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Determining the Physical Fitness of Individuals with Autism in Early and Middle Adolescence Period

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Abstract
The aim of this study is to determine the physical fitness levels of individuals with autism by comparing them with individuals in the early and middle adolescence periods with normal development and the needs of the individuals with autism in terms of physical fitness. This study is carried out at the Selçuklu Autism Foundation, which is the largest autism education center in Turkey. It is carried out in this center with autistic individuals aged 10-17 who have received sports training for at least one year, and randomly selected individuals between the ages of 10-17 who do not do sports and show normal development. In this study, the cross-sectional survey model, one of the survey models, is used. The physical fitness levels of individuals with and without autism participating in the research are determined by the Brockport Physical Fitness Test developed by the State University of New York and some motoric test batteries. The t-test for the difference between arithmetic means in independent groups is used. The other measurement is the non-parametric Mann Witney U test. According to the study findings, a high level of significant difference is found between BMI, triceps, calf, right and left hand grip, back strength, trunk lift, long jump and one mile running values in both t-test and Mann-Whitney U results in early and middle adolescence periods. As a result, according to Brockport test values, it shows that all values of individuals with autism are physically behind the individuals with normal development. These results show that individuals with autism are shorter in stature, have higher body weights and have higher BMI values than individuals with normal development.

Keywords: Autism, Physical Fitness, Early Adolescence, Middle Adolescence

1. Introductıon

Autism is a disorder that appears in the early developmental stage and manifests itself with limited regenerative behaviors, inadequacy in social interaction and communication skills (Edition, 2013). According to data from the US Department of Health, one out of every 88 school-age children is diagnosed with autism today. The incidence of autism is 3-4 times higher in boys than in girls, and today one out of every 54 boys is at risk of autism. Considering the data of the Autism Platform, it is accepted that there are approximately 550,000

individuals with autism in Turkey and around 150,000 children with autism in the 0-14 age group (ODFED, 2018).

Individuals with autism usually have delays in their movement skills (Reid & Collier, 2002). The weak movement skills seen in people with ASD may negatively affect various emotional, social and behavioral developments of these individuals. However, low mobility skills can reduce participation in physical activity and different components of physical fitness (Haga, 2008; Lopez-Williams et al., 2005). While reducing the inactive lifestyle that causes health problems in children with ASD, it is important to increase the variety of activities in order to improve the physical activity levels, motor skills and physical fitness levels of these children (Pan, 2011). Individuals with autism may have serious deficiencies in fine and gross motor skills (Obrusnikova & Miccinello, 2012). Exercise improves the motoric features of individuals with autism, reduces repetitive behaviors, increases eye contact and provides benefits in many areas such as social interaction. It positively affects the life skills of the individual, reduces attention deficit and prevents tantrums (Beyoğlu, 2017; Obrusnikova & Miccinello, 2012; Otizmvakfi, 2021; Tohumotizm, 2018, 2020). Considering all these benefits, it is seen that sports and education are a positive alternative in most aspects for children with autism in adolescence (Erol & Akçın, 2018).

Adolescence; biological and physical development, social and mental maturation, physical growth, and sexual development are the transition period from childhood to adulthood (Aslan & Koç, 2018; Parlaz et al., 2012). Adolescence periods have been defined in certain age ranges in some studies. According to the World Health Organization, the age group of 10-19 years is determined as "adolescence" (WHO, 2003). UNICEF, on the other hand, defined the early adolescence period as between the ages of 10-14 and the late adolescence period as between the ages of 15-19 (UNICEF, 2011). However, the most accepted definition of adolescence emerged by dividing adolescence into three parts. Adolescence is divided into three main parts as early, middle and late adolescence (Ekeland et al., 2005; Pawlowski, 2008). They determined the age range of early adolescence as 11-13 years old for girls and 12-14 years old for boys; the middle adolescence period as 13-16 years old for girls, 14-17 years old for boys, and the late adolescence period as 16-19 years old for girls and 17-19 years old for boys (Pawlowski, 2008). The popularity of studies on early and middle adolescence has been increasing in recent years (Erten, 2021; Turan, 2021; Uzun et al., 2020; Yuan et al., 2022).

