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THE EFFECT OF THERAPEUTIC GAME EDUCATION ON PHYSICAL HEALTH IN CHILDREN WITH BACK MUSCLE WEAKNESS

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Abstract:
The aim of this study was to investigate the effect of therapeutic play training on physical health in 10-12 year old children with back muscle weakness. Experimental research model was used in the study. According to the results of the Functional Movement Screening test, 16 children (8 Study, 8 Control) with back muscle weakness were included in the study as participants. According to the pre-test analysis results, children with weak back muscles were given therapeutic play training with 7 different games adapted to increase healthy posture and physical development for 8 weeks and 3 days a week. At the end of the therapeutic game education application process, the FMS test (post-test) was administered to the children again and the results were recorded. The groups were homogeneously distributed, independent sample t-test was used to determine the difference between the research and control groups, and paired sample t-test was used to compare the data within groups. All statistical values obtained were evaluated at 95% confidence interval and significance was evaluated at $p<0.05$ level. According to the findings obtained from the study, a statistically significant difference was found when the FMS pre-test-post-test results of the children in the study group, in which therapeutic games were applied, were analyzed ($p<0.05$). As a result of the FMS pre-test before the education program was started, it was determined that 7 of the 8 participants, who could not reach a sufficient score and whose back muscles were found to be weak, reached a sufficient score according to the FMS post-test results after the applications, and only 1 participant showed positive development although he could not get a sufficient score. When the FMS pre-post test results applied to the control group were examined, it was determined that there was no statistically significant difference $p>0.05$.

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1. Introduction

Today, the conditions that play a role in the occurrence of physical deficiencies are mainly seen as socio-economic factors (Uzuner, 2016). Especially in children, it is seen that physical inadequacies and weaknesses come to the forefront. Irregular and inadequate nutrition, physical inactivity, and digital game addiction are some of the factors that cause this situation (Garcia *et al.*, 2019). Physical weaknesses occur when physical fitness cannot be established for children. Physical fitness includes muscle endurance, muscle strength, flexibility, balance, agility, and speed in the body's muscular system (Özer, 2006).

Physiotherapy is the most preferred method to eliminate physical weaknesses (Elbasan, 2013). According to the definition of the World Confederation of Physical Therapy (WCPT), physiotherapy is the field of practice used to build people's movements and abilities in a certain order, to ensure the continuity of the skill, and to improve it. Physiotherapy can help individuals when their mobility is at risk due to aging, injury, illness, or genetic or environmental factors. According to the World Health Organization's (WHO) definition of physiotherapy, it is a field of science that evaluates and plans treatment programmes to develop and improve the motoric characteristics of people, to expand movement capacity, to treat the pain felt, to repair or prevent physical problems that may be caused by injury, disease or other disorders. Physiotherapy is integrated into the concept of play because it covers movement activity and contributes to children's physical recovery or becoming more qualified without realising it while having fun with games (Halmatov, 2017).

The concept of play, the benefits of which are mentioned in the field of physiotherapy, is expressed as "*all of the regular activities carried out in order to enjoy the current situation within the framework of specified written or verbal rules*" (Graham, 2009). When the whole of the definitions made for play are examined, it is observed that different perceptions are formed. For example; Huizinga (2010) stated that children do not start games consciously and that it is voluntarily preferred to start games. He stated that children who start games on a voluntary basis adapt to the rules specific to games and create order. Games also help learning behaviour to take place more easily and enjoyably. In addition, games enable children to adapt to daily life more easily, form the basic integrity of their psychological and physical development, and enable them to be healthier in terms of mental and physical aspects (Baykoç, 2006).

When the importance of games in terms of development is considered, it is observed that they support children's muscular development and contribute to multiple skills in terms of physical and motoric development such as throwing, holding, pulling, releasing, jumping, stretching, endurance and speed (Mangır & Aktaş, 1993). From a therapeutic point of view, the learnability of the basic movement skills contained in the

game is considered to be applicable for physical recovery and the development of physical skills. Therapeutic play, which is used for the mentioned improvements, is a type of therapy that provides recovery with movement, order, and continuity, develops positive coping methods in the child, and enables the child to gain physical competence in the event that certain physical disorders, diseases, and disorders occur and these disorders have a negative effect on the quality of life (Kıran *et al.*, 2013).

In order for a game to qualify as a therapeutic game:

1) It should be developed to provide physiological and physical benefits to children (e.g. breathing exercises to improve respiratory function, blowing on a ball or moving it by blowing on it, physically, somersaults, changing direction, running, etc.).
2) Encouraging and encouraging children to express their feelings,
3) Children should be given information or training about the games to be played (Avan *et al.*, 2020).

