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THE EFFECT OF 10-WEEK EDUCATIONAL GAMES ON ANTHROPOMETRIC AND FUNDAMENTAL MOTOR SKILL DEVELOPMENT IN PRESCHOOL CHILDREN.

Research article

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Abstract

The aim of this study is to examine the effect of 10-week educational games applied to preschool children on anthropometric and fundamental motor skill development. The sample of the research consisted of a total of 48 children aged 5–6 who attended a private kindergarten. Anthropometric characteristics of the children and measurements related to performance tests, including height, body weight, BMI, chest circumference, waist circumference, and hip circumference, were taken. To measure performance characteristics, sit and reach, horizontal jump, vertical jump, and 10-meter sprint measurements were collected both as pre-tests before the 10-week educational games training and as post-tests after the 10-week educational games training. Data analysis was performed using the SPSS 25.0 program. Descriptive statistics, including means and standard deviations (SD), were calculated for the children's descriptive information. T-tests were applied to the anthropometric measurements before and after the 10-week educational game training. As a result, no significant difference was found between the performance test results of boys and girls. The anthropometric test results of the participants included in the study indicated a significant difference between the pre- and post-test measurements within groups and between groups. When the results of this study were compared with the results of other studies in the literature, the similarities and differences could be explained by factors such as genetics, nutrition, hormones, regional differences, training practices, muscle mass, warm-up, step frequency, physical activity level, psychological condition, differences in talent selection, accuracy of measurements (times, distances, etc.), calibration settings of the test device, temperature, elevation, environment, humidity, psychological condition, and training quality.

Keywords: Motor skills[1], educational play[2], anthropometry[3], children[4],

1. Introduction

The concept of educational play, which is an important part of human life, holds significant importance for maintaining a healthy and quality life (Pakarinen et al., 2017; Miller et al., 2016). As a living being with a need for movement in its environment, humans, especially starting from early childhood, influence children's development areas through the acquisition of motor skills

(Barba-Martín et al., 2020; Urinbaevna and Abdumalikovich, 2022). Therefore, educational play should be perceived not just as a series of activities to fill children's leisure time but as a necessity that directly supports their development (Abdurahimovna and Bakhodirovna, 2023).

Starting from birth, there is a risk of various health problems due to insufficient physical activity, especially in children (Pate et al., 2018; Budreviciute et al., 2020). To minimize this risk in young age groups, educational play activities directly influence the development of anthropometric and basic motor skills (Atiković et al., 2023; Martins et al., 2021). Educational play activities carried out in the preschool period support the physical, mental, and emotional development of young children (Barbosa and Oliveira, 2016; Hsiao and Chen, 2016). Through educational play studies, not only balance as a coordinative motor skill but also bone development, muscle strength, and flexibility are significantly enhanced (Sutapa and Suharjana, 2019). The expected development of basic motor skills is facilitated by providing children with opportunities to experience them through educational play from an early age (Vernadakis et al., 2015). Play activities enable the acquisition of motor skills correctly, fluently, and rapidly (Zeng et al., 2017). Thus, children who learn through play have the chance to turn their skills into accomplishments without feeling pressured (Kokkalia et al., 2016).

Instilling a habit of physical activity from an early age plays a crucial role in promoting an active and healthy future throughout life (Lu and Montague, 2016). Studies in the literature reveal that children with more developed motor skills perform better on physical fitness tests and participate in sports activities more frequently (Driediger et al., 2018; Hulteen et al., 2018). It is also found that children between the ages of 3 and 6 show an increase in motor skills with age, and those experiencing developmental delays also lag behind in motor skills, highlighting the significance of motor competence in child development (Pasichnyk et al., 2018). Participation in educational play during the preschool period has been linked to a more successful acquisition of movement skills during the primary school years (Costa et al., 2015; Shaari and Ahmad, 2016).