Early adolescence includes a process that causes rapid physiological and physical changes (increase in body mass, increase in height, development of secondary sexual characters) and physical differences (Arıkan et al., 2013). Intense height growth in males occurs between the ages of 13-15.5 and an increase of 10-16 cm occurs per year. During the growth spurt, males may increase in height by 26-28 cm in total (Republic of Turkey, Ministry of Health, 2009). In males, there is usually a 14-month delay in the greatest body weight gain followed by the greatest height increase. This delay is the reason why the pre-adolescent growth period is two years longer in boys (Filiz, 2004). This shows that early adolescence (11-14 years) can be considered as the period in which physical characteristics change the fastest (Uzun & Boyalı, 2020). In the middle adolescence period, however, the increase in height leaves its place to weight gain and the growth rate starts to balance. The ability to learn strength and movement gained at this age again provides the optimal conditions necessary for success in sports. Middle adolescence is the period when motoric features are trained most intensively, coordinate and conditional skills are taught intensively in equal weight. While the change in body weight is similar in girls and boys until the age of 15, there are differences between the ages of 15-16. After the age of 16, the body weight of boys increases at a higher rate than girls. A slight increase in body fat ratios up to the age of 16 in boys and a slow decrease between the ages of 16-17 are observed. In girls, it is stated that there is a rapid increase between the ages of 14-15 and differences after the age of 16 (Ziyagil et al., 2010). While there is a rapid increase in height between the ages of 14-15 in boys and girls in middle adolescence, similar increases are observed between the ages of 15-16. Especially in early and middle adolescence periods, physical activity and sports have a very important effect on the physical development of adolescents (Uzun & Boyalı, 2020).

Physical activity is very important for individuals who do not show as much as individuals with normal development to lead a healthy life. (Rimmer & Braddock, 2002; Strong et al., 2005; Awamleh & Woll, 2014; Huettig & Connor, 1999). Children and young people are required to participate in at least 60 minutes of

moderate-intensity physical activity per day (Roehr, 2013). Participation in physical activities reduces body fat in children, contributes to bone development, increases socialization, reduces depressive symptoms, increases physical-physiological health and motor skills (Janssen & LeBlanc, 2010; Stanish et al., 2015). The measurement of body functions, including daily physical activity and performance, is determined by physical fitness. Body composition includes flexibility and muscular fitness (muscular endurance-muscle strength), aerobic fitness (endurance-aerobic capacity). Therefore, physical fitness tests allow us to accurately check the functional state of all these systems. Physical fitness is considered among the most important health-related information tools (Ortega, 2008; Tyler, 2014).

It is stated that the physical activity and physical fitness levels of individuals with ASD are lower than their ND peers, and the physical activity levels of individuals with ASD decrease more with increasing age (Pan et al., 2016). Especially when compared to normally developing children, individuals with autism have more problems with balance, gait, flexibility and movement speed (Dewey et al., 2007; Green & Tobin, 2009; Manjiviona & Prior, 1995; Pace & Bricout, 2015). It is seen that the majority of 16 theses and 33 articles on the physical activities of individuals with ASD in the world between 2004-2014 are concentrated in 9 countries such as the USA, Turkey, Taiwan and Canada (Görgün & Melekoğlu, 2016). It is seen that most of the studies on individuals with ASD are studies in the social field and generally applied to parents. Most other studies are limited to physical activities and not physical fitness. For this reason, it is an important need to determine the physical fitness of individuals with autism and to determine the differences between individuals with normal development. The aim of this study is to compare the individuals with autism with the individuals in the early and middle adolescence periods showing normal development and to determine the physical fitness levels and the needs of the individuals with autism in terms of physical fitness.

2. Method

The research is designed in quantitative research methods. This study is carried out with the approval of the ethics committee of Necmettin Erbakan University from the meeting numbered 03 on 18.12.2020 with the decision number 2020/135.

2.1 Research Group

The research is carried out in Selçuklu Foundation for Individuals with Autism, which is the largest autism education center in Turkey. It is carried out with individuals with autism between the ages of 10-17 who have received sports training for at least one year at the Selçuklu Foundation for Individuals with Autism and randomly selected individuals between the ages of 10-17 who show normal development and do not do sports. In this study, the cross-sectional survey model, one of the survey models, is used. The physical fitness levels of individuals with and without autism participating in the study are determined by the Brockport Physical Fitness Test developed by the State University of New York and some motoric test batteries.

2.2. Data Collections

Borckport Physical Fitness Test: BPFT is developed by the State University of New York, supported by the United States Department of Education, Office of Special Education and Rehabilitation Services, and as a product of the "Project Target" (1993-1998). It consists of twenty-seven different tests. A personalized test battery can be created according to disability and age groups. This test, which provides information about the health-related physical fitness of individuals, is developed for children and youth between the ages of 10-17 with and without disabilities. BPFT offers a wide variety of options for people with cerebral palsy, intellectual disability, congenital deformity, spinal cord injury, amputation and visually impaired people. BPFT mandates two tests for back and abdominal muscles to measure general muscle strength in children with mental or mild physical disabilities. It is recommended to select some tests among the required test groups for body composition, aerobic function and musculoskeletal function. Generally, 4-6 tests are considered sufficient for an individual to measure physical fitness (Winnick & Short, 1999). In BPFT, musculoskeletal function (muscle strength, endurance and flexibility), aerobic function and body composition can be evaluated and three or six

tests are selected from each part. In this study, from BPFT Batteries; Age, height, weight, body mass index, skinfold (triceps+calf) measurement, dominant hand grip strength for muscle strength, one mile run/walk test for endurance, sit-reach and trunk lift tests are applied for flexibility abilities.

