Original Article

EVALUATION OF THE 12-WEEK MOVEMENT TRAINING PROGRAM IN TERMS OF MORPHOLOGICAL PROPERTIES AND MOTOR DEVELOPMENT IN CHILDREN: A RESEARCH IN CHILDREN AGED 7-9

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Abstract

Introduction and Aim: Early childhood is the most important period for gaining basic movement skills and improving physical fitness parameters. Physical fitness level is a determinant of health an early age. Influencing one of the physical fitness parameters related to health or performance directly affects physical fitness. The aim of this study was to evaluate the morphological and motor development characteristics of children in the 12-week movement education program, and a research for 7-9 years old childhood was discussed.

Material and Methods: A total of 116 male students aged 7-9 participated in the study. A 12-week movement training program was applied to the students participating in the research. Before starting this program, in order to measure morphological features as a pre-test, body fat ratio, height, body weight, body mass index (BMI), head circumference, neck circumference, chest circumference, abdominal circumference, Hip circumference measurements. On the other hand flexibility, horizontal jump, vertical jumping, push-ups, sit-ups, touching the discs, 10 meters sprint, Balance flamingo measurements were taken as a performance characteristics. The same measurements were taken again as a post-test after the 12-week movement training program was over. The data of the research were analyzed in IBM SPSS 25.0 program. The mean and standard deviation statistics of the data were calculated. The "Shapiro-Wilk" test was used to determine whether the data showed normal distribution, and because all variables showed normal distribution, the Repeated Measures ANOVA (intra-group and intergroup comparison) test was performed and the level of significance was stated as $P<0.001$.

Results: When the morphological characteristics were evaluated, there was a significant difference in body weight and body fat percentage within the group, while no significant difference was found in other tests. In the comparison between the groups, a significant difference was found in all tests except body fat percentage. While a significant difference was detected in all tests within the group in performance tests, no significant difference was found between the groups in flexibility, push-ups, sit-ups and sprint values.

Conclusion: 12-week movement-based exercise provided improvements in children's motor development and morphological features. Movement education is important for children's morphological characteristics and motor development.

Keywords: Movement education, motor development, morphological features, child.

INTRODUCTION

The concept of movement, which has become an indispensable part of life, has an important place and importance in all life. [1] When movement is considered as a term, it is used synonymously with the word motor. Childhood is a period in which the most permanent and positive contributions to movement skills can be made. [2] It is important for the individual to know how to shape basic movement skills and motor skills from childhood.[3] Motor development; It is evaluated in four main periods: reflex movements (4 months-1 year), primitive movements (1-2 years), basic movements (2-7 years) and sports (special) movement periods (7-14 years) [4], which are modeled as hourglasses. [5] Ensuring the development of basic movement skills and motor skills is one of the important and critical processes in childhood. [6-7] Basic motor skills are the first step towards the acquisition of more complex skills. Basic motor skills are the first step towards the acquisition of more complex skills. [8] While it is stated that the motor skills of the child whose basic motor movements are developed will be easier and more skills as well. [9-10]

Motor development is a process that starts in the womb and is seen in movement skills and progresses continuously with the interaction of environmental effective, positive results will be obtained in more complex conditions throughout life. [11-12-13]After the basic movements period, Sports movements period; It is examined in three parts as general transition phase, special movement skills phase and specialization phase. [3-14] The sports movement period covers the age of seven and beyond. It is a period in which movement control and implementation are carried out at a good level. [15-16] By linking locomotor, manipulative and balancing skills, they have the ability to combine more movements. At this stage, there is development in the skills of the basic movement period. [17] Movement training programs to support children who perform basic movements at the best level for movement teaching for sports branches are of great importance for the development of sportive success. [18] In this period, especially children's balance, coordination, quickness, flexibility and so on. In order to contribute to their development, importance should be given to educational games with sports activities within physical education and sports programs. [19]

As a result of the studies, while the positive developments of motor skill proficiency in children together with physical activity, they revealed the opposite in relation to sedentary life. [10-20-21] In the comparison between the motor skill levels of 8-12 year old children and the physical activity levels after 6-7 years, it was seen that especially the children with higher object control skills took part in active sports in later ages. [22]

Movement education is a concept that is especially emphasized by the Ministry of National Education within the scope of physical education curriculum. Their aim is to positively affect the cognitive, affective and psychomotor development of the child in the future, thanks to the movement education programs prepared correctly. In the light of this information, the aim of this study is; To evaluate the 12-week movement education program in terms of morphological characteristics and motor development in children.

