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# *"Box Box on the Shelve! Tell Me!"*: The Effects of Adapted Plays on Physical Fitness in Autism Spectrum Disorder

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**Abstract**

The purpose of this study is to examine the effects of adapted play activities on physical fitness in individuals with autism spectrum disorder (ASD). In this study, the pretest-posttest design with a single experimental group was used. The sample of the study is comprised of 7 students with 7–13 years of age. In the measurement of physical fitness parameters of children with ASD, height, body weight, flexibility, vertical jump, and right/left hand grasping power tests were performed. SPSS 23.0 program was used. In addition to descriptive statistics, Wilcoxon signed rank test was used in the comparisons of pretest-posttest measurements. According to the findings of the research, among the physical fitness parameters, it was determined that there were statistically significant differences in the flexibility, vertical jumping, right and left-hand grasping power values, while there was statistically no significant difference concerning the body mass index values. We can mention that the obtained findings demonstrate that play activities lesson program has positive impacts on the physical fitness parameters of children with ASD, and it contributes to their motor developments. Additionally, this research study is considered significant since it leads the way for researchers and teachers of this field and it provides an insight for further studies.

**Keywords:** autism spectrum disorder, play, adaptation, physical fitness

## 1. Introduction

According to the book titled Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (2013) published by the American Psychiatric Association (APA), Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with an early development stage between 0 and 3 years of age (APA, 2013). According to the same source, it manifests itself in inabilities in two areas as persistent disorder in social communication and interaction, and limited-repetitive behavior patterns (repetitive behavior). Inabilities in the areas of social communication and interaction are characterized, in particular, by features such as inability to engage in non-verbal behavior needed in social interaction, inability to improve age-appropriate peer relationships, limitations in sharing success or interests with others and in social emotional behaviors, delay in language and speech development, repetitive language, and games that are not suitable for developmental level. As per the repetitive/obsessive behaviors and limited-repetitive behaviors, they are reported to emerge as behaviors/characteristics such as intense and unusual interest in a particular area, excessive adherence to certain orders and routines, repetitive and self-stimulating behaviors, extraordinary interest towards objects and obsessive characteristics (Kırcali-İftar, 2012; Wolkmar, 1991). Additionally, it is rated in three levels based on the intensity of the ASD.

The first level is named as "Requiring support". In children at this level, when necessary support is not provided, discernible inabilities are observed in social communication and interaction. It emerges in the form of difficulty in initiating social interaction and atypical response or failure to react to social attempt efforts of others. The second level consists of individuals who "Require Intensive Support". Children at this level show significant inabilities in their communication skills. They display features such as inability in social communication skills even if support is provided, and initiating limited social interaction or having little or abnormal responses to others. The third level consists of individuals "Requiring a Heavy Level of Support". At this level, certain features are displayed such as severe inability in non-verbal and verbal social communication and interaction, significant disorders in functionality, initiating very limited social interactions, minimal response to social stimuli from others, etc. (APA-DSM-5, 2013). However, the exact causes of the ASD are not known. It is

reported that many factors can be effective (Jick & Kaye, 2003; Kim, Han, Lyoo, Min, Kim, & Renshaw, 2010; Riva & Giorgi, 2000; Geier, Kern, Garver, Adams, Audhya, & Nataf, 2009; Windham, 2006; Van Elst, Riedel, & Maier, 2016). There are various research studies on the causes of the ASD examining certain factors such as genetic and environmental factors (Caubit, Gubellini, Andrieux, Roubertoux, Metwaly, Jacq, …, Carlier, 2016; Yi, Danko, Botelho, Patzke, Pak, Wernig, & Südhof, 2016; Kara & Yilmaz, 2019; Doenyas, 2019; Herbert, 2010), viral infections, metabolic imbalances, and exposure to chemicals (Libbey, Sweeten, McMahon, & Fujinami, 2005; Hviid, Hansen, Frisch, & Melbye, 2019; Schmidt, Hansen, Hartiala, Allayee, Schmidt, Tancredi, … Hertz-Picciotto, 2011; Ashwood, & Van de Water, 2004; Volkmar & McPartland, 2014), and studies examining children with ASD and their families (Klin & Mercadante, 2006; Demirkaya, Aksu, Taş, & Özgür, 2016; Volkmar & Wiesner, 2009).