Height Measurement: The heights of the individuals participating in the study are measured with a height scale with a precision of 0.01 cm. In the anatomical position, the bare feet are measured with the heels of the feet together, their breath held, the head in a frontal plane, and the overhead tray at the vertex point. The measurement taken is recorded in cm (Mackenzie, 2005).

Determination of Body Mass Index: The body mass index (BMI) formula (Body weight / Height²) will be used to determine the body mass index (Mackenzie, 2005).

Skinfold Measurements: Triceps skinfold measurement is taken over the triceps muscle between the shoulder tip and the elbow, and the calf skinfold measurement is taken from the inside of the leg from the highest level of the calf, with the knee flexed to 90º and placed on a raised surface (Winnick & Short, 1999).

Hand Grip: It is designed to measure hand and arm strength. During the test, the participant grasped the dynamometer at a 45º angle from the body. The participant performed 3 trials and 30 seconds were given between trials. The best score (kg) is recorded (Winnick & Short, 1999).

Trunk Lift: It is designed to measure flexibility and trunk extension. The participant is lying on the mat in a prone position. With his feet on the ground at a certain point and his hands on the ground under the thigh, the participant lifted his body above the ground. The movement is applied very slowly and in a controlled manner, with the chin parallel to the ground. The person administering the test held the ruler 2.5 cm ahead of the line on the ground at the level of the chin. The participant is given 2 attempts and the best score (cm) is recorded (Winnick & Short, 1999).

Sit-Reach: It is designed to measure flexibility in the hamstring muscle. The participant is seated on the bottom of the testing apparatus. The two legs are taut, the feet are positioned straight across at the end of the box. The participant tried to make the highest degree on the measuring ruler with his arms tense palm facing down. At least 1 second is waited for each stretch, and then the measurement is recorded. For this test, the measurement is taken with a 30x30 flexibility test apparatus, which is the best shape. The participant is given 1 trial. Score (cm) recorded (Winnick & Short, 1999)

Shoulder Stretch: It is designed to measure upper body flexibility. The participant extends one arm over his shoulder to his back and tried to touch the fingertips of both arms with the cross arm coming from below from behind. In the measurement, basically, the right or left arm is moved backwards over the shoulder. If the participant touches their fingertips, it is considered valid, and if they cannot, it is considered insufficient. When necessary, physical assistance and verbal instructions are given and the application is made (Winnick & Short, 1999).

Standing Long Jump Test: Standing on the non-slip floor, feet at the same level and behind the exit line of the toes, an explosive move is made by bringing the arms forward in a horizontal manner, with the knees bent at 45 degrees, by jumping the farthest to balance the arms. It is realized that the athlete's feet fell together without losing his balance. This test is repeated 2 times and the best result is recorded. The distance between the starting line and the fall is evaluated as cm (Şipal, 1989).

Leg-Back Strength Test: Takkei mark back and lift dynamometer are used in the measurements. After warming up for five minutes, the athletes placed their feet on the dynamometer bench with their knees bent and, with their arms stretched, their back straight and their body slightly bent forward, pulled the dynamometer bar, which was grasped with their hands, vertically using their legs with maximum force. This movement is repeated three times and the best result (kg) is recorded for each athlete (Saygin et al., 2005).

One-Mile Run Test: This test measures aerobic endurance. The goal of the test is to complete a mile in the shortest possible time. For those who desire, walking is interspersed with running, but they are encouraged to cover the distance as quickly as possible. The time is noted and completed in minutes and seconds (Winnick & Short, 1999).

2.3.Data Analysis

SPSS 21 package program is used for all statistical analyses. Descriptive statistics are used to determine group characteristics. The t-test for the difference between arithmetic means in independent groups is used. The other measurement is the non-parametric Mann Witney U test. In addition, the percentage difference in the groups is examined.

3. Results

Descriptive statistics and analysis results of the data obtained in the study are presented in tables.

Table 1: Comparison of physical feature measurements of individuals with normal development in early adolescence (1) and groups of individuals with autism (2).