One of the areas of use of therapeutic games, which aims to provide physical benefits due to its purpose, is posture disorders and weaknesses that children are congenital or affected by environmental factors. One of the most common types of these weaknesses occurs in the back muscles. Back muscle weakness is one of the physical disorders that occur in posture, which is defined as the correct posture of the musculoskeletal system (Ercan, 2019). In children, lack of conscious basic movement training or environmental factors (incorrect weight bearing, sitting in the wrong position for a long time, etc.) negatively affect the body's posture, skeletal proportion, and muscle balance, causing back muscle weakness. These wrong actions cause partial weakening of the muscles in children's bodies and differentiation of muscle ratios. According to Anon, these weaknesses in children's muscle groups can be eliminated through adapted therapeutic games (as cited in Erener & Öndoğan, 2020). During physical activity, the body achieves proper posture when all muscles work in harmony with the support of the ligaments that attach the muscles to each other (Sağır, 2021).

When the international and national literature is examined, the effect and developmental benefits of therapeutic games aimed at improving children's physical weaknesses draw attention. For example, Alfieri *et al.* (2022) argued that the game is the most accurate adaptor for the physical activities carried out by gamification to be performed with focus by the participants and for all activities to be performed as they should be. In this context, they revealed that physical disorders were eliminated and physical skills improved as a result of performing the activities in the desired form and duration. In Herrington and Brussoni's (2015) study on the importance of play and nature-based playgrounds in terms of child health and development, they drew attention to the cognitive, social, physical health, and developmental benefits of playing games. In a study by Van Delden, Aarts, and Van Dijk (2012) on concrete game design for children undergoing occupational and physical therapy, it was observed that the designed concrete games supported the physical development of children during physical therapy and accelerated the physical therapy processes. In another similar study, Ceyhan (2020)

examined the importance of play therapy in social work practices with children and pointed out that play therapy provides social and physical benefits to children. Teber (2015), in his study on youth, play, and play therapy stated that physical games in general contribute to the development of children in psychomotor, cognitive, emotional, and social terms.

According to the results obtained from the mentioned studies, the effect of therapeutic games on children is not limited to the development of physical qualities. Improving children's social qualities such as motivation, decision-making, belonging, and leadership, it contributes to children's success in all areas of their lives. In this context, the study aimed to examine the effects of the therapeutic play programme, which was adapted and prepared for 10-12 years old children with back muscle weakness, on physical health.

2. Material Methods

2.1 Research Desing

In the research, full experimental research, which is accepted as a quantitative research method, was preferred. The pre-test-post-test model was used with a study and control group. The pretest-posttest model is an analysis method used especially in experimental studies (Büyüköztürk, 2007).

2.2 Participants

In this study, "simple random sample selection" method, which is one of the "probability-based sample selection" methods, was used for participant selection. The application was made to the people selected by this method. As a criterion, 16 (13 boys, 3 girls) children (8 in the study group and 8 in the control group) who had weakness in their back muscles according to the results of Functional Herekte Screening (FMS) of students aged 10-12 years at Turkey, Sakarya city, Korucuk district, Arif Nihat Asya Secondary School were included.

2.3 Data Collection Tool

2.3.1 Height and Body Weight Measurements

The height of the participants in the study and control groups was measured in centimetres (cm) and their body weight was measured in kilograms (kg) and recorded. The body weight of the participants was measured using a Vestel digital glass scale with an accuracy of ±0.01 kg, with bare feet and wearing a student uniform in accordance with the standards set by their school (Vestel, 2023). The height of the participants was measured in cm by means of a Hoechstmass 3 metre automatic tape measure with an accuracy of ±0.001 m, with bare feet, heels together, head upright, and eyes facing straight ahead (Hoechstmass, 2023).

2.3.2 Functional Movement Screen (FMS)

The FMS test consists of 7 exercises that help to examine the general movement functions of the person and to identify weaknesses. This test organization consists of deep squat, high step, single line lunge, shoulder mobility, active straight leg raise, trunk stability-push-up, and rotation stability (Cook *et al.*, 2010). FMS scores are evaluated in the range of 0-3 points for each movement, and the highest score that can be reached at the end of the test is 21. When pain was felt during the application, 0 points were given, 1 point was given when the movement was interrupted, 2 points were given if the movement was incomplete, and 3 full points were given for the complete movement. It has been determined that people with a FMS test score of 14 and below are weaker in terms of muscle strength, balance, and coordination compared to others (Akkoç and Kırandı 2019).

2.3.3 Adapted Therapeutic Games

Polievski Sergey Aleksandrovich's book "500 games and stances" (Polievski *et al.*, 2003) was used for the games organised to overcome muscular weaknesses and gain physical qualities in 10-12 years old children with back muscle weakness (Polievski *et al.*, 2003). The therapeutic games in the book were adapted and programmed taking into account the development of children's physical qualities.

