



## Investigation of the effect of 12-week exercise training on the level of physical fitness in children with autism

Bilal KARAKOÇ<sup>1</sup> 

<sup>1</sup>Yalova University, Faculty of Sport Sciences, Yalova, Türkiye

**Araştırma Makalesi/Research Article**

**DOI:** 10.5281/zenodo.8354190

Gönderi Tarihi/Received:  
10.01.2023

Kabul Tarih/Accepted:  
06.06.2023

Online Yayın Tarihi/Published:  
20.09.2023

### Abstract

The aim of this study is to investigate the effect of 12-week exercise training on the level of physical fitness in autistic children. A total of 10 individuals, 4 females and 6 males, residing in Çanakkale city center and having autism are included in the study. The age range of individuals participating in the study is 13-19. These individuals were reached through previous volunteer projects and Kepez Special Education Vocational School. Studies were conducted 2 days a week, Monday - Thursday, for 12 weeks. The studies were conducted between 40 and 55 minutes, depending on the content of the study. Particular attention was paid to the safety and health aspects of the studies. Students studying at the Faculty of Sports Sciences supported the studies voluntarily. Various tests are used to scale the physical parameters as a data collection tool in the study. In the analysis of the data, normality test and reliability test results were examined and it was determined that the data conformed to normal distribution and was reliable. Based on this point, parametric testing techniques were used to test the data. Differences between pretest and posttest mean values were performed using Paired Groups T Test. According to the results obtained, it is concluded that there is no statistically significant difference between the height, weight, flexibility, biceps, triceps, suprailiac and suspacapula pre-test and post-test mean values of the male and female participants.

**Keywords:** Autism, exercise, physical fitness

### *12 haftalık egzersiz eğitiminin otizmli çocuklarda fiziksel uygunluk düzeyine etkisinin incelenmesi*

#### Öz

*Bu çalışmanın amacı otistik çocuklarda 12 haftalık egzersiz eğitiminin fiziksel uygunluk düzeyine etkisini tespit etmek için yapılmıştır. Araştırmaya Çanakkale il merkezinde ikamet eden ve otizm tanısı almış 4 kadın 6 erkek toplamda 10 birey dahil edilmiştir. Çalışmaya katılan bireylerin yaş aralığı 13-19 dur. Bu bireylere daha önce çalışılan gönüllü projelerden ve Kepez Özel Eğitim Meslek Okulu'ndan ulaşılmıştır. Çalışmalar 12 hafta boyunca haftada 2 gün Pazartesi – Perşembe günleri yapılmıştır. Çalışmalar çalışmanın içeriğine göre 40-55 dk arasında yapılmıştır. Çalışmalarda güvenlik ve sağlık boyutuna özellikle dikkat edilmiştir. Çalışmalara Spor Bilimleri Fakültesinde okuyan öğrenciler gönüllü olarak destek olmuştur. Araştırmada veri toplama aracı olarak fiziksel parametreleri ölçmek amacıyla (çeşitli testler kullanılmıştır). Verilerin analizinde normallik test, güvenilirlik test sonuçları incelenmiş, verilerin normal dağılıma uyduğu ve güvenilir olduğu tespit edilmiştir. Bu noktadan hareketle verilerin test edilmesinde parametrik test teknikleri kullanılmıştır. Ön test ve son test ortalama değerleri arasındaki farklılıklar Eşleştirilmiş Gruplar T Testi kullanılarak gerçekleştirilmiştir. Elde edilen sonuçlara göre kadın ve erkek katılımcıların boy, ağırlık, esneklik, biceps, triceps, suprailiac ve suspacapula ön test son test ortalama değerleri arasında istatistiksel olarak anlamlı düzeyde farklılık olmadığı tespit edilmiştir.*

**Anahtar Kelimeler:** Otizm, egzersiz, fiziksel uygunluk

**Sorumlu Yazar/Corresponded Author:** Bilal KARAKOÇ, **E-posta/e-mail:** bilal.karakoc@yalova.edu.tr  
Genişletilmiş Türkçe Özet, makalenin sonunda yer almaktadır.

