation functionality resulting in inability to meet developmental and socio-cultural criteria for personal independence and social responsibility. Unless an ongoing basis is provided, adaptive deficiencies restrict functionality in one or more activities of daily life, such as communication, social participation and independent living in different environments such as home, school, work and society.
3. Intellectual and adaptive deficiencies start at the developmental stage (APA 2013).

In our country, children with ID who receive special education support from rehabilitation centers are diagnosed with a mental disability report in hospitals, and then their educational diagnosis is made. After these diagnoses, they receive special education support and the cost of this support is covered by the state. When this study was planned, DSM4 diagnostic criteria were used in our country, but since DSM5 was updated at the beginning of the studies, it was stated by experts that children meeting DSM4 criteria met DSM5 criteria. For this reason, DSM5 criteria were taken as basis in the study. Children with ID registered in the Guidance Research Centers of the Directorate of National Education were included in this study. In the province where the study was conducted, the number of 8-

Table 1 Demographic characteristics of children in experimental and control groups

Age, height and weight of the participants:					
Groups		Height	Weight	Average	Standard deviation
Control	16	139.00 ± 11.98	36.82 ± 6.40	10.06	1.52
Experimental	18	140.72 ± 12.85	37.33 ± 11.88	10.33	1.45

12 years old children diagnosed with ID was not available. However, among 200 children registered in Van ipekyolu Counseling Research Center and other counties, who were diagnosed with ID, 102 children who continued their education in primary education and received special education support in rehabilitation were identified. Of these children, 25 children residing in the same settlement, receiving special education support from the same rehabilitation center and with families who accepted participation in the study were identified. Five children out of 25 children were not included in the study because they did not meet the inclusion criteria. The experimental group of 20 children who met the specified criteria were accepted for participation in the study, and 20 children who went to separate rehabilitation centers with similar characteristics were determined as the control group. The consent form for the children included in the experimental and control groups to participate in the study was signed by the families and the study was initiated. The study continued with 18 children, as the families of two children among the 20 children in the experimental group moved out of the city. Of the 20 children in the control group, one child's family moved out of the province and the families of 3 children stated that they could not continue the study due to some social problems and because of moving from the district where the educational practice was carried out, so the study was conducted with 16 children. The study, which was designed semi-experimentally with pre-test and post-test, was carried out with 34 children with intellectually disability, including 16 control group children with ID (8 girls, 8 boys) and 18 experimental group children with ID (11 boys, 7 girls) (Table 1).

The mean age of the participants in the control group was 10.06 ± S 1.52 years, weight 36.82 ± 6.40 kg, and height 139.00 ± 11.98 cm. The average age of the experimental group was 10.33 ± S 1.45 years, weight 37.33 ± 11.88 kg, and height 140.72 ± 12.85 cm.

The permission and application research and evaluation commission for research and research support to be carried out in schools and institutions affiliated with the Ministry of National Education approved the implementation of this study by considering ethical criteria with the letter number 21089 according to article fifth of the instruction. Study procedures were approved by Karadeniz Technical University Institute of Educational Sciences. Written permission was obtained from the parents of the participants in the study. Karadeniz Technical University Educational Sciences Institute approved all materials and procedures used in this study.

Inclusion and exclusion criteria

Children with ID participating in this study were selected from among children with ID diagnosis according to DSM-V diagnostic criteria, between the ages of 8-12 years, who continued their education in public schools and received special education support in rehabilitation. Self-care skills, such as the ability to follow instructions, perform personal care, and the ability to put on and take off their clothes on their own, were determined as preliminary criteria. The condition of not having any other disability other than ID and not having chronic health problems was sought. Children with poor communication skills and difficulties receiving instructions were not included in the study. In addition, children who do not regularly participate in physical activity were included in the study. The inclusion and exclusion criteria were confirmed by interviewing the families of the identified children with ID and by interviewing the special education teachers working at the schools where the children were educated. In addition, the researcher and a child development specialist individually evaluated the children who agreed to participate in the study according to the criteria.

Data collection tools

A general information form to obtain information about children and their families, the Bruininks Oseretsky test of motor proficiency second edition brief form (BOT-2 BF) to evaluate the motor skills of children with ID and the parent form of the "Pediatric Quality of Life Inventory (PedsQL) scale" were used as data collection tools.

General information form

The General Information Form contains questions about the child's name and surname, gender, date of birth, number of siblings and order of birth, behaviors of the child in the family, self-care skills, age of the mother and father, and education level in order to obtain information about the child and their parents.