Educational play activities conducted during the preschool period contribute to the proper execution of movements, the determination of anthropometric values, and the development of necessary skills for our daily lives. In this context, the support and implementation of educational play activities with appropriate age groups and well-designed programs become essential for achieving more effective results in the development of basic motor skills in children.

2. Method

2.1. Research Model

The participants were trained in educational games for 10 weeks. All anthropometric measurements and Motor Performance Tests of the students were performed before and after the 10-week educational games training. The flow chart of the research is given in Figure 1.

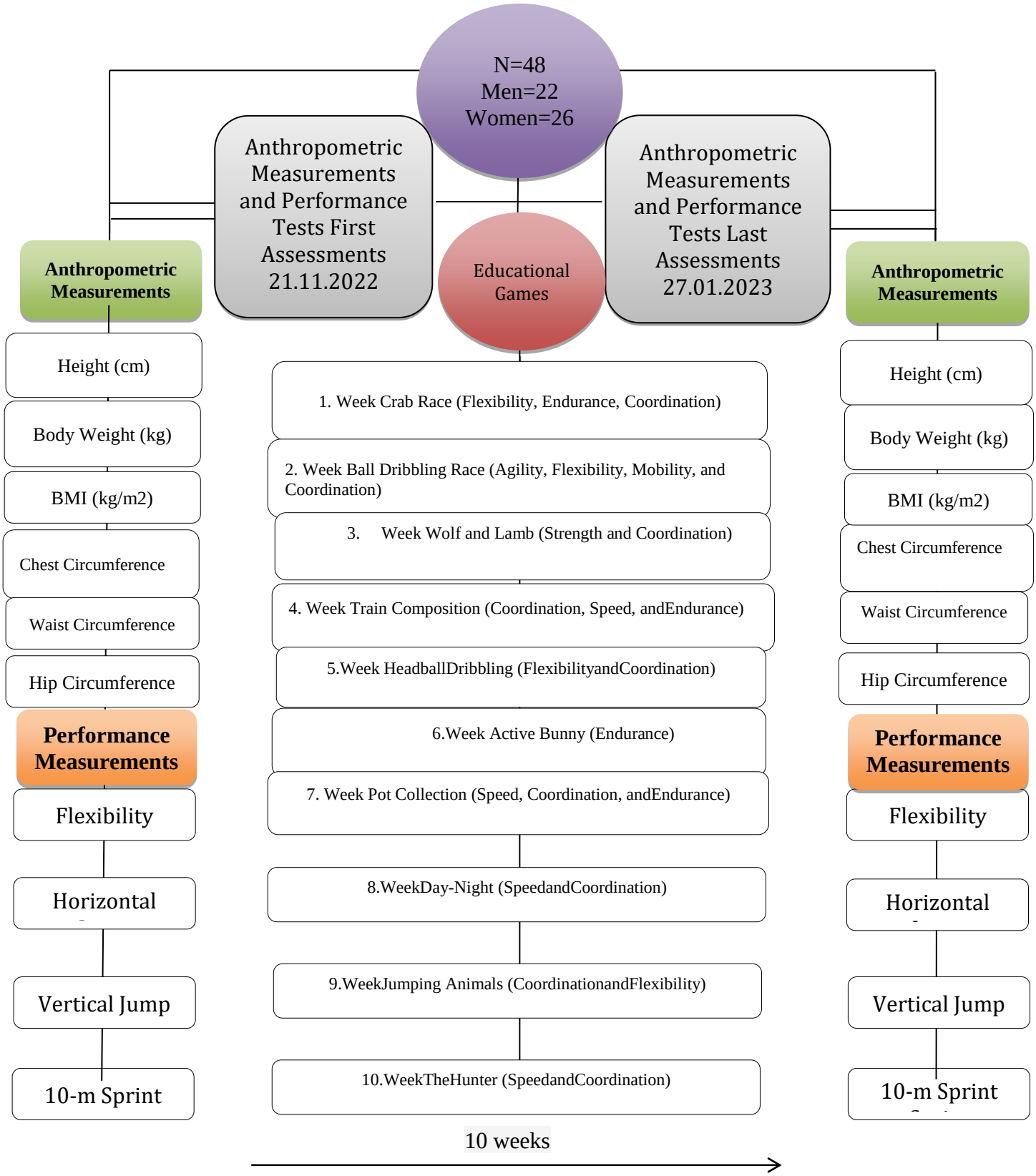

Figure 1. Flow diagram of

2.2. Research Group

Detailed information about game training and anthropometric measurements was provided to the research group, and necessary permissions were obtained from the parents of the children participating in the exercise. The study was limited to 10 weeks, and it was determined that none of the participating children had any health issues. The sample of the research consisted of a total of 48 children aged between 5-6, who were attending a special kinder garden. The anthropometric characteristics and performance test results of the children are presented in Table 1.

2.3. Data Collection

Over a span of 10 weeks, educational games were administered to preschool students (refer to Figure 1). To gauge their progress, measurements of anthropometric and performance characteristics were conducted and documented. On the initial day, anthropometric measurements, which encompassed height, body weight, BMI, chest circumference, waist circumference, and hip circumference, were taken. The subsequent day involved the collection of performance measurements, which included flexibility, horizontal jump, vertical jump, and a 10-meter sprint. These measurements served as both pre-tests conducted before the 10-week educational game training and post-tests conducted after the 10-week educational game training. Prior to the commencement of the tests, meticulous checks were conducted to ensure the calibration and linearity of the measuring instruments. Additionally, their reliability was verified. The measurements were carried out in a sports hall on a non-slip surface, maintaining a temperature of approximately 22°C. The performance tests were administered twice to all groups, and the best results were recorded. The educational games were consistently held at the same times every day for a duration of 10 weeks, ensuring the participants' regular participation. This study received approval from the Kırıkkale University Non-Interventional Research Ethics Committee and adhered to the principles outlined in the Helsinki Declaration. Participants and their parents were thoroughly informed about the study's procedures, and written consent forms were signed by the parents.