MATERIALS AND METHODS

There were 116 participants in this study. The participants were given a multi-directional movement training program for 12 weeks. Anthropometric measurements and Motor Performance Tests of the students were applied before and after the 12-week movement training. The flow chart of the research is given in Figure 1.

Flow diagram of study design

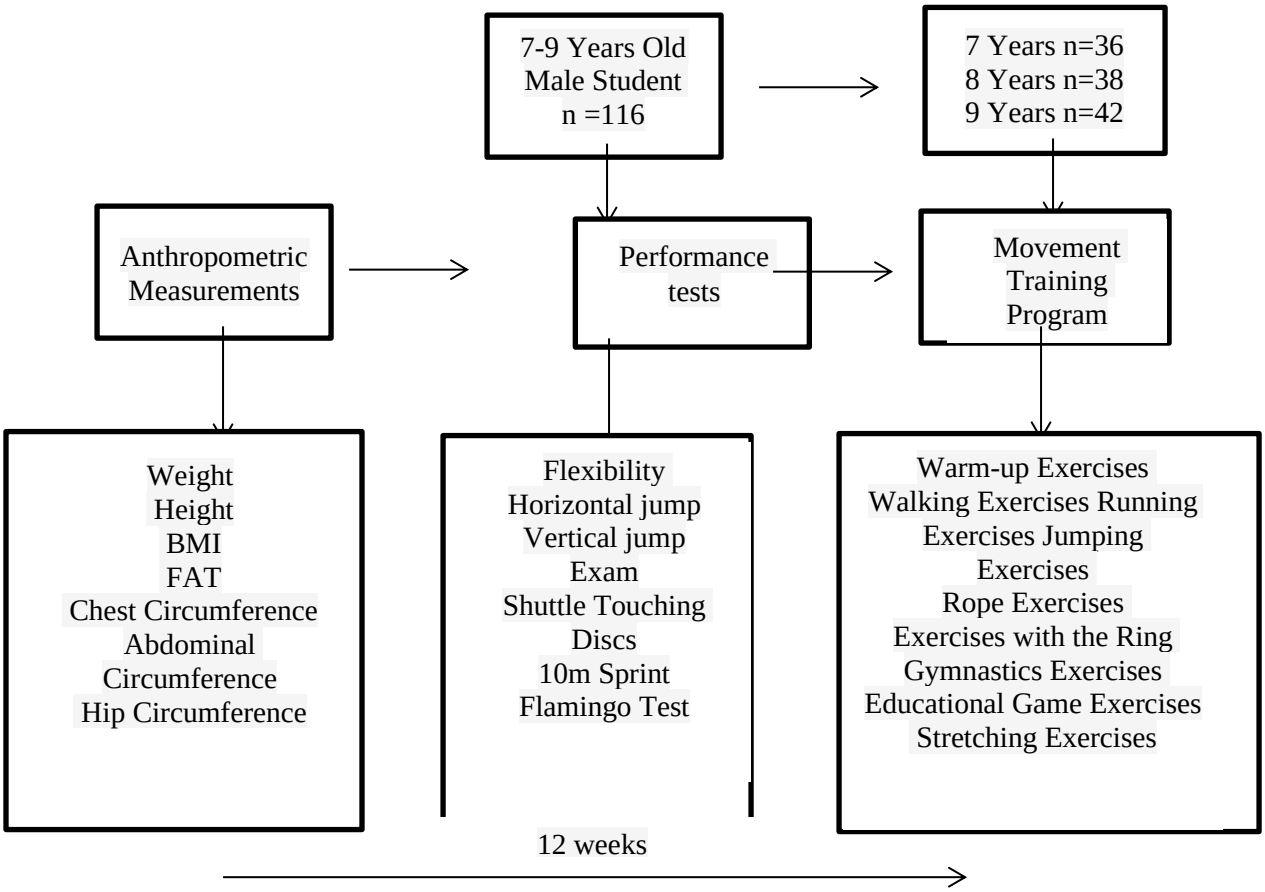

Figure 1. Flow diagram of study design

Research group

A total of 116 male students aged 7-9, studying in Kırıkkale private primary schools in Turkey, in the schools of the research. General physics for students' technical information and information are given in Table 1.