Studies conducted in recent years in the world and in our country demonstrate that there is a growing proportion of children diagnosed with ASD. In a study covering the years 2000 to 2014, it was determined that the number of individuals diagnosed with ASD increased by 6% to 15% each year (Baio, 2014; Baio, Wiggins, Christensen, Maenner, Daniels, Warren, & Dowling, 2018). In addition, according to the data of the American Center for Disease Control and Prevention, the ASD occurs 1/68. It is considered that approximately 1% of the world's population is ASD (Christensen, Braun, Baio, Bilder, Charles, Constantino, …, Yeargin-Allsopp MChristens, 2018). It is observed that the number is increasing and OSB treatment approaches are gaining importance. In addition to medical treatments, the importance of providing education and training environments necessary for individuals to integrate into society and to realize their independent life skills is also increasing.

In the training of ASD individuals, the playing skills are taught and teaching through the play method is used. Unlike their normally developing peers, children with ASDs experience significant inadequacies in displaying spontaneous play behavior. It is reported that this is due to the inadequacy of social communication and interaction, which is the main problem of children with ASD, consequently preventing children from being socially accepted (Childress, 2011; Wolfberg & Schuler, 1999; Vuran, 2007). Play is the universal language of all children. Through play, children connect with the past and prepare for future situations. It is reported that play positively influences the developmental characteristics of individuals with ASD in certain studies (Kurt & Yurtçu, 2017; Dawson, Rogers, Munson, Smith, Winter, Greenson, … Varley, 2010; Princiotta, Goldstein, & Naglieri, 2013; Memari, Panahi, Ranjbar, Moshayedi, Shafii, Kordi, & Ziaee, 2015). In the method of teaching through physical education and play, certain methods are used such as "expression method", "faultless teaching", "teaching through discrete essays", "teaching through modeling (Show and practice method)", "activity charts", "positive behavior support", "shaping", and "participation". The priority here is to determine the basic interests and needs of children accurately, and in this direction, to make a choice of methods. Because depending on the child's existing performance, sometimes a single method can be used or sometimes certain methods can be used together. In the teaching of functional and basic mobility skills, the child's play with different purposeful play materials contributes positively to the child's development (Tsai & Lin, 2011; Ozer & Ozer, 2000; Reid & Parsons, 2002). In addition, children can develop the ability to express themselves, communicate and interact with their environment through play. Additionally, it was reported that play activities in evidence-based applications in schools are effective in children with ASD (National Autism Center – NAC, 2015).

The aim of educational plays used in physical education courses is to improve motor skills and physical fitness levels in children. Physical fitness is the capacity of work particular to the individual. This capacity depends on one's strength, quickness, endurance, coordination, and interoperability of these features. The level of physical fitness varies depending on the type of work done (Zorba & Saygın, 2009). In addition, the exercise-based applications are accepted among the promising applications in the NAC report, and it was accepted among the applications on scientific bases by the National Professional Development Center on Autism Spectrum Disorder, NPDC on ASD report. According to the NPDC on ASD (2013), exercise is a method administered to affect the development of physical fitness of ASD-diagnosed students in a positive manner, as well as to reduce inappropriate behavior and increase desired behaviors (Odom, Cox, & Brock 2013; Waligórska, Kucharczyk, Waligórski, Kuncewicz-Sosnowska, Kalisz, & Odom, 2019). For these reasons, our study is important both for its contribution to the literature and for providing new insights to the researchers of this field.

In this respect, the aim of the study is to examine the effects of adapted play activities on the physical fitness levels of individuals with autism spectrum disorder.