## INTRODUCTION

Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental disorder with qualitative damages in social and communication skills, insistent behaviors, and a range of motor sensory obstacles (Bello-Mojeed et al., 2016). There is no current pharmacological treatment for autism, but there are pedagogic, psychotherapeutic therapies and pharmacological treatments that help control behavioral evidences. Recent data show that exercise treatment programs can reform cognitive and behavioral evidences in children with ASD (Toscano et al., 2018). Moreover, basic diagnostic evidences, many children with ASD may have damages in cognitive-behavioral and perceptual-motor areas, motor function, as well as static and dynamic balance (Srinivasan et al., 2014). Children with ASD may have troubles in performing age-appropriate motor skills due to low muscle tone, postural disorders and coordination disorders (Shillingsburg et al., 2015). Due to social and behavioral deficits, children with autism typically show lower levels of physical activity, a sedentary lifestyle, and lower exercise tolerance than their peers (Pan & Frey, 2006; Must et al., 2014). Studies on the effect of physical activity on children and adults with autism report positive results (Sorensen & Zarrett, 2014; Bremer et al., 2016). Studies have shown that the attendance of children with ASD in comprehensive physical activities with their peers facilitates the implementation of activities (Ward & Ayvazo 2006) and supports motor skill development (Pan, 2011). Attendance in physical activities has a positive effect on the health, motor coordination and cardiovascular fitness of children with ASD (Lalonde et al., 2014; Menear & Eumeier, 2015; Sowa & Meulenbroek, 2012). Thanks to these activities, children with ASD improve their social behavior (Gregor et al., 2018), communication skills (Yarımkaaya et al., 2017), and improve their quality of life (Groff et al., 2009).

People with autism have more musculoskeletal complications than their peers, cerebral palsy, congenital deflexion of the feet and hips, hypotonia and scoliosis are more likely to be seen (Vonken et al., 2006). These circumstances have an impact on physical capacity as well as the potential to be physically active and suitable and develop motor skills. (Wouters et al., 2016). Children's physical activity and motor development are arguments that can be affected and are certainly related to physical fitness (Cattuzzo et al., 2016). It is seen that children and adolescents with thoughtful handicaps have lower levels of physical activity (Einarsson et al., 2016) and age-related motor competence (Hartman et al., 2010) compared to their peers. Decreased physical activity of individuals with autism frequently leads to obesity (Srinivasan et al., 2014). In addition, participation in physical activity decreased the level of stress, anxiety

and anxiety in individuals with autism; psychosocial improvement, such as increases in self-anxiety, socialization, self-confidence and sense of achievement, and reductions in the risks of death and disease from diseases such as diabetes, obesity, and cardiopulmonary diseases; it leads to increases in motor function, muscle strength and physical fitness levels (Çelik & Buğday, 2022). Children with autism cannot benefit enough from leisure activities such as social isolation, limited communication skills, poor eye contact, stereotyped movements and behaviors, inadequate activity opportunities, and therefore physical and social activities, and have difficulties in maintaining them (Savucu, 2022). To improve the physical fitness of children with autism through exercises, it is necessary to pay attention to the physical fitness level of each individual. Exercises contribute to the development of self-sufficiency in people with autism. Physical activity and exercises are also very important for weight control of people with autism. Activities carried out for autistic children will try to reduce aggressive behaviors while improving physical, cognitive and social skills. It is known that children with ASD who do physical activity or exercise perform better academically and socially. In this context, the aim of our study is to search the effect of 12-week exercise training on the level of physical fitness in autistic children. Looking at similar studies, it was difficult to find female participants. In our study, there is not much difference between the number of girls and boys participating. One of our aims in doing this study is to reinforce and develop the theoretical knowledge that students studying at the Faculty of Sports Sciences have with practice. The participation stability of the volunteer students who participated in our study was at a very high level. This study also gave us experience for other studies to be carried out.

## **METHOD**

### **Research model**

In this study, single-pattern research, which is a type of experimental research from pre-test-post-test quantitative research designs, is used (Büyüköztürk et al., 2011).

### **Research group**

A total of 10 individuals, 4 females and 6 males, living in Çanakkale city center and suffering from autism between the ages of 13-19, were included in the study. The selection of children with autism was decided based on their consistency in participation in previously worked volunteer projects, the teachers of the Special Education Vocational School where they received education, and interviews with their families. Families who wanted their children to participate in the study were asked to sign a "family consent form". Before the studies, research approval numbered 2023/21 was received from Yalova University Human Research Ethics

Committee dated 23.02.2023. Transportation for the works was provided by the municipality. Participants were picked up from certain points of the city and dropped off at the same points after the study.