Bruininks Oseretsky test of motor proficiency second edition

The Bruininks Oseretsky test of motor proficiency was developed by Bruininks Oseretsky in 1978 to measure

motor skills (cited by Bruininks and Bruininks 2010). This test battery was used by many researchers. Bruninks Oseretsky BOT-2 was used on 2485 individuals between the ages of 6-12 and Fransen *et al.* (2014). The reliability of the BOT-2 test is high for the systematic evaluation of motor development studies conducted for children with ID and autism (Downs *et al.*, 2020).

Different versions of the BOT2 test battery are used in Turkey. These are motor competence tests consisting of 23 items used by Işık and Zorba (2020). The highest score that can be obtained from the test was determined as 100. The BOT-2 test used by Karakaş in a study in 2018 consists of 53 items and eight subtests. The total maximum score from the test is 320. Düger *et al.* (1999) applied the gross and fine motor parts of the Burininks test to 120 healthy children between the ages of 4 and 11 years. Mülazı moğlu-Ballı (2006) adapted the Burininks test battery to Turkish and conducted a validity and reliability study on children without ID aged 5-6 years. The highest score that can be obtained from this test is 243. In our study, the Bruininks Oseretsky test of motor proficiency second edition brief form, which was updated in 2010, was used. The specified forms were used for each child involved in the experimental group.

Features of this test are that it can be done quickly and test materials can be obtained easily. It differs from other tests with these features. In addition, this form evaluates sensory perception and motor performances together. It is a test that briefly measures children's fine and gross motor skills within 15-20 min (Bruininks and Bruininks 2010). The raw scores obtained by the participants were converted into point scores and evaluated as eight subtests. The pre-tests applied before the study started, and the post-tests were repeated after the study. The highest score that can be obtained from the test battery was determined as 72 (Bruininks and Bruininks 2010). The 12-item version of the BOT-2 BF test was also used by Köse *et al.* (2021).

The BOT-2 BF test consists of 8 subtests and 12 items. The application of 12 items is as follows. The first 5 items are performed at the desk. For this reason, a table and chair suitable for the child's ergonomic characteristics and a quiet test area were organized.

- Two tests in the Fine Motor Precision test;
  - Filling a star.
  - Draw a line through a path.
- Two tests in the Fine Motor Integration test;
  - Copying Overlapping circles.
  - Copy a diamond.
- Dexterity Test
- Five tests were conducted on the table including Stringing Blocks.
  - The tests mentioned below were conducted in the gym.
- Two subtests in the Bilateral Coordination test;
  - Touching nose with index finger (eyes closed)
  - Pivoting thumbs and index fingers.
- Balance test;
  - Walking forward heel to-toe on a line.
- Speed and Agility test;
  - One-legged side hop.
- Two tests for Upper Limb Coordination;
  - Catching a tossed ball -one hand
  - Dribbling a ball -alternating hands
- Strength test;
  - Full push-ups (for boys).
  - Knee push-ups (for girls) (Bruininks and Bruininks 2010).
- Height and Weight Measurements.
  - Body weight measurement was carried out with an electronic weighing device with an accuracy of -0.01 kg. Measurements were completed in anatomical posture position in bare feet, with light clothing on children.
  - Height measurements of children were made with a stadiometer, with accuracy ± 1mm. In anatomical stance, the values were recorded in cm in bare feet with heels together.

Pediatric quality of life inventory (PedsQL)

The Pediatric Quality of Life Inventory (PedsQL) is a modular instrument for measuring health-related quality of life of 2–18-year-old-children. Pediatric Quality of Life Inventory (PedsQL) was used as a data collection instrument. The instrument was developed by Varni *et al.* (1999). In the current research, parental forms which were designed for the characteristics of the children aged between 8 and 12 were used. The Turkish validity and reliability tests of the form were performed by Memik *et al.* (2008). There are other versions of this data collection tool which were developed for different age groups. There is a Likert type answer scale with five answer options: (0 = never, 1 = seldom, 2 = sometimes, 3 = often, 4 = always). The points which are obtained from the items are calculated and a score between 0 and 100 is linearly obtained (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0). A score between 0 and 100 indicates the quality of life score and an increase in the scores means an increase in the quality of life. Pediatric Quality of Life Inventory (PedsQL) consists of inventory total score, physical functioning, psychosocial health, school functioning, emotional functioning, and social functioning. The Cronbach alpha coefficient of the scale was 0.88 (Memik *et al.* 2008).

In Turkey, İlhan *et al.* in a study in the field of physical education and sports in 2013 also used the quality of life parent form for children with intellectually disability. Saltık and Başgül (2013) used the parent form to evaluate the quality of life of children with neurofibromatosis type 1.