Data Collection Tools

Movement training program was applied to the students for 12 weeks. Before the 12-week training program was started, pre-test, and after the 12-week movement training was completed, post-test measurements were made to measure morphological and sportive performance characteristics, and the recording was recorded. Body fat ratio, Height, Body weight, BMI, Head circumference, Neck circumference, Chest circumference, Abdominal circumference, Hip circumference were collected to measure morphological characteristics. In order to measure performance characteristics, flexibility, horizontal jump, vertical jump, push-ups, sit-ups, touching discs, 10 meters sprint, balance flamingo measurements were collected both as a pre-test before the 12-week training and as a post-test after the 12-week training.

Movement Training Program

Movement training program was applied to 116 students between the ages of 7-9 for 12 weeks in the gym belonging to the School for half an hour, 3 days a week. Within the scope of the movement training program, warm-up exercises, walking

exercises, running exercises, jumping exercises, balance exercises, ball exercises, rope exercises, stretching exercises and educational game exercises were made.

Performance Test

12-week movement training program Flexibility to measure children's motor performance Pre-test and post-test results of Horizontal Jump, Vertical Jump, Push-up, Sit-up, Tapping Discs, 10 m Sprint, Flamingo Test values were measured.

Flexibility

The athlete sits in front of the sit-down box measuring 35 cm long, 45 cm wide and 32 cm high, rests his bare feet on the inner surface of the box and tries to reach as far as possible without bending his knees with both hands. The last point it can reach is recorded. It will be done 3 times and the best result will be obtained. [23]

Horizontal Jump

In the standing long jump test, which is used to measure explosive force, the athlete's fingertips and body are positioned just behind the starting line. When he feels ready, he tries to carry himself the farthest horizontally by using his whole body. The best of 2 repetitions was recorded, measured in centimeters (cm) from the rearmost point of contact with the ground.[24]

Vertical Jump

Fusion Sport Mat was used for the vertical jump test. Before starting the test, all athletes were asked to warm up after being informed about the test. In order to learn and apply the correct technique, familiarization tests were made and during the jump, it was requested that the jumps fall to the same place on the mat with all their strength, with all their strength bent at 90 degrees. Attention has been paid to ensure that the athlete falls on the same floor during jumping and landing on the platform. Here, attention was paid to ensure that the position of the subject during the jump and landing on the platform was the same. The jump heights obtained from the measurements repeated twice were evaluated in 'cm'. The measurement was repeated twice and the best result was recorded in cm. Rest between two measurements is given as 5 minute. [25]

Push-up

Athletes were asked to raise and lower their bodies on a gymnastic mat fixed to the floor, face down, with their feet stretched from the knees and the knees stretched out without touching the ground, with their body weight on the toes and arms. A 1/1000 precision stopwatch was used for the 30-second push-up test. Recorded in terms of the athlete's highest number of push-ups (pieces). [23]

Sit-up

Athletes were asked to lie on their back with their hands on the nape of a gymnastic mat fixed to the floor. With the soles of the feet adjacent, both knees bent at 90°, the shuttle test at maximum speed was started with the 'start' command. During the sit-up test, the feet of the athletes were kept stationary so that the contact between their feet and the ground would not be interrupted. A 1/1000 precision stopwatch was used for the 30 second shuttle test. The athlete's highest number of sit-ups (pieces) was recorded. [23]

Tapping Discs

The participant sits on the test table with his feet slightly open. After standing in front of him, after the start command is given, he tries to touch both discs with his preferred hand as fast as he can. The test begins when the participant is ready. He touched

the discs as fast as possible. He touched each disc 25 times. When the test was finished, the "Stop" command was given and the test was terminated. The test is done twice. The best time is recorded as points. [26]

10 m Sprint

The measurement will be made by placing a photocell device with a precision of 0.01 seconds at the start and end points of the marked 10-meter track. Time will start when the subject feels ready and passes through the starting gate, and time will stop as soon as he/she passes through the finish gate. The time elapsed between the start and end gates will be recorded. After a 10-minute rest interval, the best of 2 attempts will be recorded.[27]