**Table 1. The study program applied in the research**

Week 1	a-Walking exercise, abdominal exercises
	b-Walking exercise, exercise with medicine balls
Week 2	a-Fast walking exercise, fitness exercise
	b-Balance board exercises, flexibility exercises
Week 3	a-Fast walking between slalom bars, exercises with the ball
	b- Strength exercises (moving and throwing medicine balls)
Week 4	a-Flexibility exercises (Various postures)
	b-Throws, catches (throws with hands and feet)
Week 5	a-Flexibility exercises (Picking up objects while lying down and on your back)
	b-Basic Gymnastics (Bear walk, caterpillar walk)
Week 6	a-Balance exercises (Progressing on the balance board with various balls)
	b-Zig zagging fast walks, Chair grabbing
Week 7	a-Strength (Jumps)
	b-Coordination (fast walking and ball carrying on the coordination track)
Week 8	a-Exercises with basketball
	b-Exercises with soccer ball
Week 9	a-Slalom exercises with balls
	b-Tennis practice
Week 10	a-Coordination exercises (passing over and under the ladder bars)
	b-Basketball ball bouncing, dribbling
Week 11	a-Football dribbling, football shooting
	b-Fitness work (Basic work with small weights)
Week 12	a-Football and basketball hitting exercises
	b-Basketball exhibition match (individuals with mixed autism and volunteer students)

Studies were carried out for an average of 40-55 minutes. In the studies, attention was paid to the health and safety of the participating individuals. Necessary time is allocated for warm-up and cool-down depending on the content of the study.

#### **Data collection**

**Height measurements:** The subject's weight is equally distributed on both feet, the heels are together and in contact with the stadiometer, the head is in the Frankfort plane, the arms are hanging freely from the shoulders to the sides. During the measurement, the subject is asked to take a deep breath and keep the upright position without leaving the heels on the ground. The moving part of the stadiometer is brought to the top of the head and the hair is compressed sufficiently to note the measurement (Özer, 2007). A Desis Ekoter brand device was used to measure height.

**Body weight measurement:** The participant stands in the middle of the platform of the scale in a way that distributes his weight on both feet. The participant's face is turned to the scale and is upright (Lohman et al., 1988; Özer, 2007). A Desis Ekoter brand device was used to measure body weight.

**Sit – Reach test measurement:** Subject sits on the floor and rests the soles of their feet flat on the test bench. A forward lunge is made from the trunk. Knees should not be bent. The furthest point reached with the hands in front of the body is recorded (Winnick & Short, 1999; Özer, 2007). S&R brand sit-reach test brand was used in sit-reach test measurement.

**Biceps:** It is measured from the point on the elbow pit and the acromion line in the region where the biceps muscle protrudes most anteriorly. The subject is measured while standing, with the arm to be measured freely hanging down, by folding it vertically (Winnick & Short, 1999; Özer, 2007). Holtain skinfold caliper was used for biceps measurement.

**Triceps:** Measured from the midpoint between the acromion and the olecranon. The subject is standing with his arms hanging freely to the sides. Standing behind the measuring subject and folding it from the determined point with his left hand, he measures with the caliper in his right hand (Winnick & Short, 1999; Özer, 2007). Holtain skinfold caliper was used for triceps measurement.

**Suprailiac:** Measured 45 degrees diagonally from the top of the iliac crest on the midaxillary axis. The subject's feet are in an upright posture with the arms hanging freely to the sides (Winnick & Short, 1999; Özer, 2007). Holtain skinfold caliper was used for suprailiac measurement.

**Supscapula:** Folds 45 degrees diagonally below the inferior angle of the scapula. The subject is standing with his arms hanging freely to the sides (Winnick & Short, 1999; Özer, 2007). Holtain skinfold caliper was used for supscapula measurement.