Data collection process

Children with ID between the ages of 8 and 12 years who met the criteria for the study and whose families

provided both written and oral interviews at the institution where the children were included. Families and children were invited to the school with an appointment system. The "General Information Form" prepared by the researcher was used to obtain various data about children with ID and their families. These interviews were held together with psychologists and special education experts. The capacities of the children to receive instructions were evaluated by the expert teachers in the institution. Children with ID who were suitable for the study were identified. Parents who agreed to participate in the study were invited to participate. They were asked to fill in the form. In order to objectively evaluate the parent form during the post-test, the same parent who filled the form in the pre-test was requested to fill in post-test and was informed about it.

A pen was given to the parents to fill in the Pediatric Quality of Life Inventory (PedsQL) Scale, which assesses the quality of life of their children. The form was filled in a quiet environment. Parents were informed about how to complete the scale. The scales were received after being filled in by the parents. For the objectivity of the study, it was stated that the parents should fill in the questions in the scale in line with their observations in the process. Measurements were continued by the researcher within the scope of the instructions for the Bruininks test battery. Tolerance was shown to children who left the tests unfinished or did not want to continue. Two separate stopwatches were used for tests that required time. In the test application, the researcher followed the application from beginning to end. All children were tested under the same conditions. Separate observation forms were kept for each child and improvements were recorded.

A camera was also used during the tests. Measurements were made under appropriate heating and insulated lighting conditions. The researcher communicated with the researchers who used this test before, and considered suggestions and professional experience gained at the university.

Researchers and instructors

Support was received from a researcher working in the field of special education and having knowledge in the field of the mentally handicapped, as well as 3 trainers and 3 special education specialists who carry out physical education and sports activities for individuals with disability in special education institutions. Information and training about the test instruction and application conditions were provided to the officers involved in the study. The Bruininks Oseretsky test of motor proficiency second edition brief form (BOT-2 BF) was administered to children under the supervision of the researcher with the help of educators. Test instructions were followed. Each test was explained one by one. Parents and children were invited together through an appointment system to attend tests to measure motor skills. These were carried out in the gym and in the area where the laboratory tests were carried out. Pediatric Quality of Life Inventory (PedsQL) was completed by families.

Data analysis

Statistical analysis was performed with SPSS Software (Version 17.0). In statistical analysis, measurements were evaluated with Shapiro Wilk tests, it was observed that the distribution of variables was not normal. Nonparametric statistical methods, Wilcoxon Signed Rank Test statistics, and descriptive statistical methods were used for statistical analysis due to the use of scales in the measurements, scoring, lack of normal distribution, and the number of individuals in the groups being less than 30.

Pilot study

This was carried out in line with the suggestions of field experts who gave their opinions during the preparation of the activity program. Before this study started, a 6-hour pilot application was carried out with a group of 10 children with ID. It was carried out with children and their families who agreed to participate in the pilot study in the special education institution. The children involved in the pilot study did not take part in the 14-week main study. The purpose of the 6-hour pilot application was to increase the success of the actual program activities, as well as to determine whether there was a need to revise the program.

Materials used in the physical education activities program

Sphygmomanometer, first aid kit, slalom bars, badminton net, tennis net and materials, meter stick and stopwatch, funnel, softball with different properties, football, handball, volleyball, basketball, tennis balls, balance device, obstacles, cushion, hoop, whistle, stopwatch, rope, racket, and balloon were used. Children in the control and experimental groups included in the study were asked to attend with sports equipment and this was accepted by the parents.

Physical education activities program and practice

Based on the physical activities program of the Ministry of National Education, an activity program was prepared by examining the basic physical education curriculum with the opinions of two field experts (Ministry of education 2012, 2013). The 14-week physical education activity program, which takes 60 to 70 min 2 days a week, was created under the supervision of the researcher and two field experts, and the study was continued for 14 weeks. The determined physical education activity program was planned by

Table 2 Pre-test and post-test wilcoxon signed-rank test comparison of motor performance scale items according to groups

Tests	Groups	Post-test-pre-test	N	Mean rank	Sum of rank	z	p
Fine Motor Precision	Control group	Negative rank	5	5.50	27.50	−1.327	0.185
		Positive rank	8	7.94	63.50		
		Equal	3				
	Experimental group	Negative rank	0	0.00	0.00	−3.482	0.000
		Positive rank	15	8.00	120.00		
		Equal	3				
Fine Motor Integration	Control group	Negative rank	1	2.00	2.00	−2.625	0.009
		Positive rank	9	5.89	53.00		
		Equal	6				
	Experimental group	Negative rank	0	0.00	0.00	−3.347	0.001
		Positive rank	14	7.50	105.00		
		Equal	4				
Manuel Dexterity	Control group	Negative rank	6	5.00	30.00	−1.000	0.317
		Positive rank	3	5.00	15.00		
		Equal	7				
	Experimental group	Negative rank	1	9.00	9.00	−2.600	0.009
		Positive rank	12	6.83	82.00		
		Equal	5				