## 2. Method

### *2.1 Research Model*

This research, which examines the effects of the adapted physical education and play activities lesson on the

physical fitness levels of individuals with autism spectrum disorder (ASD), was designed as a single-group and pretest-posttest method, which is among the quantitative research methods. In this model, the effect of the applied process is tested on a single group. The measurements of the subjects concerning the dependent variable are obtained by using the same measuring tools on the same subjects as pretest before application, and then posttest after application. There is no radnomness and no matching (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2016).

*2.2 Research Group*

The participants of the study are comprised of 7 students (6 males, 1 female) with 7–13 years of age, who had autism spectrum disorder reports and receiving their education at the Special Education School in Muş province at the 2018–2019 academic year.

Table 1. Descriptive analysis results of the participants

| | N | Min. | Max. | Mean | S.D. |
|---|---|---|---|---|---|
| **Age** | 7 | 7.00 | 13.00 | 10.71 | 2.42 |
| **Height** | 7 | 122.00 | 152.00 | 137.57 | 12.42 |
| **Weight** | 7 | 27.00 | 51.00 | 40.71 | 10.62 |

*2.3 Data Collection Tools*

In terms of the measurements of the pyhsical fitness, height, weight, flexibility, vertical jumping, right-hand and left-hand grasping powers were measured. Before the measurements, explanations were made to the students through being a model and physical assistance, and subsequently two measurements were taken from the students, and the higher value was recorded.

2.3.1 Measurements of Height and Weight

The measurements of the body weight and height of the students were measured in sportswear without shoes. In the body weight measurements, *Oncomed sc-101* bascule was used, and measuring tape with 0.1 cm sensitivity was used in height measurements.

2.3.2 Sit-Reach Flexibility Test

The length, width, and height sizes of the sit-reach (flexibility) test stand were 35 cm, 45 cm, and 32 cm, respectively. The upper surface of the stand was 45 cm long and 45 cm wide. On the upper surface, a ruler of 0–50 cm is fixed to have parallel lines with 5-cm intervals in between. During the measurements, the child sat on the floor and leaned straight against the test table with bare foot. The child tilted his/her body forward, and without bending the knees, stretched forward as far as he/she could with the hands in front of the body, gently pushing the ruler forward. He/she waited 1–2 sec at the farthest point he/she could reach without bending forward or backward. The test was repeated twice and the highest value was recorded.

2.3.3 Vertical Jumping Test

Vertical jumping performances of the students were measured by using the jumping board. Students were asked to jump as high as they could. The test was applied twice and the best score was recorded.

2.3.4 Hand Grasping Power Test

During the measurement of the hand grasping power values of the participants that was employed while the participants were standing, it was determined that their dominant hands were the right hand, and the measurements were employed with the *Takei Grip-d* hand dynamometer which measures the strength between 0–100 kg. The dynamometer was adjusted to the hands of each child. Keeping his/her straight arm away from the body on its side with an angle of 10–15 degrees from the shoulder, each child was asked to grasp his/her hand with maximum force without touching his/her body. The measurement was applied twice for the left and right hands separately, and the best score was recorded in kg.

*2.4 Data Collection*

The research was conducted within the scope of the 50-min adapted physical education and play activities course applied 2 days a week for 16 weeks. Participants were divided into 2 groups (groups of 4 and 3 people) and play activities were held. The adapted play activities were prepared in line with the curriculum of learning area/sub-learning areas of the Ministry of National Education. Play plans were prepared in the form of target/target-behaviors, teaching methods and techniques, teaching technology and materials, application,

measurement, and evaluation phases, and the implementation was processed in accordance with these play plans. Initially, the first measurements of physical fitness were taken, and the final measurements were taken at the end of the 16 weeks.

*2.5 Data Analysis*

In the analysis of the data obtained in the research, the SPSS 23.0 program was used. In the analysis of the data, descriptive statistics and normality tests were applied. Since the data did not demonstrate normal distribution, the Wilcoxon Signed Ranks Test was administered, which is among the "non-parametric" tests. The significance level was accepted as 0.05 for the comparisons.