Flamingo balance Test

The participant stepped on a metal tool 50 cm long, 4 cm high, 3 cm wide, covered with a non-slip material, with a thickness of not more than 5 mm. To maintain tool ground clearance, 15 cm long and 2 cm wide feet are placed at both ends of the beam. The participant put his preferred foot on the tool to stay balanced for one minute, bent his other leg backwards and grabbed it with his hand in the same direction. The test and time were stopped when the participant tried to balance in this position and lost his balance, that is, when he left his leg bent behind or when any part of his body touched the ground. [26]

Analysis of data

The data obtained from the children included in the study were analyzed in the IBM SPSS 25.0 program. The mean and standard deviation statistics of all data were calculated. Whether the data showed normal distribution was examined with the "Shapiro-Wilk" test, because all variables showed normal distribution, the Repeated Measures ANOVA (intra-group and intergroup comparison) test was performed and the level of significance was determined as $P<0.001$. In these comparisons, the post-test values were more than the pre-test values. found to be better.

RESULTS

A total of 116 boys participated in the study. The first and last measurements of the morphological characteristics and the values of the motor performance tests, percentage change values (%) and differences (Λ) are shown in the tables (Table 1-2).

Table 1 Evaluation of change and percentage values of body composition measurements before and after training

n=116	Pre	Post	T_{pre}-T_{post}			F statistic				
Varaible	**M±SD**	**M±SD**	**Δ**	**%**	**η²**	**Group X Time**	**Time**	**Group**	**Tukey**	**η²**
Weight										
7 years	26.3±4.8	27.6±4.6	1.3±0.6	4.9	0.749					
8 years	30.1±6.8	31.2±6.7	1.2±0.5	3.7	0.701	0.001	0.001	0.001	9>8=7	0.270
9 years	37.2±9.9	38.4±9.9	1.2±0.1	3.2	0.744					
Height										
7 years	123.5±6.1	123.9±6.1	.43±0.1	0.03	0.854					
8 years	130.1±7.5	131.1±7.5	.39±0.1	0.07	0.837	0.069	0.001	0.001	9>8>7	0.406
9 years	137.6±7.3	137.9±7.3	.38±0.1	0.02	0.841					
BMI (Kg/m²)										
7 years	16.9±2.5	17.9±2.4	1.0±.1.2	5.9	0.258					
8 years	17.5±2.8	18.0±2.6	0.5±0.7	2.9	0.104	0.009	0.001	0.001	9>8=7	0.111
9 years	19.7±3.9	19.9±3.8	0.3±0.8	1,0	0.041					
Fat (%)										
7 years	24.0±5.6	22.9±4.6	1.1±1.4	4.8	0.148					

8 years	25.2±6.6	24.1±5.4	1.1±1.6	4,6	0.163	0.001	0.000	0.130	--	0.035
9 years	27.1±7.6	25.5±6.4	1.6±1.5	6.3	0.298					
Chest Circumference (cm)										
7 years	59.3±4.8	60.6±4.8	1.2±0.5	2.2	0.731					
8 years	61.3±6.5	62.6±6.7	1.3±0.4	2.1	0.753	0.392	0.000	0.001	9>8=7	0.244
9 years	68.5±8.9	69.8±9.1	1.4±0.4	1.9	0.794					
Abdominal Circumference (cm)										
7 years	58.4±6.5	57.2±6.2	1.2±0.6	2.0	0.578					
8 years	61.7±7.6	60.4±7.5	1.3±0.6	2.2	0.628	0.744	0.000	0.001	9>8=7	0.153
9 years	66.7±9.9	65.5±9.9	1.2±0.5	1.8	0.621					
Hip Circumference (cm)										
7 years	68.5±6.4	67.4±6.2	1.1±0.4	1.5	0.520					
8 years	71.5±7.8	70.3±7.6	1.2±0.4	1.7	0.580	0.085	0.000	0.001	9>8=7	0.139
9 years	75.8±8.3	74.5±8.2	1.3±0.8	1.7	0.672					