2.3.1. Educational Games Program

For 10 weeks, 48 kindergarten students aged 5-6 years old played educational games in the school gymnasium for half an hour, 2 days a week. The educational games training program included warm-up exercises, walking exercises, running exercises, jumping exercises, balance exercises, ball exercises, rope exercises and stretching exercises.

2.3.2. Performance Test

After 10 weeks of educational games, pre-test and post-test results of Flexibility, Horizontal Jump, Vertical Jump, Push-up, Sit-up, Tapping Discs, 10 m Sprint, Flamingo Test values were measured to measure the performance of preschool children.

2.3.3. Flexibility (Sit and Reach Test)

The participants sits in front of a sitting box that is 35 cm long, 45 cm wide, and 32 cm high. They place their bare feet on the inner surface of the box and try to reach as far as possible without

bending their knees. She repeats this movement three times, and each time, the farthest point she can reach is recorded. The aim is to achieve the best result (López-Miñarro ve Rodríguez-García, 2010; Sekendiz et al., 2010).

2.3.4. Horizontal Jump

The Horizontal Jump is used as a test of explosive strength and assesses the athlete's ability to perform a standing long jump. Athletes stand just behind the starting line and mark the starting point with their fingertips. When they feel ready, they try to carry themselves as far horizontally as possible using their whole body. The athlete performs this jump twice at best, and the distance from the back-most point of contact is measured and recorded in centimeters (cm). In this way, the athlete determines the highest level of performance. (Lockieve et al., 2015; Ayán-Pérez et al., 2017).

2.3.5. Vertical Jump

The Fusion Sport Mat was used in the vertical jump test. All athletes participating in the test were informed about the test and given time to warm up. Practice tests were performed to learn and practice the correct technique, and during the jump, the athletes were asked to fall on the same place on the mat by bending their knees 90 degrees using all their strength. During the jump and landing on the mat, care was taken to ensure that the athletes landed on the same ground, so the jumping and landing positions of the subjects were carefully monitored. The measurements were repeated twice, and the best result for each subject was recorded in centimeters (cm). A rest period of 5 minutes was given between the two measurements (Cheung et al., 2016; Struzik et al., 2017).