## 3. Results

Table 2. Physical fitness pretest and posttest descriptive analysis results of the participants

| Variable | | N | Min. | Max. | Mean | S.D. |
|---|---|---|---|---|---|---|
| **Flexibility (cm)** | Pre | 7 | 12.00 | 28.00 | 18.714 | 6.499 |
| | Post | 7 | 13.00 | 30.00 | 22.142 | 5.928 |
| **Vertical Jumping (cm)** | Pre | 7 | 2.20 | 8.40 | 4.885 | 2.394 |
| | Post | 7 | 4.90 | 14.30 | 8.257 | 3.393 |
| **Right hand grasping (kg)** | Pre | 7 | 4.70 | 6.50 | 5.600 | .6806 |
| | Post | 7 | 8.60 | 14.20 | 10.828 | 1.854 |
| **Left hand grasping (kg)** | Pre | 7 | 2.70 | 8.00 | 5.414 | 1.600 |
| | Post | 7 | 3.90 | 11.40 | 8.785 | 2.539 |
| **Body Mass Index (BMI) (kg/m$^2$)** | Pre | 7 | 18.14 | 26.40 | 21.160 | 2.986 |
| | Post | 7 | 16.76 | 24.73 | 20.308 | 2.859 |

*Note*. Pre = Before the implementation; Post = After the implementation.

Table 3. Pretest and posttest Wilcoxon test results of the participants concerning their flexibility

| Post Flexibility<br>Pre Flexibility (cm) | N | Rank mean | Rank total | Z | p |
|---|---|---|---|---|---|
| Negative rank | 0 | .00 | .00 | -2.375 | .018* |
| Positive rank | 7 | 4.00 | 28.00 | | |
| Equal | 0 | | | | |

*Note*. *P<0.05; N (6) (Pre = Before the implementation) (Post = After the implementation).

Based on the analysis results shown in Table 3, it was determined that there were statistically significant differences between the pretest and posttest values of flexibility (z=-2.375. p<0.05)

Table 4. Pretest and posttest Wilcoxon test results of the participants concerning their vertical jumping

| Post Vertical Jumping<br>Pre Vertical Jumping (cm) | N | Rank mean | Rank total | Z | p |
|---|---|---|---|---|---|
| Negative rank | 1 | 1.00 | 1.00 | -2.197 | .028* |
| Positive rank | 6 | 4.50 | 27.00 | | |
| Equal | 0 | | | | |

*Note*. *P<0.05; N (6) (Pre = Before the implementation) (Post = After the implementation).

Based on the analysis results shown in Table 4, it was determined that there were statistically significant differences between the pretest and posttest values of vertical jumping (z=-2.197. p<0.05)

Table 5. Pretest and posttest Wilcoxon test results of the participants concerning their Right Hand

| Post Right Hand<br>Pre Right Hand (kg) | N | Rank mean | Rank total | Z | P |
|---|---|---|---|---|---|
| Negative rank | 0 | .00 | .00 | -2.366 | .018* |
| Positive rank | 7 | 4.00 | 28.00 | | |
| Equal | 0 | | | | |

*Note*. *P<0.05; N (6) (Pre = Before the implementation) (Post = After the implementation).

Based on the analysis results shown in Table 5, it was determined that there were statistically significant differences between the pretest and posttest values of right (dominant) hand grasping power (z= -2.366. p<0.05)

Table 6. Pretest and posttest Wilcoxon test results of the participants concerning their Left Hand

| Post Left Hand<br>Pre Left Hand (kg) | N | Rank mean | Rank total | Z | P |
|---|---|---|---|---|---|
| Negative rank | 1 | 2.00 | 2.00 | -2.028 | .043* |
| Positive rank | 6 | 4.33 | 26.00 | | |
| Equal | 0 | | | | |

*Note*. *P<0.05; N (6) (Pre = Before the implementation) (Post = After the implementation).

Based on the analysis results shown in Table 6, it was determined that there were statistically significant differences between the pretest and posttest values of left-hand grasping power (z=-2.028. p<0.05) level.