### **Data analysis**

Statistical analyzes of the data are carried out in IBM SPSS – 20.0 package program. Skewness-kurtosis values and Cronbach Alpha reliability coefficient were examined for the normality distribution of the data, and it was determined that the variance complied with the normal distribution and the results were reliable. Based on this point, parametric testing techniques were used to test the existing hypotheses in the research. The mean standard deviation values of all obtained data are calculated. The differences between the pre-test and post-test mean values are made according to the Paired Groups T Test.

## FINDINGS

**Table 2. T-test results of male's pre-test and post-test mean values**

Variables	N	Pre-Test		Post-Test		df	t	P
		$\bar{x}$	SD	$\bar{x}$	Sd			
Height	6	166.50	8.82	166.83	8.97	5	-1.581	0.175
Weight	6	63.16	12.57	64.66	12.20	5	-1.695	0.151
Flexibility	6	13.16	9.88	13.83	9.74	5	-0.698	0.516
Biceps	6	7.83	5.49	8.16	4.44	5	-0.466	0.661
Triceps	6	11.66	5.42	12.33	4.92	5	-0.830	0.444
Suprailiac	6	17.33	9.99	18.33	8.64	5	-0.707	0.511
Supscapula	6	15.16	9.53	16.00	9.03	5	-0.773	0.474

Table 2 contains the Paired Groups T Test Results of male participants regarding the existing variables. When the current results are examined, male participants' height variable (166.50±8.82; 166.83±8.97), weight (63.16±12.57; 64.66±12.20), flexibility (13.16±9.88; 13.83±9.74), biceps (7.83±5.49; 8.16±4.44), triceps (11.66±5.42; 12.33±4.92) mean values of suprailiac (17.33±9.99; 18.33±8.64) and suspcapula (15.16±9.53; 16.00±9.03). It is concluded that there is no statistically crucial difference between the pre-test and post-test mean values of the male participating in the study ( $p>0.05$ ).

**Table 3. T-test results of female's pre-test and post-test mean values**

Variables	N	Pre-Test		Post-Test		df	t	P
		$\bar{x}$	SD	$\bar{x}$	Sd			
Height	4	130.20	10.21	130.75	9.70	3	-1.000	0.391
Weight	4	40.00	20.60	40.50	20.79	3	-1.732	0.182
Flexibility	4	21.75	5.67	22.75	6.44	3	-2.449	0.092
Biceps	4	10.25	3.86	10.25	4.42	3	0.000	1.000
Triceps	4	15.75	5.67	16.00	5.94	3	-1.000	0.391
Suprailiac	4	16.25	8.77	16.25	9.70	3	0.000	1.000
Supscapula	4	14.25	7.67	14.50	7.54	3	-1.000	0.391

Table 3 shows the Paired Groups T Test Results of female participants regarding the existing variables. When the current results are examined, female participants' height variable (130.20±10.21; 130.75±9.70), weight (40.00±20.60; 40.50±20.79), flexibility (21.75±5.67; 22.75±6.44), biceps (10.25±3.86; 10.25±4.42) triceps (15.75±5.67; 16.00±5.97) mean values of suprailiac (16.25±8.77; 16.25±9.70) and supscapula (14.25±7.67; 14.50±7.54). It is concluded that there is no statistically crucial difference between the pre-test and post-test mean values of the female participating in the study ( $p>0.05$ ).

## **DISCUSSION AND CONCLUSION**

To investigate the effect of 12-week exercise training on the level of physical fitness in children with Autistic Spectrum Disorder, the following results are obtained by measuring some physical parameters.

In the findings, it is concluded that there is no statistically crucial difference between the height, weight, flexibility, biceps, triceps, suprailiac and suspcapula pre-test and post-test mean values of the male and female participants. As a result of the research, the expected decrease in weight measurements is not observed. The reason of this; participants may have social life outside of training hours or unconscious nutrition. As a result, it is seen that there is an increase between the pre-test and post-test mean values of male and female participants, but this increase do not create a significant difference when compared statistically.