Variables	*Group*	*N*	*Mean*	*S.D*	*S.H*	*Min.*	*Max.*	*X1-X2*	*t.*	*P*	*Mann-Whitney U*	*P*
Age (year)	1	23	11,39	1,07	,224	10	13	-,018	-,054	,95	251,500	,972
	2	22	11,41	1,14	,243	10	13					
Height (cm)	1	23	148,00	11,44	2,38	128	169	1,81	,603	,55	245,000	,855
	2	22	146,18	8,50	1,81	126	164					
Body weight (kg)	1	23	40,73	11,63	2,42	21,90	62,30	-6,24	-1,662	,10	187,500	,137
	2	22	46,97	13,52	2,88	23,40	70,00					
BMI (kg/m²)	1	23	18,27	3,57	,746	13,17	26,61	-3,32	-2,790	,00**	144,000	,013*
	2	22	21,59	4,38	,935	14,74	28,89					

** <0,01, * <0,05

According to the study findings, a high level of significant difference is found between BMI values in both t-test and Mann-Whitney U results (table 1).

Table 2: Comparison of subcutaneous fat and paw strength measurements of individuals with normal development in early adolescence (1) and groups of individuals with autism (2).

Variables	*Group*	*N*	*Mean*	*S.D*	*S.H*	*Min.*	*Max.*	*X1-X2*	*t.*	*P*	*Mann-Whitney U*	*P*
Triceps	1	23	14,33	5,61	1,17	5	25	-3,583	-2,139	,03*	162,000	,03*
	2	22	17,91	5,62	1,19	8	27					
Calf	1	23	14,33	5,28	1,10	5	23	-4,765	-2,793	,00**	143,500	,01*
	2	22	19,09	6,14	1,31	9	33					

Right hand	1	23	19,09	4,77	,99	7,70	28,9	8,210	6,310	,00**	42,000	,00**
	2	22	10,88	3,88	,82	5,60	17,6					
Left hand	1	23	18,26	5,07	1,05	8,40	28,0	8,002	5,741	,00**	56,000	,00**
	2	22	10,26	4,20	,89	5,20	16,7					

** <0,01, * <0,05

According to the study findings, a high level of significant difference is found in the triceps, calf, right and left hand grip values in both the t-test and the Mann-Whitney U results (table 2).

Table 3: Comparison of flexibility, strength and endurance measurements of individuals with normal development in early adolescence (1) and groups of individuals with autism (2).

Variables	***Group***	***N***	***Mean***	***S.D***	***S.H***	***Min.***	***Max.***	***X1-X2***	***t.***	***P***	***Mann-Whitney U***	***P***
Sit-Reach	1	23	20,17	7,05	1,47	1	31	2,58	1,161	,25	192,000	,16
	2	22	17,59	7,86	1,67	5	33					
Back Strength	1	23	53,91	16,82	3,50	23	100	26,68	6,629	,00**	36,000	,00**
	2	22	27,23	8,76	1,86	20	50,5					
Trunk Lift	1	23	30,09	4,96	1,03	20,0	38	9,49	5,350	,00**	68,000	,00**
	2	22	20,59	6,83	1,45	10	37					
Long Jump	1	23	124,39	24,00	5,00	73,0	172	73,25	10,575	,00**	4,000	,00**
	2	22	51,14	22,38	4,77	13	94					
One-Mile Run	1	23	12,24	1,66	,34	8,7	15	-3,89	-5,003	,00**	69,500	,00**
	2	22	16,13	3,32	,70	12,3	24					

According to the study findings, a high level of significant difference is found in the t-test and Mann-Whitney U results in back strength, trunk lift, long jump and one-mile running values (table 3).

Table 4: Comparison of physical feature measurements of individuals with normal development in middle adolescence (1) and groups of individuals with autism (2).

	Group	***N***	***Mean***	***S.D***	***S.H***	***Min.***	***Max.***	***X1-X2***	***t.***	***P***	***Mann-Whitney U***	***P***
Age (year)	1	14	15,35	1,15	,30	14	17	-,07	-,169	,867	94,000	,849
	2	14	15,42	1,08	,29	14	17					

Height (cm)	1	14	169,64	4,46	1,19	162,0	176,0	2,71	1,006	,324	72,500	,240
	2	14	166,92	9,05	2,42	151,0	184,0					
Body weight (kg)	1	14	63,85	7,78	2,08	44,0	71,5	-6,68	-1,391	,187	81,000	,434
	2	14	70,53	16,2	4,33	50,0	105,2					
BMI (kg/m²)	1	14	22,14	2,28	,60	16,56	25,19	-3,12	-1,994	,057	48,000	,022*
	2	14	25,26	5,40	1,44	18,73	41,09					

** <0,01, * <0,05

Normal and autistic groups are compared in middle adolescence. Accordingly, a significant difference is found in BMI values in Mann-Whitney U results (table 4).

Table 5: Comparison of subcutaneous fat and paw strength measurements of individuals with normal development in the middle adolescence (1) and groups of individuals with autism (2).