Table 7. Pretest and posttest Wilcoxon test results of the participants concerning their Bmi (kg/m2)

| Post Bmi (kg/m2)<br>Pre Bmi (kg/m$^2$) | N | Rank mean | Rank total | Z | p |
|---|---|---|---|---|---|
| Negative rank | 6 | 4.17 | 25.00 | -1.859 | .063 |
| Positive rank | 1 | 3.00 | 3.00 | | |
| Equal | 0 | | | | |

*Note*. *P<0.05; N (6) (Pre = Before the implementation) (Post = After the implementation).

Based on the analysis results shown in Table 7, it was determined that there was statistically no significant difference between the pretest and posttest values of the BMI levels (z=-1.859. p>0.05).

## 4. Discussion and Conclusion

This study was conducted to examine the effects of adapted play activities on the physical fitness of individuals with ASD. In the literature, there are numerous studies reporting that physical activities have positive effects on the development areas of individuals with ASD (Ganz & Flores, 2008; Watkins, O'Reilly, Kuhn, & Ledbetter-Cho, 2019; Blanc, Adrien, Roux, & Barthélémy, 2005; Jung, & Sainato, 2015; Jung & Sainato, 2013). However, this study primarily focused on the effect of the adapted play on physical fitness. In the research findings, it was determined that there were statistically significant differences between the pretest and posttest values of the participant students with autism spectrum disorder concerning flexibility (z=-2.375. p<0.05), vertical jumping (z=-2.197. p<0.05), right (dominant) hand grasping power (z=-2.366. p<0.05), and left-hand grasping power (z=-2.028. p<0.05) levels. However, it was determined that there was statistically no significant difference between the pretest and posttest values of the BMI levels (z=-1.859. p>0.05). In studies on play skills teaching, it was reported that play interventions employed in the adapted environments positively contributed to the development in play skills of children with ASD, increased their social interactions, and reduced negative behaviors (Dauphin, Kinney, & Stromer, 2004; Hine & Wolery, 2006). In this context, we can say that the progress in the levels of physical fitness achieved in our study has a positive effect on the social interactions of the participants. In addition, it was also reported that physical activities administered to individuals with ASD had an impact on the development of children's physical fitness and motor skills (Pitetti, Rendoff, Grover, & Beets, 2007; Lotan, Isakov, & Merrick, 2004; Yanardağ, Ergun, & Yılmaz, 2009). Since the findings obtained in our research study increased positively, we can say that the previous studies support our research. In the literature, it is reported that the period of basic is movements is important in the development of motor skills, and by preparing a basis for other body movements, it is extremely important to gain more complex movements (Sarol, 2013). Considering that the students participating in our study are in the period of basic movements, the significance of the study is better understood. Positive results were reported in the literature (Yanardağ, Ergun, & Yılmaz, 2009; DeBolt, Clinton, & Ball, 2010; McLaughlin, Byers, & Vaughn, 2010; Magnusson, Cobham, & McLeod, 2012; Azar, McKeen, Carr, Sutherland, & Horton, 2016; Keskin, Hanbay, & Kalyoncu, 2017; Kara & Yılmaz, 2019; Namlı, 2011; Yanardağ, 2007). These results support our study. It was determined in our study that there was no statistically significant difference between pretest and posttest levels of body mass index (z=-1.859. p>0.05). We can mention that this result is due to the fact that the play activity studies applied are low-intensity plays. Because the body mass index (BMI) is simply calculated to determine the relationship between height and mass. It is a highly objective criterion that provides information about the nutritional status

of children and adults (Neyzi, Günöz, Furman, Bundak, Gökçay, & Darendeliler, 2008). Considering the BMI values of the participant students (mean 20.308), it can be said that the mean weight is ideal in male and female children.

As the conclusion, since the children with ASD have limited opportunities and appropriate play environments and adaptations to develop peer interaction and other critical developmental skills, it can be mentioned that the adapted play activities provided in our study positively influenced the individuals with ASD for the physical fitness levels of children by providing these limited opportunities. In line with these results, it is considered that this study is significant since it guides researchers and teachers, who will work in this field, and provides an insight for further studies. Additionally, in further studies, the effects can be examined by including different groups of disabilities.

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