BMI: Body mass index; Pre: Pretraining. Post: Posttraining. *p< 0.001

Anthropometry results of the participants included in the study were significant between the first and last test measurements of the weight (Kg) and fat (%) averages within the groups (p <0.001*), Height (cm), BMI (Kg/m2), chest circumference (cm) There was no significant difference between the mean of abdominal circumference (cm) and hip circumference (cm) measurements between the first and last test measurements (p >0.001). When examined between the groups, no significant difference was found between the values of fat (%) (p >0.001) (Table 1). When the effect size of Eta squared values (η2) within the groups was examined, the weakest effect was seen in BMI (Kg/m2) values (p >0.001, effect size 0.041), while the greatest effect was seen in height (cm) values (p <0.001*, effect size 0.854). When the Eta squared values (η2) of the participants between the groups were examined, the smallest effect was seen in the fat (%) values (p >0.001, effect size 0.035), while the greatest effect was seen in the height (cm) values (p <0.001*, effect size 0.406).

Table 2 Evaluation of change and percentage values of performance measurements before and after training

n=45	**Pre**	**Post**	**T_{pre}-T_{post}**			**F statistic**				
Varaible	**M±SD**	**M±SD**	**Δ**	**%**	**η²**	**Group X Time**	**Time**	**Group**	**Tukey**	**η²**
Flexibility test (cm)										
7 years	24.8±4.3	27.6±3.9	2.7±1.1	11.3	0.642					
8 years	22.4±4.7	25.5±4.3	3.1±1.4	13.8	0.710	0.001	0.001	0.073	--	0.045
9 years	24.1±4.5	26.5±4.2	2.5±1.0	9.9	0.628					
Horizontal jump (cm)										
7 years	89.6±15.8	96.7±18.4	7.1±4.1	7.9	0.372					
8 years	94.6±9.6	103.4±13.6	8.8±5.3	9.3	0.487	0.001	0.001	0.001	9=8>7	0.071
9 years	97.6±15.4	109.7±19.9	12.1±6.0	12.4	0.666					
Vertical jump (cm)										
7 years	16.0±1.0	17.7±1.0	1.7±0.5	10.6	0.723					
8 years	16.8±1.2	18.4±1.1	1.6±0.7	9.5	0.707	0.001	0.001	0.001	9>8>7	0.407
9 years	17.9±1.1	19.7±1.0	1.8±0.6	10.0	0.767					
Push-up (S)										
7 years	5.9±3.9	10.9±4.3	5.1±1.8	84.7	0.742					
8 years	5.6±4.2	11.0±4.8	5.4±1.8	96.4	0.776	0.001	0.001	0.902	--	0.002
9 years	5.8±5.0	11.7±5.4	5.9±1.5	100.2	0.817					
Sit-up (S)										
7 years	14.5±4.9	20.5±4.5	5.9±1.6	41.3	0.793					
8 years	13.9±3.9	19.9±4.1	6.0±1.5	43.1	0.803	0.001	0.001	0.282	--	0.022
9 years	15.4±4.0	21.5±4.1	6.0±2.0	39.6	0.821					
Touching the Discs (sn)										
7 years	14.1±2.4	12.4±2.4	1.7±0.5	13.7	0.770					

8 years	11.2±1.8	9.7±1.8	1.5±0.6	15.5	0.737	0.001	0.001	0.001	9=8>7	0.375
9 years	10.6±1.6	9.40±1.6	1.6±0.4	12.8	0.780					
10 m Sprint(sn)										
7 years	3.1±0.3	2.9±0.3	0.1±0.7	6.8	0.593					
8 years	3.0±0.2	2.9±0.2	0.1±0.1	3.4	0.530	0.001	0.001	0.317	--	0.020
9 years	3.0±0.3	2.9±0.3	0.1±0.4	3.4	0.566					
Filamingo balance test (sn)										
7 years	8.9±6.3	13.8±27.9	4.9±3.5	55.1	0.391					
8 years	11.3±6.5	17.0±7.6	5.7±2.5	50.4	0.476	0.001	0.001	0.003	9>8=7	0.096
9 years	13.8±9.4	22.4±12.2	8.5±4.1	62.3	0.694					

Pre: Pretraining. Post: Posttraining. 1RMT: Repetition maximum total weight, *p< 0.001