Mac Donncha and Watson (1999) included the 13-14 age group with and without Educable Mental Disability in their study, and they obtained an average of 10.1 cm in the disabled group regarding the sit-and-reach test. In the study of Chow et al. (2005), Educable Mentally Disabled girls achieved better results than boys in terms of sit-reach values. Although no gender-specific difference is determined in this study in terms of significance value, when the mean values are examined, it is seen that the values of the girls are high in this study. These values show parallelism with our research results. Pommering (1994) do not find a significant improvement in the body weights of 14 mentally handicapped people after 10 weeks of aerobic exercise. This study shows parallelism with our study. In a study conducted by Chow et al. (2005) on trainable mentally retarded young individuals from Hong Kong, it is stated that the skinfold values of boys are lower than girls. In the results of our study, it is observed that the skinfold values of girls are lower than boys. These study results are in contrast with our study results.

As a result of the study conducted by Kara et al. (2019), the basic movement training applied to 6-11 year old boys with autism for 12 weeks is statistically significant between pre-test and post-test in terms of standing long jump, flexibility, vertical jump, squat and push-up variables difference is found. In Kavlak's (2019) study, it is observed that children with autism who participated in regular physical activity showed improvement in balance, flexibility, speed, running, fine motor and upper extremity explosive strength. As a result of the study conducted by Arslan and İnce (2015), it is seen that the results of the running speed and agility, balance I, balance II, standing long jump tests of the exercise group are statistically significant in favor of

the post-test, while there is no crucial difference between the pre- and post-test data of bilateral coordination. In the current study, physical activity alone is not sufficient for the improvement of physical characteristics such as height, weight, flexibility, biceps, triceps, suprailiac and scapula in individuals with autism, in order to achieve meaningful results, it has been seen that studies are needed to support the lifestyles of individuals with autism who have a stagnant life, such as their nutritional habits after physical activity.

Magnusson et al. (2012), in their study on 6 autistic children between the ages of 9-15, applied a total of 16 sessions of exercise programs (warm-up, high-intensity interval training, aerobic exercises, resistance training) 2 days a week, 60 minutes a day, provided that they were completed in 8 or 12 weeks. It is emphasized that the flexibility post-test average values of the children were higher than the pre-test values after the exercise (e.g., cooling down and stretching) were applied and that no statistically significant difference was observed. The results of our study with this study give parallel results.

In the literature research, it is seen that there are not many studies conducted on individuals with autism between the ages of 13-19. At the same time, it is seen that the number of female participants with autism is lower than male participants.

### **Suggestions**

There must be a sufficient number of instructors and volunteer participants in exercise and sports activities with individuals with autism. Otherwise, injuries may occur as a result of wrong movements while working.

There may be many differences between the physical conditions of individuals in studies with individuals with autism, and these differences should be taken into consideration.

There may be differences in perception in individuals with autism, and these differences should be taken into account when explaining and presenting studies.

Individuals with autism quickly lose their gains when they take a break from sports and exercise, so it is very important to ensure the continuity of the studies.

The financial means available to autistic families and the education level of their families can be a determining factor in autistic individuals' access to sports exercise opportunities. Therefore, autistic individuals with low financial status and whose families' education level are low should also be reached and offered sports exercise opportunities.



Necessary precautions must be taken to prevent children with autism from getting sick after their studies.

When working with individuals with autism, the work area must be safe and negative materials should not be present in the work area.