Variables	***Group***	***N***	***Mean***	***S.D***	***S.H***	***Min.***	***Max.***	***X1-X2***	***t.***	***P***	***Mann-Whitney U***	***P***
Triceps	1	14	18,03	5,07	1,35	9,0	24,0	-,82	-,399	,693	89,000	,43
	2	14	18,85	5,80	1,55	9,0	28,0					
Calf	1	14	19,42	4,32	1,15	11,0	26,0	-,92	-,443	,662	81,000	,43
	2	14	20,35	6,54	1,74	8,0	32,0					
Right hand	1	14	28,92	4,62	1,23	20,3	35,8	11,37	5,502	,000**	16,000	,00**
	2	14	17,55	6,19	1,65	9,6	30,0					
Left hand	1	14	29,67	3,97	1,06	23,0	34,0	12,43	5,55	,000**	16,500	,00**
	2	14	10,26	7,37	1,97	6,8	33,3					

According to the study findings, a high level of significant difference is found in the right and left hand grip values in the t-test and Mann-Whitney U results (table 5).

Table 6: Comparison of the flexibility, strength and endurance measurements of the groups of individuals with normal development in middle adolescence (1) and individuals with autism (2).

Variables	***Group***	***N***	***Mean***	***S.D***	***S.H***	***Min.***	***Max.***	***X1-X2***	***t.***	***P***	***Mann-Whitney U***	***P***
Sit-Reach	1	14	12,85	6,53	1,74	2,0	20,0	1,42	-,704	,487	92,500	,80
	2	14	14,28	3,85	1,02	5,0	22,0					
Back Strength	1	14	92,03	18,99	5,07	57,0	121,5	59,10	10,548	,000**	26,000	,00**
	2	14	32,92	8,87	2,37	22,0	49,5					

Trunk Lift	1	14	22,57	4,39	1,17	16,0	30,0	2,32	1,096	,283	66,500	,14
	2	14	20,25	6,58	1,76	11,0	34,0					
Long Jump	1	14	145,07	34,41	9,19	72,0	188,0	81,21	6,117	,000**	11,000	,00**
	2	14	63,85	35,82	9,57	14,0	119,0					
One-Mile Run	1	14	10,96	1,95	,52	8,70	15,70	-2,92	-2,260	,032*	50,000	,02*
	2	14	13,88	4,42	1,18	8	25,50					

** <0,01, * <0,05

According to the study findings, a significant difference is found in one mile running values, a high level of significant difference in back strength and long jump values in the t-test and Mann-Whitney U results (table 6).

4. Discussion and Conclusion

In this study, it is aimed to determine the physical fitness of individuals with autism (ASD) by comparing individuals with autism in the early (10-14 years) and middle adolescence (14-17 years) periods with those with normal development (ND).

In the study, it is found that the mean height of ND individuals in the 10-17 age range, in the early and middle adolescence period, is higher than the individuals with ASD. In terms of body weights, it is seen that ASD individuals have much higher values than ND individuals in both early and middle adolescence periods. This difference is significantly higher in the body mass index means among those with ASD. Moreover, it is seen that individuals with ASD progress towards obesity with the middle adolescence period. According to Taner (2020), development is a whole in individuals with ASD, as in individuals with ND. While this situation is slow in individuals with ASD, it is experienced rapidly in individuals with ND. It has been reported that the mean height of ND 202 individuals aged 10-12 is 141 cm (Saygın et al., 2005) and the mean height of boys with an mean age of 13,1 years is 155,2 cm (Saygın & Karacabey, 2004). In 30 male individuals aged 10-16 years with ASD, the height is determined as 139,50 cm (Şimşek, 2017). In the study findings, when the height values are examined, it is seen that there is an increase in height depending on age in both groups, and the mean height of individuals with ASD is 2 cm in early adolescence and 3 cm in middle adolescence than ND individuals. In the light of these findings and in the literature, it is seen that individuals with ASD are shorter than their age groups. Şimşek (2017) reported that the body weight of 30 male individuals aged 10-16 with ASD is 41,45 kg. In the study, when the body weight values are examined, it is seen that there is an increase in body weight values depending on age in both groups, and the body weight of individuals with autism is heavier than their peers with normal development in both early and middle adolescence. BPFT, according to the preferred general standard norms, the body mass index value is expressed as 23,75 kg/m² for males aged 10-17, 22,3 kg/m² for males aged 10-14, and 25,75 kg/m² for males aged 14-17. (Winnick & Short, 2014). In a study conducted with 30 males individuals with ASD aged 10-16 years, BMI was 20,72 kg/m² (Şimşek, 2017), and the BMI value of ND individuals between the ages of 10 and 12 is 18,58 kg/m² (Saygin et al., 2005). When the body mass index values are examined, it is seen that there is an increase in the body mass index depending on the age and height values in both groups, and the mean body mass index of individuals with ASD is higher in both early and middle adolescence than their ND peers, but lower than the standard values. It is thought that the reason why it is lower than the standard values is that our study group consisted of individuals with autism who have been exercising for at least a year. It is also observed that BMI values of individuals with ASD begin to rise above the normal limits towards the middle adolescence period.