taking into account the development levels and motor skills of the children, both for individual practices and for group activities. Educational games were included to increase the gains in accordance with the activity plan. Basic skills were practices in weeks 1–8 of the study. In weeks 9–14 of the practice, the progress of children was considered and practices requiring more rapid movement and coordination were included. Educational games related to the subject in the practice program were included. Studies were carried out without interrupting the systematic teaching process and the reading and writing program in rehabilitation contributed to the practice (Tekin-İftar 2009). Most of the methods used for the education of children with healthy development are used in the field of special education (Özer 2017). During the activity program, support was received from special education experts and the practice program was initiated. Children with ID in the experimental group were divided into 2 groups, taking into account their school times. In the study, support was received from two students who took physical education and sports lessons for individuals with disability in the undergraduate application, in the dimension of showing movements from time to time.

The physical education activity program was carried out in the gym. The inclusion of educational games in all activities carried out in the study positively affected the participation of children in the activity. Therefore, supporting children with ID through educational games in physical education and sports practices enabled children to perceive the practices in the activity as entertaining. After each activity in the study, a general evaluation was made by the instructors, and points that should be repeated where necessary were repeated once more. Badminton and tennis rackets, colored balloons, badminton ball and tennis ball were used in object control studies. However, since the last two activities of the study after the training about racket use took place as short matches and activities, the gains for the last two activities were not included in the diagram. Below is the 13-week schedule for the Physical Education Activities Program.

Activity time: 60-70 min

S1 activities program (online resource 1)

Findings. The findings regarding the pre-test and post-test results of the physical education activity program on motor skills and quality of life are shown below.

As seen in Table 2, the fine motor precision in the post-test motor performance scores of the experimental group increased statistically significantly compared to the pre-test ($^*p < 0.05$). There was no statistically significant improvement in the fine motor precision of children in the control group ($p > 0.05$).

As seen in Table 2, the fine motor integration in the post-test motor performance scores of the experimental group increased statistically significantly compared to the pre-test ($^*p < 0.05$). In the control group, the fine motor integration in the post-test motor performance scores statistically significantly increased compared to the pre-test ($^*p < 0.05$). However, the performance improvement level of the experimental group was found to be higher than the control group. As seen in Table 2, the manual dexterity in post-test motor performance scores of the experimental group increased statistically significantly compared to the pre-test ($^*p < 0.05$). There was no statistically significant improvement in manual dexterity of children in the control group ($p > 0.05$).

As seen in Table 3, the bilateral coordination of the experimental group increased statistically significantly in the post-test motor performance scores compared to the pre-test ($^*p < 0.05$). The post-test motor performance scores of the control group for bilateral coordination increased statistically significantly compared to the pre-test ($^*p < 0.05$). However, the significance level was higher in the experimental group than in the control group.

As seen in Table 3, the post-test motor performance scores for balance in the experimental group increased

Table 3 Pre-test and post-test Wilcoxon signed-rank test comparison of motor performance scale items according to groups

Tests	Groups	Post-test-pre-test	N	Mean rank	Sum of rank	z	p
Bilateral Coordination	Control group	Negative rank	0	0.00	0.00	−2.264	0.024
		Positive rank	6	3.50	21.00		
		Equal	10				
	Experimental group	Negative rank	0	0.00	0.00	−3.072	0.002
		Positive rank	12	6.50	78.00		
		Equal	6				
Balance	Control group	Negative rank	1	2.50	2.50	−1.725	0.084
		Positive rank	5	3.70	18.50		
		Equal	10				
	Experimental group	Negative rank	0	0.00	0.00	−2.994	0.003
		Positive rank	11	6.00	66.00		
		Equal	7				
Speed and Agility	Control group	Negative rank	1	1.50	1.50	-.816	0.414
		Positive rank	2	2.25	4.50		
		Equal	13				
	Experimental group	Negative rank	1	6.00	6.00	−3.448	0.001
		Positive rank	16	9.19	147.00		
		Equal	1				

statistically significantly compared to the pre-test ($^*p < 0.05$). There was no statistical improvement for the balance test of children in the control group ($p > 0.05$). As seen in Table 3, the post-test motor performance scores for speed and agility of the experimental group increased statistically significantly compared to the pre-test ($^*p < 0.05$). No statistical improvement was found in the speed and agility test for children in the control group ($p > 0.05$).