Table 1: Therapeutic Game Education Program

Game Title	Game Duration	Game Type	Game Effect
Caterpillar	40 min.	Team	Strength - Coordination
Jumping Rabbit	40 min.	Individual	Strength-Balance-Rapidity
Foot Scissors	40 min.	Team	Strength- Coordination- Flexibility
Stafet	40 min.	Team	Strength- Coordination- Endurance
Game Commando	40 min.	Individual	Strength- Coordination- Endurance
Wheelbarrow	40 min	Team	Strength- Coordination- Endurance
Ball Hunter	40 min.	Team	Strength- Coordination- Endurance- Flexibility

2.4 Data Collection

All of the research applications were carried out in Sakarya city, Korucuk district, Arif Nihat Asya Secondary School sports hall. An 8-week period was used to collect the data. At the beginning of the application, FMS tests of the children were performed with random sample selection and the tests lasted 2 days in total in order to reach the desired number in the sample. According to the prepared programme, the application study lasting 8 weeks was designed to last 3 days of each week and each application lasted 40 minutes, provided that it was intermittent.

2.5 Data Analysis

In the process of evaluating the data collected from the research, SPSS 26.0 package programme was used for statistical analysis of the data. Descriptive statistics (height, age, weight mean) were taken, and it was determined that the data had a normal distribution

by looking at the kurtosis and skewness values. If the skewness and kurtosis values take a value between -1.5 and +1.5, it is accepted that the data show normal distribution (Tabachnick *et al.*, 2013). Afterwards, an independent sample t-test was used to determine the difference between the research and control groups as a result of the pre-test and post-test, and paired sample t-test was used to compare the data within groups.

3. Results

In this section of the study, the results of the analyses are presented.

Table 2: Demographic and Physical Characteristics of the Children Participating in the Study

	N	Min.	Max.	Avg.	Ss.
Age (year)	16	10	12	10.87	.83
Body Weight (kg)	16	27	48	35.75	7.08
Height (cm)	16	135	155	144.75	8.27

Table 2 shows the demographic and physical characteristics of the children who participated in the study. When the data are taken into consideration, 16 children participated in the study, the mean age of the children was 10.87 ± .83 years, the mean body weight was 35.75 ± 7.08 kilograms, and the mean height was 144.75 ± 8.27 centimetres.

Table 3: FMS Pre-test Results (Study-Control)

	N	Avg.	Ss.
Experimental Group			
Deep Squat	8	1.50	.53
Hurdle Step	8	1.88	.64
Inline Lunge	8	1.75	.46
Shoulder Mobility	8	2.63	.51
Active Straight-Leg Raise	8	2.00	0
Trunk Stability Push Up	8	1.88	.64
Rotary Stability	8	1.25	.46
Control Group			
Deep Squat	8	1.50	.53
Hurdle Step	8	1.75	.46
Inline Lunge	8	1.75	.46
Shoulder Mobility	8	2.50	.75
Active Straight-Leg Raise	8	2.25	.46
Trunk Stability Push Up	8	1.88	.64
Rotary Stability	8	1.50	.53

When we analysed the data in Table 3, the pre-test data average obtained as a result of 7 functional movements applied to the study group in the FMS test was calculated as 12.89 points. Since this average was below the threshold of 14 points, it was determined that the participants were weak in terms of strength, balance, flexibility, and coordination. In

addition, the sum of the pre-test data average obtained as a result of 7 functional movements applied to the control group in the FMS test was calculated as 13.13 points. Since this average was below the 14-point threshold, it was determined that the participants were weak in terms of strength, balance, flexibility, and coordination.

Table 4: FMS Post-test Results (Study-Control)

	N	**Avg.**	**Ss.**
Experimental Group			
Deep Squat	8	2.00	0
Hurdle Step	8	2.13	.35
Inline Lunge	8	2.25	.46
Shoulder Mobility	8	3.00	0
Active Straight-Leg Raise	8	2.50	.53
Trunk Stability Push Up	8	1.75	.46
Rotary Stability	8	1.63	.51
Control Group			
Deep Squat	8	1.75	.46
Hurdle Step	8	1.63	.51
Inline Lunge	8	1.88	.35
Shoulder Mobility	8	2.50	.75
Active Straight-Leg Raise	8	2.13	.35
Trunk Stability Push Up	8	1.25	.70
Rotary Stability	8	1.13	.35

When we examine the data in Table 4, the post-test data average obtained as a result of 7 functional movements applied to the study group in the FMS test was calculated as 15.26 points. Since this average exceeded the 14-point threshold, it was determined that the participants improved in terms of strength, balance, flexibility, and coordination compared to the pre-test, and a significant difference was observed. In the FMS test of the control group, the sum of the post-test data average obtained as a result of the 7 functional movements applied was calculated as 12.27 points. Since this average was below the 14-point threshold, it was determined that the participants were weak in terms of strength, balance, flexibility, and coordination.