In the study, the fat measurement level of ND individuals in early adolescence (triceps+calf) is 28,66 mm, that of individuals with ASD is 37 mm, and in middle adolescence, the level of fat measurement (triceps+calf) of ND individuals is 37.45 mm, and individuals with ASD is 39,2 mm. BPFT, according to the preferred general

standard norms, the mean skinfold (triceps+calf) value is expressed as 33 mm in 10-17 males. (Winnick & Short, 2014). It has been observed that as the age increases, the subcutaneous fat values of both normally developing and autistic individuals increase. In the current study, when body weight, BMI and skinfold measurements are examined, it is found that individuals with ASD are more overweight and fatter, especially during middle adolescence, compared to individuals with ND. According to Karaküçük (2012), one of the main problems of individuals with ASD is being overweight. Excess weight caused by nutritional disorders and antipsychotic drugs creates a state of obesity, which causes many disorders. Very selective eating habits of children with autism cause many vitamin and mineral deficiencies (Kałużna-Czaplińska et al., 2011). In the study of Çiftçi (2020), in which the anthropometric measurements of 50 individuals diagnosed with ASD are evaluated, the mean age of the children, 36 of whom are boys and 14 of whom are girls, is 11.49±4.51. Considering the BMI values, 4% of the individuals are underweight, 36% are normal, 18% are slightly obese and 42% are obese. It has been determined that individuals with ASD are slightly overweight and overweight. The results in the literature support the present study.

The hand grip strength measurement level (right hand + left hand) of ND individuals in early adolescence (10-14 years) is determined as 38,16 kg and 21,14 kg for individuals with ASD. In middle adolescence (14-17 years), the claw strength measurement level of ND individuals (right hand + left hand) is 58,59 kg, and 27,81 kg for individuals with ASD. According to the preferred general standard norms of BPFT, the dominant hand grip strength of 10-17 years old males is specified as 38,62 kg. Dominant hand grip strength is given as 31 kg for the age of 10-14, and 49 kg for the age of 14-17. There is an mean increase in value parallel to the increase in age (Winnick & Short, 2014). The hand grip strength is found to be 18,91 kg in ND individuals aged 12 years (Saygin et al., 2005). Considering the results of the study, it is determined that hand grip strength increased with age, as in the current study. In a study conducted with 12 children with autism, it is determined that there is a significant difference in the mean of the claw strength pretest and posttest (Cerrahoğlu et al., 2017). In the present study, right hand strength is higher than left hand strength in both groups, and an increase in hand grip strength of 8 kg is observed in middle adolescence. It is thought that the reason why the grip strength of children with autism (right hand + left hand) is lower than those with ND is due to the low active use of motor skills.

In the study, the mean back strength in early adolescence is 53,91 kg in individuals with ND and 27,23 kg in individuals with ASD. In middle adolescence, the mean back strength is found to be 92,03 kg in individuals with ND and 32.92 kg in individuals with ASD. Individuals with autism may exhibit serious deficiencies in gross and fine motor skills (Arslan, 2019). Although individuals with autism seem agile and have a high level of physical fitness, they may not be sufficiently motivated to complete motor tests or may not fully understand the purpose of the test (Levinson & Reid, 1993). It is thought that the reason why right hand strength, left hand strength and back strength are low in individuals with autism is that the use of hand dynamometer and back dynamometer is difficult and learning takes place later in individuals with autism than in individuals with ND.

In the study, the mean sit-to-reach in early adolescence is 20,17 cm in individuals with ND and 17,59 cm in individuals with ASD. In middle adolescence, the mean sit-to-reach is determined as 12,85 cm in individuals with ND and 14,28 cm in individuals with ASD. According to the preferred general standard norms of the Brockport Physical Fitness Test, the mean sit-to-reach flexibility value for males aged 10-17 is 20 cm (Winnick & Short, 2014). In a 12-week study, a 6-11 year old male individual with ASD is measured and flexibility pre-test is 20,22 cm and post-test is 24,78 cm (Kara et al.,2019). In a study conducted with 30 males individuals aged 10-16 years with ASD, flexibility is reported as 3 cm (Şimşek, 2017). In a study conducted with 6 individuals with autism aged 16-23, flexibility is found to be 2,83 cm in the pre-test and 6,33 cm in the post-test (Taner, 2020). In the present study, there is a decrease in the flexibility value depending on the increase in age. This supports the studies in the literature.