As seen in Table 4, the post-test motor performance scores of the experimental group for upper limb coordination showed a statistically significant improvement compared to the pre-test ($^*p < 0.05$). For the control group, a statistically significant improvement was found in upper limb coordination post-test motor performance scores compared to the pre-test ($^*p < 0.05$). However, the performance improvement level of the experimental group was found to be higher than the control group. As seen in Table 4, the post-test motor performance scores of the experimental group for strength of girls and boys showed a statistically significant improvement compared to the pre-test ($^*p < 0.05$). No statistical improvement was found in the strength test for children, girls and boys, in the control group ($p > 0.05$).

As seen in Table 5, a statistically significant difference was found between the co-observations of the Pediatric Quality of Life Inventory (PedsQL) and Inventory Total Score for children in the experimental group. In the control group, no statistically significant improvement was found between the co-observations of PedsQL scores and Inventory Total score scores ($p > 0.05$).

As seen in Table 5, a statistically significant difference was found between the PedsQL and Physical Functioning co-observations for children in the experimental group. Post-test practice PedsQL scores increased statistically compared to pre-test scores ($^*p < 0.05$). Among the PedsQL co-observations of the children in the control group, a statistically significant improvement was found in Physical Functioning scores ($^*p < 0.05$). However, the development level obtained in the experimental group was found to be higher than the control group.

As seen in Table 5, a statistically significant difference was found between the PedsQL Psychosocial Health co-observations of the children in the experimental group ($^*p < 0.05$). In the control group, no statistically significant improvement was found between the co-observations of PedsQL Psychosocial Health scores ($p > 0.05$).

As seen in Table 6, a statistically significant difference was found between the PedsQL school functioning co-observations of the children in the experimental group. Post-test practice (PedsQL) scores showed a statistically significant improvement and increased significantly compared to the pre-test ($^*p < 0.05$). In the control group, the level of development was not statistically significant among the co-observations of (PedsQL) School Functioning scores ($p > 0.05$).

As seen in Table 6, a statistically significant difference was found between PedsQL emotional functioning co-observations for children in the experimental group. Post-test practice (PedsQL) scores showed a statistically significant improvement and increased significantly compared to the pre-test ($^*p < 0.05$). The level of development was not statistically significant among the co-observations of PedsQL emotional functioning scores in the control group ($p > 0.05$).

As seen in Table 6, a statistically significant difference was found between the (PedsQL) social functioning co-observations for children in the experimental group. Post-test practice (PedsQL) scores showed a statistically significant improvement and increased significantly compared to the pre-test ($^*p < 0.05$). The level of development was not statistically significant among the co-observations of (PedsQL) Social Functioning scores in the control group ($p > 0.05$).

Table 4 Pre-test and post-test Wilcoxon signed-rank test comparison of motor performance scale items according to groups

Tests Equal	Groups 0	Post-test-pre-test	N	Mean rank	Sum of rank	z	p
Upper Limb Coordination	Control group	Negative rank	2	6.00	12.00	−2.151	0.031
		Positive rank	10	6.60	66.00		
		Equal	4				
	Experimental group	Negative rank	0	0.00	0.00	−3.640	0.000
		Positive rank	17	9.00	153.00		
		Equal	1				
Strength (a) girls	Control group	Negative rank	1	1.50	1.50	−1.625	0.104
		Positive rank	4	3.38	13.50		
		Equal	3				
	Experimental group	Negative rank	0	0.00	0.00	−2.392	0.017
		Positive rank	7	4.00	28.00		
		Equal	0				
Strength (b) boys	Control group	Negative rank	0	0.00	0.00	−1.633	0.102
		Positive rank	3	2.00	6.00		
		Equal	5				
	Experimental group	Negative rank	0	0.00	0.00	−2.980	0.003
		Positive rank	11	6.00	66.00		

Table 5 Comparisons of PedsQL sub-scales with pre-test and post-test Wilcoxon signed-rank test according to groups

Tests	Groups	Post-test-pre-test	N	Mean rank	Sum of rank	z	p
Inventory Total score	Control group	Negative rank	7	10.50	73.50	-.285	0.776
		Positive rank	9	6.94	62.50		
		Equal	0				
	Experimental group	Negative rank	1	1.00	1.00	−3.576	0.000
		Positive rank	16	9.50	152.00		
		Equal	1				
Physical Functioning	Control group	Negative rank	3	6.00	18.00	−2.191	0.028
		Positive rank	11	7.91	87.00		
		Equal	2				
	Experimental group	Negative rank	1	3.00	3.00	−3.602	0.000
		Positive rank	17	9.88	168.00		
		Equal	0				
Psycho-social Health	Control group	Negative rank	7	9.00	63.00	-.660	0.509
		Positive rank	7	6.00	42.00		
		Equal	2				
	Experimental group	Negative rank	1	5.50	5.50	−3.489	0.000
		Positive rank	17	9.74	165.50		
		Equal	0				