A significant difference was found between the first and last test measurements of all the tests within the groups in the performance test results of the participants included in the study (p <0.001*). p >0.001) (Table 1). When the effect size of Eta squared values (η2) within the groups is examined, the weakest effect was seen in the horizontal jump (cm) values (p <0.001*, effect size 0.372), while the largest effect was seen in the shuttle (s) values (p <0.001*, effect size 0.821). When the effect size of the Eta squared values (η2) of the participants between the groups was examined, the smallest effect was seen in the Push-up (s) values (p >0.001, effect size 0.002), while the largest effect was seen in the vertical jump (cm) values (p <0.001*, effect you 0.407).

DISCUSSION

Early childhood is the most important period for gaining basic movement skills and improving physical fitness parameters. Physical fitness level is a determinant of health at an early age. Influencing one of the physical fitness parameters related to health or performance directly affects physical fitness. In this study, it was aimed to evaluate the morphological characteristics and motor development of children in the 12-week movement education program. 116 boys between 7 and 9 aged participated in the study. In the study, morphological features, pre-test and post-test values of motor performance tests, percentage values and differences were examined. When the pre-test and post-test scores of the mean of the morphological results of the children were examined, a significant difference was found in the Weight and fat (%) scores (p<0.001*), while the mean values of Height, BMI, chest circumference, abdominal circumference and hip circumference were determined. -No significant difference was found between test and post-test scores (p>0.001). When the pre-test and post-test scores of the mean between groups were examined, no significant difference was found between the scores of fat (%) (p>0.001).

One of the most appropriate activities to meet the movement needs of children is movement training activities. These studies are of great importance in the development of the child's muscle coordination, endurance, strength and flexibility. [10-11] In many studies, physical activity and exercise programs as environmental factors It has been observed that it has a positive effect on the growth and development of children. [28-29] The data we obtained as a result of our study and previous studies in this field support each other.

Koç and Tekin (2011) compared the morphological measurements and performance measurements of the students in the experimental group and the students in the control group, it was found that the scores of the students in the experimental group were higher in favor of acquiring and developing movement skills. In the scores of our study, it was observed that there was no difference except for weight and body fat percentage according to the results of morphological characteristics between and within the groups. In this respect, our study does not coincide with the study of writers. [30] However, it has been determined that there is a difference in terms of performance test scores. In this respect, the scores of our study are similar to this study.

In a study called "The effect of movement education program on the motor development of children" by Yarımkaya and Ulucan (2015), it was determined that the movement education program had a positive effect on motor development. [19] Our study shows parallelism with this study, as there was a difference between the pre-test and post-tests of the performance tests in terms of all variables. In the study named "Analysis of Basic Motor Skills Gaining Training Program" conducted by Duman (2019), it was seen that the scores of the children participating in the motor development training program increased and it supported the motor development. [31] In this study, the improvement in the performance test scores of the children who participated in the 12-week movement training program is similar to the study.

In the study of Wu et al. (2021), when examining the relationship between basic movement skills and motor fitness quality, a significant relationship was found between movement skills and motor fitness. Movement training, performance tests and morphological scores in our study are similar to the study of Wu et al. [32] Movement education program; It is known that it affects children's jumping and dynamic balance performances positively, [33-34] contributes positively to the development of

hand-eye coordination, [35] and contributes positively to large and small motor development. [36]

Studies have shown that; if children are encouraged to learn motor skills, their abilities go through a more rapid development phase than expected according to their age. Interfering with motor development not only accelerates motor development, but also prevents potential delays and promotes appropriate skill development. [37-38]

CONCLUSION

There was a significant difference in weight and body fat percentage in terms of morphological characteristics within the age group of 7-9-year-old children of the 12-week movement training program. The reason for this is that there are individual differences and it is thought that the body fat percentage of children who are overweight will be high. As a result, Performance tests showed that each age group created a significant difference in all variables. When we look at the age groups (between groups), no significant difference was found in flexibility, push-ups, sit-ups and sprint tests. It is thought that the reason for this is that each child has a different movement history and is at different maturation levels, but even if each child makes a difference in his peer group, it is not possible to catch a higher group without a different movement training. When the movement training pre-test and post-test data were compared, it was seen that the post-test data were better.

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