## REFERENCES

- Arslan, E., & İnce, G. (2015). 12 haftalık egzersiz programının atipik otizmlı çocukların kaba motor beceri düzeylerine etkisi. *Uluslararası Spor Egzersiz ve Antrenman Bilimi Dergisi*, 1(1), 51-62.
- Bello-Mojeed, M., Ani, C., Lagunju, I., & Omigbodun, O. (2016). Feasibility of parent-mediated behavioural intervention for behavioural problems in children with autism spectrum disorder in Nigeria: A pilot study. *Child and Adolescent Psychiatry and Mental Health*, (10), 28.
- Bremer, E., Crozier, M., & Lloyd, M. (2016). A systematic review of the behavioural outcomes following exercise interventions for children and youth with autism spectrum disorder. *Autism*, 20(8), 899-915.
- Cattuzzo, M. T., dos Santos-Henrique, R., Ré, A. H. N., de Oliveira, I. S., Melo, B. M., de Sousa Moura, M., ... et al. (2016). Motor competence and health related physical fitness in youth: A systematic review. *Journal of Science and Medicine in Sport*, 19(2), 123-129.
- Chow, B., Frey, G. C., Cheung, S. Y., & Louie, H. T. L. (2005). An examination of health-related physical fitness levels in Hong Kong youth with intellectual disability. *Journal of Exercise Science and Fitness*, 3(1), 9-16.
- Çelik, O. T., & Buğday, B. (2022). Otizmlı çocuklarda fiziksel aktivite. *Anatolian Journal of Health Research*, 3(1), 30-32.
- Mac Donncha, C., Watson, A. W., Mcsweeney, T., & O'Donovan, D. J. (1999). Reliability of Eurofit physical fitness items for adolescent males with and without mental retardation. *Adapted Physical Activity Quarterly*, 16(1), 86-95.
- Magnusson, J. E, Cobham, C., & Mcleod, R. (2012). Beneficial effects of clinical exercise rehabilitation for children and adolescents with autism spectrum disorder (ASD). *Journal of Exercise Physiol*, 15, 71 – 79.
- Einarsson, I. Þ., Jóhannsson, E., Daly, D., & Arngrímsson, S. Á. (2016). Physical activity during school and after school among youth with and without intellectual disability. *Research in Developmental Disabilities*, 56, 60-70.
- Kara, E., Beyazoğlu, G., & Uysal, E. (2019). Otizmlı temel hareketin düzeltilmesi düzeltme etkisi. *SPORMETRE Beden Eğitimi ve Spor Bilimleri Dergisi*, 17 (1), 88-102.
- Gregor, S., Bruni, N., Grkinic, P., Schwartz, L., McDonald, A., Thille, P., ... et al. (2018). Parents' perspectives of physical activity participation among Canadian adolescents with Autism Spectrum Disorder. *Research in Autism Spectrum Disorders*, (48), 53–62.
- Groff, D. G., Lundberg, N. R., & Zabriskie, R. B. (2009). Influence of adapted sport on quality of life: Perceptions of athletes with cerebral palsy. *Disability and rehabilitation*, 31(4), 318-326.
- Hartman, E., Houwen, S., Scherder, E., & Visscher, C. (2010). On the relationship between motor performance and executive functioning in children with intellectual disabilities. *Journal of Intellectual Disability Research*, 54(5), 468-477.

- Kavlak, B. (2019). *Otizmli çocuklara uygulanan düzenli fiziksel aktivite programının bazı motorik özelliklere etkisi* [Yüksek lisans tezi, Kocaeli Üniversitesi]. Sağlık Bilimleri Enstitüsü.
- Lalonde, K. B., Macneill, B. R., Eversole, L. W., Ragotzy, S. P., & Poling, A. (2014). Increasing physical activity in young adults with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 8(12), 1679-1684.
- Lohman, T. G., Roche, A. F., & Martorell, R. (1988). *Anthropometric standardization reference manual*. Human Kinetics Books
- Wouters, M., Evenhuis, H. M., & Hilgenkamp, T. I. (2020). Physical fitness of children and adolescents with moderate to severe intellectual disabilities. *Disability and Rehabilitation*, 42(18), 2542-2552.
- Menear, K. S., & Neumeier, W. H. (2015). Promoting physical activity for students with autism spectrum disorder: Barriers, benefits, and strategies for success. *Journal of Physical Education, Recreation and Dance*, 86(3), 43-48.
- Must, A., Phillips, S. M., Curtin, C., Anderson, S. E., Maslin, M., Lividini, K., ... et al. (2014). Comparison of sedentary behaviors between children with autism spectrum disorders and typically developing children. *Autism*, 18(4), 376-384.
- Pan, C. Y. (2011). The efficacy of an aquatic program on physical fitness and aquatic skills in children with and without autism spectrum disorders. *Research in Autism Spectrum Disorders*, 5(1), 657-665.
- Pommering, T. L., Brose, J. A., & Randolph, E. (1994) Effects of an aerobic exercise program on communitybased adults with mental retardation. *Mental Retardation*, (32), 218 –26
- Savucu, Y. (2020). Otizmli çocuklarda erken tanı, eğitim ve fiziksel aktivitenin önemi. *Uluslararası Spor Egzersiz ve Antrenman Bilimleri Dergisi*, 6(3), 105–109
- Shillingsburg, M. A., Bowen, C. N., Peterman, R. K., & Gayman, M. D. (2015). Effectiveness of the direct instruction language for learning curriculum among children diagnosed with autism spectrum disorder. *Focus on Autism and Other Developmental Disabilities*, 30(1), 44-56.
- Sorensen, C., & Zarrett, N. (2014). Benefits of physical activity for adolescents with autism spectrum disorders: A comprehensive review. *Review Journal of Autism and Developmental Disorders*, 1(4), 344-353.
- Sowa, M., & Meulenbroek, R. (2012). Effects of physical exercise on autism spectrum disorders: A meta-analysis. *Research in Autism Spectrum Disorders*, (6), 46–57.
- Srinivasan, S. M., Pescatello, L. S., & Bhat, A. N. (2014). Current perspectives on physical activity and exercise recommendations for children and adolescents with autism spectrum disorders. *Physical Therapy*, 94(6), 875-889.
- Toscano, C. V., Carvalho, H. M., & Ferreira, J. P. (2018). Exercise effects for children with autism spectrum disorder: metabolic health, autistic traits, and quality of life. *Perceptual and Motor Skills*, 125(1), 126-146.
- Vonken, M. T. H., Maaskant, M. A., & Van den Akker, M. (2006). Aandoeningen van het bewegingsapparaat bij mensen met een verstandelijke handicap. *Nederlands Tijdschrift Voor De Zorg Aan Verstandelijk Gehandicapten*, (32), 98-111.
- Ward, P., & Ayvazo, S. (2006). Classwide peer tutoring in physical education: Assessing its effects as an inclusion strategy with Kindergartners with Autismn. *Adapted Physical Activity Quarterly*, 23(3), 233-244.
- Winnick, J. P., & Short, F. X. (1999). *The brockport physical fitness test manual*, Human Kinetics.