Table 6 PedsQL sub-scales comparisons of pre-test and post-test Wilcoxon signed-rank test according to groups

Tests	Groups	Post-test-pre-test	N	Mean rank	Sum of rank	z	p
School Functioning	Control group	Negative rank	4	8.75	35.00	−1.123	0.261
		Positive rank	10	7.00	70.00		
		Equal	2				
	Experimental group	Negative rank	2	3.00	6.00	−3.222	0.001
		Positive rank	14	9.29	130.00		
		Equal	2				
Emotional Functioning	Control group	Negative rank	7	8.36	58.50	−1.548	0.122
		Positive rank	5	3.90	19.50		
		Equal	4				
	Experimental group	Negative rank	2	7.50	15.00	−3.083	0.002
		Positive rank	16	9.75	156.00		
		Equal	0				
Social Functioning	Control group	Negative rank	7	8.71	61.00	−1.126	0.260
		Positive rank	6	5.00	30.00		
		Equal	3				
	Experimental group	Negative rank	2	2.00	4.00	−3.441	0.001
		Positive rank	15	9.93	149.00		
		Equal	1				

Discussion and conclusion

In the study, the effects of the physical education activities program on the motor skills and quality of life of children with ID (8-12 years old) were evaluated. As a result of the study, the motor skills and quality of life of children with ID who participated in the physical education activities program improved more than children with ID who did not participate in the program. Similarly, in studies conducted with children with ID, exercise programs had positive effects on motor skills.

For example, Baghande *et al.* (2019) investigated a cognitive and motor exercise program, Malekpour *et al.* (2012), investigated the effect of adapted play education on the motor skills of preschool children with ID, Ashori *et al.* (2018) investigated the effect of a motor therapy program on motor skills and Mehralitabar *et al.* (2015) investigated the effects of handball education on the motor skills of children with ID. All these studies reveal that physical activities support the motor skills of children with ID.

In the study, in the program applied to children with ID, physical education activities were supported by educational games, and many specific activities in the above-mentioned studies were integrated with physical activity cards and applied to children. This led to the development of many motor skill areas in terms of motor development. The results reveal that the physical education activities program is more inclusive in terms of motor skills. Oviedo *et al.* (2014) found that a physical activity program, which included aerobic, strength and balance training, improved the cardiovascular fitness, strength and balance skills of individuals with ID. Giagazoglou *et al.* (2013) stated that a trampoline exercise intervention program affected the motor and balance abilities of school-age children with ID. In our study, although it did not include one-to-one strength and balance training, the physical education activities program we applied developed the balance skills of children with ID similarly. Jaydari *et al.* (2016) trained children with ID (13-17 years old) with traditional games. Transfer and manipulation motor skills improved with traditional games. In the program used in the study, physical education activities were supported by educational games. This reveals that games improve the motor skills of individuals with ID.

As a result of the activity program, an improvement was found in the fine motor skill performances of the children in the experimental group. There was no improvement in the fine motor performance of the control group. Ashori *et al.* (2018) stated that a motor therapy program designed according to the SPARK motor program, which combines games and sports studies, improved fine motor skills. Moghadasi *et al.* (2020) applied the SPARK program for trainable children with ID. At the end of the study, fine motor skills of boys with ID between the ages of 7-9 developed. However, Baghande *et al.* (2019) stated that the practice of a 24-hour lesson activity including cognitive and motor exercise programs was not effective on fine motor skills. This shows that activities involving games are more effective for children with ID. The fact that there are educational games in the activities in the program used in this study and the effectiveness of studies in which the game content SPARK program was applied in terms of the development of motor skills supports this result. Lotfi *et al.* (2018) conducted a study about the effects of body percussion rhythmic exercises for 12 weeks on motor skills among children with ID aged 8-12, and found that there were significant improvements in fine motor skills variables.