In the study, the mean trunk lift in early adolescence is 30,09 cm in individuals with ND and 20,59 cm in individuals with ASD. In middle adolescence, the mean trunk lift is found to be 22,57 cm in individuals with ND and 20,25 cm in individuals with ASD. According to the preferred general standard norms of BPFT, the lower limit accepted in the mean of trunk lift test results in mentally retarded individuals aged 10-17 is 23 cm, and the upper limit is 30 cm (Winnick & Short, 2014). When we look at our trunk lift and sit-reach measurement

results, we see that the values of individuals with autism are lower than the standards. It is thought that low strength and flexibility in individuals with autism are due to poor daily living skills and sedentary lives.

In the study, the mean long jump in early adolescence is 124,39 cm in individuals with ND and 51,14 cm in individuals with ASD. In middle adolescence, the mean long jump is measured as 145,07 cm in ND individuals and 63,85 cm with ASD. In a study conducted on 6 adult individuals with autism, 4 boys and 2 girls, aged 16-23, the pre-test standing long jump score mean in the standing long jump study group is 20,67±16,00; the post-test mean score is found to be 93,50±48,14 (Taner, 2020). In the current study, it can be said that the low long jump values of individuals with ASD are due to the difficulties experienced by individuals with autism in characteristics such as jumping, balance, and explosiveness.

In the study, the mean running time of one mile in early adolescence is 12,24 minutes in individuals with ND and 16,13 minutes in individuals with ASD. In middle adolescence, the mean one-mile running time is 10,96 minutes in individuals with ND, while it is 13,88 minutes in individuals with ASD. BPFT, according to the preferred general standard norms, the value of running a mile for 10-17 years is 9,68 minutes. The 10-14 age running value is 10,38 minutes and the 14-17 age running value is 8,72 minutes (Winnick & Short, 2014). In the current study, there is an increase in running speed depending on age, but the values we found after our measurement are seen to be very low compared to accepted standards. It can be said that the reason for this is that the subjects do not exercise for 45 minutes once a week and do not do long-term exercises.

According to the findings of the study, it is observed that there are differences between individuals with autism and those with normal development in terms of physical fitness. As a result, according to the Brockport test values, it is seen that all the values of individuals with autism are physically behind those with normal development. These results show that individuals with autism are shorter in stature, have higher body weights and have higher BMI values than individuals with normal development. It has been concluded that individuals with autism gain more weight, especially during middle adolescence, and that more time should be devoted to aerobic exercises in this period. In the light of these results, it has been seen that the implementation of a long-term physical activity program in a professional environment is an important requirement for the physical development of children with autism in both early and middle adolescence. For this reason, it has been determined that it is insufficient for children with autism to take sports lessons once a week.

References

Arıkan, D., Çelebioğlu, A., & Tüfekçi, F. G. (2013). Çocukluk dönemlerinde büyüme ve gelişme. Pediatri Hemşireliği. Akademisyen Tıp Kitabevi, 53-66.

Arslan, E. (2019). Otizm ve spor. Spor bilimler alanında araştırma makaleleri, 105-127

Aslan, H., & Koç, Z. (2018). Ortaokul öğrencilerinin beden imajı ve sosyal kaygı düzeyleri. Eğitim Kuram ve Uygulama Araştırmaları Dergisi, 4(3), 65-77.

Awamleh, A., & Woll, A. (2014). The Influence of Physıcal Exercıse on Indıvıduals Wıth Autısm: Is Physıcal Exercıse Able to Help Autıstıc. Journal of Social Sciences, 10(2), 46-50. : https://doi.org/10.3844/jsssp.2014.46.50

Beyoğlu, F. (2017). Sporun otizmli bireyler uzerindeki etkileri. https://www.anneysen.com/makaleler/sporun-otizmli-bireyler-uzerindeki-etkileri_2316

Cerrahoğlu, N., Günar, B.B., & Abanoz, H. (2017). The effects on physıcal fıtness of 4 month physıcal actıvıty program ın autıstıc chıldren. Socıal Scıences Studies Journal, 3(8),1579-1586.

Çiftçi, Ç. (2020). Otizm spektrum bozukluğu olan çocukların antropometrik ölçümlerinin değerlendirilmesi. Adnan Menderes Üniversitesi Sağlık Bilimleri Fakültesi Dergisi, 4(3), 203-209. https://doi.org/10.46237/amusbfd.551902

Dewey, D., Cantell, M., & Crawford, S. G. (2007). Motor and gestural performance in children with autism spectrum disorders, developmental coordination disorder, and/or attention deficit hyperactivity disorder. Journal of the International Neuropsychological Society, 13(2), 246-256. https://doi.org/10.1017/S1355617707070270

Edition, F. (2013). Diagnostic and statistical manual of mental disorders. Am Psychiatric Assoc, 21, 591-643

Ekeland, E., Heian, F., & Hagen, K. B. (2005). Can exercise improve self esteem in children and young people? A systematic review of randomised controlled trials. British journal of sports medicine, 39(11), 792-798. http://dx.doi.org/10.1136/bjsm.2004.017707

Erol, S., & Akçın, Ö. Z. (2018). Otizm ve Spor. http://www.acikbeyin.com.tr/otizm-ve-spor/

Erten, R. (2021). Orta Ergenlik Dönemindeki Öğrencilerin Farklı Değişkenler Açısından Beslenme Bilgi Düzeylerinin İncelenmesi. Sportive, 4(2), 107-116. https://doi.org/10.53025/sportive.949805

Filiz. (2004). Rehabilitation and return to sports in children. Acta Orthop Traumatol Turc, 38(1), 151-162.