2.3.6.10 m Sprint

The test was performed by placing a photocell device with an accuracy of 0.01 seconds at the startand end points of the 10-meter track. The timing started automatically when the subject felt ready and passed through the startgate and stopped when the subject passed through the end gate. In this way, the time between the start and end Gates was precisely recorded. Subjects rested for 10 minutes between tests, and the best result was recorded (Ceylan et al., 2016; Howe et al., 2017).

2.4. Analysis of Data

The data collected from the children in our study were analyzed using SPSS Statistical Software (version 25, SPSS, Inc., an IBM Company, Chicago, Illinois). We calculated the mean and standard deviation for all the data. To assess whether the data exhibited a non-normal distribution, we applied the Kolmogorov-Smirnov test (Razali and Wah, 2011). However, all variables in our study were found to follow a normal distribution. Subsequently, we conducted a Repeated Measures t-test to compare both within and between groups. In reporting the statistical differences, we adhered to the American Psychological Association (APA) 6.0 style guidelines. Additionally, we computed Cohen's d values to determine effect sizes, categorizing them as insignificant (<0.20), small (0.20-0.59), medium (0.6-1.19), large (1.2-1.99), or very large (Hopkins et al., 2009). A significance level of $p < 0.05$ was used to define statistical significance.

3. Results

A total of 48 boys and girl participated in the study. To determine the effect of 10-week educational games on the anthropometric and basic motor skill development of preschool children, the following statistics were performed.

Table 1. Demographic characteristics of the participants

	Variables	N	M±SD
Male and Female	Age (yrs)	48	5.46±0.5
	Height (cm)		105.1±4.5
	Body weight (kg)		17.8±3.7
	BMI (kg/m2)		15.9±2.7
Male	Age (yrs)	22	5.45±0.5
	Height (cm)		106.4±4.3
	Body weight (kg)		17.7±2.4
	BMI (kg/m2)		15.3±2.0
Female	Age (yrs)	26	5.46±0.5
	Height (cm)		104.0±4.4
	Body weight (kg)		17.9±4.6
	BMI (kg/m2)		16.4±3.2

The mean age of the preschool children was 5.46±0.5 years, and the mean height was 105±4.5 cm. The mean body weight was 17.8±3.7 kg, and the BMI was 15.9±2.7 kg/m2. It was observed that the BMI of male participants was lower than that of females (Table 1).

Table 2. Descriptive statistics of boys and girls and gender differences

Variables	Girls (n = 26)	Boys (n = 22)	t	p	*ES*	*Descriptor*
Anthropometry						
Body Weight (Kg)	18.6±4.	18.7±2.2	-0.017	0.986	0.021	Trivial
Height Length (cm)	105±4.4	107±4.1	-2.200	**0.033***	0.047	Trivial
BMI (Kg/m²)	16.7±3.1	16.0±1.5	0.967	0.338	0.287	Small
Chest Circumference (cm)	61.6±5.4	61.4±5.1	0.130	0.897	0,038	Trivial
Abdominal Circumference (cm)	59.5±7.2	58.9±6.2	0.246	0.889	0,089	Trivial
Hip Circumference (cm)	68.4±6.0	68.0±6.8	0.208	0.836	0,062	Trivial
Fitness						
Flexibility test (cm)	28.5±4.2	26.8±3.2	1.520	0.135	0.456	Small
Horizontal jump (cm)	115±11.6	105±15.2	2.440	**0.019***	0.074	Trivial
Vertical jump (cm)	17.5±5.4	15.1±4.4	0.964	0.341	0.487	Small
10m Sprint(sn)	3,01±0,3	2,92±0,3	1.687	0.092	3.000	Very Large

BMI; Body mass index, ES; *Cohen's d* effect size, *; statistically significant *p< 0.05

Table 2 shows the demographic information and fitness data of the participants according to gender. According to the results of the study, there was no significant difference between the performance test results of the boys and the girls except horizontal jump.