In the fine motor adaptation test, statistical improvement was found in the experimental and control groups. It is thought that children in the control and experimental group in the study continuing their education in the school curriculum and education about literacy may have affected the pre-test post-test fine motor adaptation. The higher development seen in the experimental group shows the benefits of physical education for children with ID. Korkusuz and Top (2019) stated that physical activity practices develop fine motor skill integration in children with ID depending on the group and time. Sood *et al.* (2017) stated that bocce education had a significant effect on the development of visual-motor integration among children with ID. The object control activities carried out within the scope of the program improved the manual dexterity of the experimental group. However, no improvement was detected in the performance of the control group. Similarly, many studies reveal that physical activity programs improve the manual dexterities of children with ID. Kalgotra and Warwal (2019) stated that children with ID who participated in the Aerobic Conditioning Program had improved upper extremity speed and manual dexterity. Likewise, Kao and Wang (2018) stated that the Frisbee game training, conducted for 6 weeks, improved the grasping ability and manual dexterity of children with ID. Chen *et al.* (2019) stated that a 15-week inclusive football program applied to individuals with ID significantly increased their manual dexterity. Aalizadeh *et al.* (2019) stated that a motor skill training program applied to children aged 7-10 improved object control skills in children with ID. Lotfi *et al.* (2018) stated that manual dexterity of children with ID aged 8-12 improved in a 12-week study about the effects of body percussion rhythmic exercises on motor skills.

In the study, statistical improvement was determined in the pre-test post-test performances of both control and experimental groups for bilateral coordination motor performance tests. The bilateral coordination motor skills of the children with ID who participated in the physical education activity program developed more. It is thought that the development between the pre-test and the post-test in the control group is due to the effect of the educational institutions the children attend. The results of studies also support this research. Işık and Zorba (2020) stated the Hemsball game skill training program applied to children with ID between the ages of 12-16 improved bilateral coordination; Baghande *et al.* (2019) stated that a 24-hour lesson activity practice including cognitive and motor exercises improved bilateral coordination; and Mehralitabar *et al.* (2015) stated that handball training applied in 18 sessions improved bilateral coordination.

Korkusuz and Top (2019) stated that 14-week physical activity practice improved hand-arm coordination in children with ID, and Kao and Wang (2018), stated that game training for 6 weeks improved hand-eye coordination of children with ID. The physical education activity practice applied in the study improved the balance performance of children with ID in the experimental group. There was no improvement in the balance performance of the control group. The activities carried out to improve balance in the 14-week physical education activity attracted the attention of children and increased their interest in activities. When Maïano *et al.* (2019) examined studies in the field, exercise was an effective method in the development of balance for children with ID. Different studies in the literature show that people with ID positively affect the development of balance. (Işık and Zorba 2020; Kalgotra and Warwal 2019; Asonitou *et al.* 2018; Giagazoglou *et al.* 2013; Hoseini *et al.* 2017; Haghighi *et al.* 2015; Baghande *et al.* 2019, Sumaryanti and Ndayisenga 2019; Kong *et al.* 2019; Yalfani *et al.* 2017; Fotiadou *et al.* 2017; Mikołajczyk and Jankowicz-Szymańska 2017; Mikołajczyk and Jankowicz-Szymańska 2014; Stojanović *et al.* 2018; Oviedo *et al.* 2014; Ghasempour *et al.* 2015). In addition, Ma *et al.* (2020), stated that physical activity sports programs and practice performed with different methods such as fitness exercise, combined strength and proprioceptive training, dual-duty functional exercises, trampoline exercise, hippotherapy and core strength training increased balance performance. Dipasquale and Roberts (2020) stated that 12 weeks of dance training improved the postural stabilization of individuals with ID.

The 14-week program increased the speed and agility performance of children with ID. The diversity of the activities in the program and the planning and practice of them to affect basic motor skills differentiates this program from other studies. There was no improvement in the speed and agility performance of the control group. There are studies similar to the results obtained in this study. Mehralitabar *et al.* (2015) stated that handball training in 18 sessions improved speed and agility in the experimental group, but there was no difference in the control group. Kalgotra and Warwal (2019) stated there was an improvement in the running speed and agility of children with ID who participated in an aerobic conditioning program and Kong *et al.* (2019), stated that tai chi training improved leg strength. Asonitou *et al.* (2018) stated that individuals with ID improved speed especially in physical exercise practice done for 4 months. Baghande *et al.* (2019) stated that the practice of 24-course activities, including cognitive and motor exercise programs, was effective on running speed and agility.

Among the upper limb coordination tests, which are other parameters in the study, statistical improvement was found in the pre-test and post-test comparisons of both experimental and control groups. The performance development of children in the experimental group increased more than the control group. Kalgotra and Warwal (2019) found improvement in the upper limb coordination of children with ID who participated in an aerobic fitness program, while no improvement was detected in the control group. Kong *et al.* (2019) stated that tai chi education improved upper limb coordination, Bibro and Żarów (2021) conducted activities with an artificial climbing wall for individuals with ID. The activities significantly improved the strength and upper limb coordination.