When the pre-test-post-test results of the study group are compared in Table 5, no difference is observed in trunk stability-push-up ($t=.552$, $p>0.05$) and rotary stability ($t=-1.426$, $p>0.05$), while no difference is observed in deep squat ($t=-2.646$, $p<0. 05$), hurdle step ($t=-1.000$, $p<0.05$), inline lunge ($t=-2.646$, $p<0.05$), shoulder mobility ($t=-2.049$, $p<0.05$), and active straight leg raising ($t=-2.646$, $p<0.05$). When the pre-test-post-test results of the control group data were compared, no statistically significant difference was found ($p<0.05$).

Table 5: T-Test Results (Study-Control)

	N	Avg.	Ss.	t	p
Experimental Group					
Deep Squat	8	-.500	.53	-2.646	.033*
Hurdle Step	8	-.250	.70	-1.000	.035*
Inline Lunge	8	-.500	.53	-2.646	.033*
Shoulder Mobility	8	-.375	.51	-2.049	.043*
Active Straight-Leg Raise	8	-.500	.53	-2.646	.033*
Trunk Stability Push-Up	8	.125	.64	.552	.059
Rotary Stability	8	-.375	.74	-1.426	.197
Control Group					
Deep Squat	8	-.250	.46	-1.528	.170
Hurdle Step	8	.125	.64	.552	.598
Inline Lunge	8	-.125	.64	.552	.598
Shoulder Mobility	8	.375	.51	1.342	.510
Active Straight-Leg Raise	8	.125	.35	1.000	.351
Trunk Stability Push Up	8	.625	.74	2.376	.053
Rotary Stability	8	.375	.51	2.049	.080

4. Discussion

In this study, the effects of therapeutic game education applied to children with back muscle weakness in the 10-12 age group on physical health were examined. At the beginning of the study, children whose back muscle weaknesses were determined by FHT pre-test results were classified into 8 study and 8 control groups. Adapted therapeutic games were applied to the children in the study group and at the end of the 8-week study, a statistically significant difference was found in the examination of the effects of therapeutic games applied with the FHT post-test on the back muscles. When the FHT pre-test-post-test results of the children in the control group, who were not included in the therapeutic game education within the scope of the study, were examined, no significant difference was found.

When some related studies that support the results obtained from the study are examined, (Khunturaev, 2020) argue that traditional action and movement games are more effective in raising primary school children in a healthy way and developing physical development parameters, unlike digital games. Physical activities that form the basis of this process have found a significant difference in the direction of strengthening health by increasing children's physical development, motor skills, and body functionality. Santos *et al.* (2021) concluded that because video games provide a unique and exciting opportunity for social interaction, physical video games improve mental and physical health in children and adolescents in many ways by ensuring the correct expenditure of energy. Gmez-Portes *et al.* (2020), as a result of their study, revealed that when physical activity is gamified, participation in the activity takes place with higher motivation and thus physical development is observed positively. A similar study

(Pakarinen, 2017) stated that therapeutic games provide physical and social benefits to children.

Yarlykova and Chubukova (2016) examined the effect of traditional outdoor games on the development of physical qualities in children and as a result, they found a significant difference in the development of motor skills and movement functions of children. When another study related to our study is examined, (Khorkova, 2017), the development of physical qualities in children through physical education significantly expands the musculoskeletal system, the functional capabilities of the child's body, and the range of movements that children can use. In addition, it creates preconditions for mental and motor activity, which supports our study. Baranowski *et al.* (2016) found a significant difference in terms of children and adolescents moving correctly through play activities and increasing physical activity. Azizi-Soleiman *et al.* (2023) concluded in their study that educational-therapeutic games prevent obesity in children and adolescents and have a curative effect against sleep disorders and physical disorders. In addition, the same results were revealed in a similar study by Teke and Avşaroğlu (2020).

As a result, when the physical effect of therapeutic games on children aged 10-12 years with weakness in the back muscles was examined, it can be said that the therapeutic games played have a positive effect on the correction of unhealthy posture formation and increase of physical fitness of children. The findings of our study proved that therapeutic games support the formation of healthy posture and play a healing role against back muscle weaknesses. The hypothesis of our study was supported by the fact that all children except 1 child in the study group, who participated in the research, exceeded the proficiency score (14 points) determined in the FMS test thanks to the physical benefits they obtained from therapeutic games. As a result of the data obtained, a course called "Game Education" can be added to the education curricula of children starting from primary school to high school. In addition, taking into account the principle of "the child discovers by learning", suggestions can be made to parents and prospective parents to receive play education. In addition, based on the results of this study and considering that the life process of an individual consists of physical, psychological, and social phenomena, studies can be conducted to learn the psychological and social effects of therapeutic games on children.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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