Table 3. Descriptive statistics and t-test results, comparisons and effect size results of preschool children's anthropometric measurements before and after 10 weeks of educational play.

Variables	**Pre**	**Post**		**In-group**			**Out - group**	
5 years (n= 26) 6 years (n= 22)	M±SD	M±SD	p	ES	Descriptor	p	ES	Descriptor
Body Weight (Kg)								
5 years	17.7±3.7	18.5±3.6	**0.001***	0.219	Small	**0.001***	0.005	Trivial
6 years	17.9±3.8	18.7±3.9	**0.001***	0.208	Small			
HeightLength (cm)								
5 years	105±4.6	106±4.4	**0.001***	0,022	Trivial	**0.001***	0,016	Trivial
6 years	105±4.6	106±4.4	**0.001***	0.038	Trivial			
BMI (Kg/m^2)								
5 years	15.9±2.7	16.4±2.4	**0.001***	0.196	Trivial	**0.001***	0.082	Trivial
6 years	16.1±2.5	16.6±2.5	**0.001***	0.200	Trivial			
Chest Circumference (cm)								
5 years	59.7±5.4	60.7±4.9	**0.001***	0.194	Trivial	**0.001***	0.327	Small
6 years	61.2±5.5	62.3±4.9	**0.001***	0.211	Small			
Abdominal Circumference (cm)								
5 years	56.8±6.4	57.7±6.4	**0.001***	0,140	Trivial	**0.001***	0.427	Small
6 years	59.5±6.6	60.5±6.7	**0.001***	0.150	Trivial			
Hip Circumference (cm)								
5 years	66.1±6.4	67.1±6.1	**0.001***	0,160	Trivial	**0.001***	0.328	Small
6 years	68.2±6.1	69.1±6.1	**0.001***	0.148	Trivial			

BMI: Body mass index; **Pre:**Pretraining. **Post**: Posttraining.ES; *Cohen's d* effect size, *; statistically significant *p< 0.05

The anthropometric test results of the participants in our study revealed a statistically significant difference in means between the initial and final test measurements, both within and between the groups ($p < 0.05$), as indicated in Table 3. When we examined the effect sizes using Cohen's d values within the groups, we observed that the smallest effects were observed in height ($p < 0.05$, effect size 0.022), abdominal circumference ($p < 0.05$, effect size 0.140), and hip circumference ($p < 0.05$, effect size 0.148). Conversely, the largest effects were observed in body weight (kg) ($p < 0.05$, effect size 0.219) and chest circumference ($p < 0.05$, effect size 0.211). Upon analyzing Cohen's d values for differences between groups, we found that the smallest effect was in body weight (kg) ($p < 0.05$, effect size 0.05), whereas the largest effect was in abdominal circumference (cm) ($p < 0.05$, effect size 0.427).

Table 4. Descriptive statistics and t-test results, comparisons and effect size results of preschool children's performance measurements before and after 10 weeks of educational play.

Variables	**Pre**	**Post**	**In-group**			**Out - group**		
5 years (n= 26) 6 years (n= 22)	M±SD	M±SD	p	ES	Descriptor	p	ES	Descriptor
Flexibility test (cm)								
5 years	24.1±4.5	27.9±3.9	**0.001***	0.193	Trivial	**0.001***	0.020	Trivial
6 years	23.6±5.2	27.5±3.8	**0.001***	0.199	Trivial			
Horizontaljump (cm)								
5 years	94±12.9	110±13.9	**0.001***	0,119	Trivial	**0.001***	0,007	Trivial
6 years	96±13.1	111±14.4	**0.001***	0.109	Trivial			
Verticaljump (cm)								
5 years	12.7±4.6	16.4±5.3	**0.001***	0.746	Large	**0.001***	0.019	Trivial
6 years	12.8±4.3	16.5±5.0	**0.001***	0.793	Large			
10m Sprint(sn)								
5 years	3.35±0.2	3.28±0.3	**0.001***	2.194	VeryLarge	**0.001***	2.000	Very Large
6 years	3.32±0.2	3.22±0.3	**0.001***	3.333	VeryLarge			