The strength and resistance skills in the test battery used in the study were evaluated by push-up action. According to the pre-test and post-test results of the study, while improvement was found in the strength and resistance performances of the experimental group, no improvement was found in the control group. Similarly, in many studies, strength and resistance skills were developed. Collins and Staples (2017) stated that 35 children aged 7-12 who participated in a 10-week program and completed the Brockport Physical Fitness Test had significantly increased aerobic capacity and muscle strength and endurance. Pejčić *et al.* (2019) stated that a 12-week sports games program improved strength and flexibility parameters in children with ID. Asonitou *et al.* (2018) stated that a physical exercise for 4 months improved muscle strength and endurance especially of individuals with ID. Sumaryanti and Ndayisenga (2019) stated that a 6-week physical activity practice program was effective in improving leg muscle and strength. Xu *et al.* (2020) stated that a 16-week adapted rhythmic gymnastics (ARG) program significantly improved most of the physical fitness parameters of children with ID in the experimental group. It was especially effective for abdominal strength and upper extremity muscle strength compared to the control group. Jo *et al.* (2018) stated that muscle endurance was significantly improved following exercise, and after practice consisting of 90 min of band exercises and rhythmic activity twice a week, significant improvements were found in muscle endurance in the experimental group.

The physical education activity program increased the quality of life as well as the motor skills of children with ID. In the study, there was an improvement in Physical Functioning, Psychosocial Health, School Functioning, Emotional Functioning and Social Functioning skills, which constitute quality of life. In the control group, an improvement was observed in Physical Functioning skills. The fact that children in the control and experimental groups in the program continued their education in institutions affiliated with the Ministry of National Education may explain the development seen in both the control and experimental group. The higher increase in quality of life scores in

the experimental group compared to the control group can be explained by the effect of the program. İlhan *et al.* (2013) stated children who participated in physical education and sports activities had more improvements in quality of life skills (Physical Functioning, Psychosocial Health, School Functioning, Emotional Functioning, Social Functioning) compared to a control group, in a study conducted about the effects of physical education activities on quality of life. The result of this research supports the findings of the study. Lee and Jeoung (2016), on the other hand, drew attention to the relationship between motor skills and behavioral problems among people with ID. In a study with 117 individuals with ID, improving motor skills was stated to improve problem behaviors. Stanisic *et al.* (2012) stated that a specially adapted 8-week basketball training program increased physical fitness and could help improve the quality of life in children with ID. Giagazoglou *et al.* (2012) stated that a 10-week hypotherapy treatment program positively affected the quality life of children with ID who participated in the program.

There are studies examining the effects of physical activities on quality of life in groups with different ID. Laferrier *et al.* (2015) stated that sports, exercise and regression activities were effective in improving self-esteem and quality of life in individuals with disability in their study of 220 individuals. Haegele *et al.* (2017) stated that physical activity has a positive effect on quality of life in individuals with visual impairment. Shapiro and Malone (2016) stated that just as entertaining therapeutic and competitive activities enabled the development and maintenance of physical and psychological functioning, they served as a guide to increasing health-related quality of life. Ganesh and Mishra (2016) stated that there was a positive correlation between individuals' physical activity levels and all areas of life quality in a study with 84 individuals with physical disability in India. Zar *et al.* (2018) stated that exercising positively affected the quality of life, mental health and depression, according to the results of the study in Iran. As seen in studies, it is necessary to apply physical activity programs to increase the quality of life of individuals with ID. The findings of the study also reveal that it is beneficial to adapt physical activity programs to individuals in order to increase the quality of life of individuals with ID.

Conclusion and recommendations

According to the research, children with ID who participated in a 14-week physical education program were more successful in motor skills than children who did not participate in the program. The applied physical education activity program is important for the motor development of children with ID as improvements were found in all skills including fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, speed and agility, upper limb coordination, and strength evaluated within the scope of motor skills. The applied program also developed Physical Functioning, Psychosocial Health, School Functioning, Emotional Functioning and Social Functioning skills, which are dimensions of quality of life of children with ID. According to the results of the research, it will be beneficial for parents to direct their children to schools and children's centers with physical education programs in order to improve the motor skills and quality of life of children with ID. Adding physical activity programs to sustainable projects within the education programs prepared by the policy makers for children with ID will provide developmental contributions. Research about the effects of physical activity studies with larger groups and groups with different ID can contribute to the fields of children with ID and sports research.

Limitations

The scales we used to determine the results of the research were developed and adapted by others. For this reason, the results are limited to the scale scores. In this context, it is an experimental study that works with a small group. Conducting the study at the same time as special education for children with ID limited the duration and intensity of the study. The different school hours of children with ID limited the study. The age variable was seen as a limitation in the study. It will be beneficial if this study is applied with a larger sample group with more research to represent the general view.

Acknowledgment

We would like to thank the institutions, families and experts who supported the study.

Conflict of interest

No potential conflict of interest was reported by the authors.

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