Wouters, M., Van Der Zanden, A. M., Evenhuis, H. M., & Hilgenkamp, T. I. (2017). Feasibility and reliability of tests measuring health-related physical fitness in children with moderate to severe levels of intellectual disability. *American Journal on Intellectual and Developmental Disabilities*, 122(5), 422-438.

Yarımkaaya, E., İlhan, E., & Karasu, N. (2017). An investigation of the changes in the communication skills of an individual with autism spectrum disorder participating in peer mediated adapted physical activities. *Ankara University Faculty of Educational Sciences Journal of Special Education*, 18(2).

KATKI ORANI CONTRIBUTION RATE	AÇIKLAMA EXPLANATION	KATKIDA BULUNANLAR CONTRIBUTORS
Fikir ve Kavramsal Örgü <i>Idea or Notion</i>	Araştırma hipotezini veya fikrini oluşturmak <i>Form the research hypothesis or idea</i>	Bilal KARAKOÇ
Tasarım <i>Design</i>	Yöntem ve araştırma desenini tasarlamak <i>To design the method and research design.</i>	Bilal KARAKOÇ
Literatür Tarama <i>Literature Review</i>	Çalışma için gerekli literatürü taramak <i>Review the literature required for the study</i>	Bilal KARAKOÇ
Veri Toplama ve İşleme <i>Data Collecting and Processing</i>	Verileri toplamak, düzenlemek ve raporlaştırmak <i>Collecting, organizing and reporting data</i>	Bilal KARAKOÇ
Tartışma ve Yorum <i>Discussion and Commentary</i>	Elde edilen bulguların değerlendirilmesi <i>Evaluation of the obtained finding</i>	Bilal KARAKOÇ

#### **Destek ve Teşekkür Beyanı/ Statement of Support and Acknowledgment**

Bu çalışmanın yazım sürecinde katkı ve/veya destek alınmamıştır.

*No contribution and/or support was received during the writing process of this study.*

#### **Çatışma Beyanı/ Statement of Conflict**

Araştırmacıların araştırma ile ilgili diğer kişi ve kurumlarla herhangi bir kişisel ve finansal çıkar çatışması yoktur.

*Researchers do not have any personal or financial conflicts of interest with other people and institutions related to the research.*

#### **Etik Kurul Beyanı/ Statement of Ethics Committee**

Bu araştırma, Yalova Üniversitesi Etik Kurulunun 2023/21 sayılı kararı ile yürütülmüştür.

*This research was conducted with the decision of Yalova University Ethics Committee numbered 2023/21*



This study is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).