Pre: Pretraining. **Post**: Posttraining.ES;*Cohen's d*effect size, *; statisticallysignificant*p< 0.05

Regarding the performance test results of the study participants, we observed a significant difference between the initial and final test measurements within the groups for all tests ($p<0.05$), as outlined in Table 4. When we scrutinized the effect sizes using Cohen's d values within the groups, we noted that the smallest effect was observed in horizontal jump (cm) values ($p<0.05$, effect size 0.109), while the most substantial effect was found in the 10 m sprint (s) values ($p<0.05$, effect size 3.333). Upon analyzing the Cohen's d values for differences between groups, we observed that the smallest effect was in horizontal jump (cm) values ($p<0.05$, effect size 0.007), whereas the largest effect was seen in the 10 m sprint (s) values ($p<0.05$, effect size 2.000).

4. Discussion and Conclusion

The purpose of this study is to examine the effect of 10 weeks of educational games applied to preschool children on anthropometric and basic motor skill development. According to the study results, there was no significant difference in demographic information, anthropometrics, or performance measurements between boys and girls. However, when the descriptive statistics and t-test results of anthropometric measurements before and after the 10-week educational game intervention for preschool boys and girls were compared, significant differences were observed between the initial and final measurements within each group and between the groups. Within-group effect size was weakest for height, waist circumference, and hip circumference, while the largest within-group effect was seen for body weight and chest circumference. When comparing values between boys and girls, the weakest effect was found for body weight, and the largest effect was observed for waist circumference. As for the performance test results, the within-group effect size was weakest for the vertical jump and greatest for the 10 m sprint values. Between-group values showed the smallest effect for the horizontal jump and the largest effect for the 10 m sprint values.

In comparison to the study by Önal and Şirinkan in 2021, which focused on improving fundamental movement skills in elementary school students through planned games and movement education

applications, our study showed parallel results in the vertical jump test but not in the flexibility test. Similarly, when compared to the study by Latorre-Román et al. (2018), which investigated the effects of a physical activity program in preschool settings on physical fitness, our study showed parallel results in the horizontal jump and sprint tests but not in the vertical jump test. In the study by Özbar et al. in 2015, it was emphasized that the movement education program applied to children aged 4-6 years positively affected the body composition of the experimental group and made progress above normal development. In addition, it was observed that this training program, which continued for one year, positively affected the height of the children. In the same study, it was determined that the body weight of the children was not affected by the movement education program during this period. In addition, it was stated that the activities carried out as part of physical education practices improved the balance, agility, fast running, ball throwing, ball catching, and long jumping skills of 6-year-old children, and that play activities positively affected children's balance, catching, and running skills.

In our country, it is observed that physical activity-based intervention programs in the preschool period generally focus on basic movement models and games. A small number of studies have included the training of sports branches such as athletics, folk dances, gymnastics, and swimming. When the international literature is examined, it is seen that such studies generally focus on locomotor and aerobic activities, which are organized at moderate to high intensity. However, the common point of these studies is that it is more effective and easier for preschool children to naturally start with basic locomotor movements such as running, jumping, skipping, rolling, climbing, and crawling, that these activities should be supported by games, and that children should be encouraged to accelerate their heart rate and sweat during the activity (Capella-Peris et al., 2020).

The reasons for these similarities and differences between our study and other studies in the literature may be attributed to genetic factors, nutrition, hormones, regional variations, training practices, muscle mass, warm-up routines, step frequency, physical activity levels, psychological state, differences in skill selection, measurement accuracy (e.g., timing, distances), calibration of test devices, temperature, elevation, environment, humidity, and training quality.

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