Görgün, B., & Melekoğlu, M. A. (2016). Otizm Spektrum Bozukluğu (OSB) Olan Bireylerin Fiziksel Aktivitelerine İlişkin Yapılan Çalışmaların Gözden Geçirilmesi. Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi, 17(03), 347-376. https://doi.org/10.21565/ozelegitimdergisi.268559

Green, H., & Tobin, Y. (2009). Prosodic analysis is difficult… but worth it: A study in high functioning autism. International Journal of Speech-Language Pathology, 11(4), 308-315. https://doi.org/10.1080/17549500903003060

Haga, M. (2008). The relationship between physical fitness and motor competence in children. Child: care, health and development, 34(3), 329-334. https://doi.org/10.1111/j.1365-2214.2008.00814.x

Huettig, C., & Connor, J. O. (1999). Wellness programming for preschoolers with disabilities. Teaching Exceptional Children, 31(3), 12-17.

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. International journal of behavioral nutrition and physical activity, 7(1), 1-16.

Kałużna-Czaplińska, J., Socha, E., & Rynkowski, J. (2011). B vitamin supplementation reduces excretion of urinary dicarboxylic acids in autistic children. Nutrition research, 31(7), 497-502. https://doi.org/10.1016/j.nutres.2011.06.002

Kara, E., Beyazoğlu, G., Uysal, E. (2019). The effect of basıc movement traınıng on physıcal fıtness parameters ın chıldren wıth autısm. SPORMETRE Beden Eğitimi ve Spor Bilimleri Dergisi, 17(1), 88-102. https://doi.org/10.33689/spormetre.503317

Karaküçük, S. (2012). Otistik Bireylerde Spor Eğitimi ve Rehabiltasyon/Terapatik Rekreasyon. Gazi Kitabevi.

Levinson, L. J., & Reid, G. (1993). The effects of exercise intensity on the stereotypic behaviors of individuals with autism. Adapted physical activity quarterly, 10(3), 255-268.

Lopez-Williams, A., Chacko, A., Wymbs, B. T., Fabiano, G. A., Seymour, K. E., Gnagy, E. M., Chronis, A.M., Burrows-Maclean, William Pelham, J.R., & Morris, T.L. (2005). Athletic performance and social behavior as predictors of peer acceptance in children diagnosed with attention-deficit/hyperactivity disorder. Journal of emotional and Behavioral Disorders 13,(3), 173-180. https://doi.org/10.1177/10634266050130030501

Mackenzie, B. (2005). Performance evaluation tests. Electric World plc, 24(25), 57-158.

Manjiviona, J., & Prior, M. (1995). Comparison of Asperger syndrome and high-functioning autistic children on a test of motor impairment. Journal of autism and developmental disorders, 25(1), 23-39.

Obrusnikova, I., & Miccinello, D. L. (2012). Parent perceptions of factors influencing after-school physical activity of children with autism spectrum disorders. Adapted Physical Activity Quarterly, 29(1), 63-80. https://doi.org/10.1123/apaq.29.1.63

ODFED. (2018). Türkiye de Otizm. http://www.odfed.org/otizm/

Ortega, F. B. (2008). Physical fitness in childhood and adolescence: a powerful marker of health. International journal of obesity, 32(1), 1-11. http://dx.doi.org/10.1038/sj.ijo.0803774

Otizmvakfi. (2021). Tedavi ve Eğitim. https://www.otizmvakfi.org.tr/tedavi-ve-egitim/

Pace, M., & Bricout, V.A. (2015). Low heart rate response of children with autism spectrum disorders in comparison to controls during physical exercise. Physiology & behavior, 141, 63-68. https://doi.org/10.1016/j.physbeh.2015.01.011

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. https://doi.org/10.1016/j.rasd.2010.08.001

Pan, C.Y., Tsai, C.L., Chu, C.H., Sung, M.C., Ma, W.Y., & Huang, C.Y. (2016). Objectively measured physical activity and health-related physical fitness in secondary school-aged male students with autism spectrum disorders. Physical therapy, 96(4), 511-520. https://doi.org/10.2522/ptj.20140353

Parlaz, E., Tekgül, N., Karademirci, E., & Öngel, K. (2012). Adolescence period: Physical growth, psychological and social development process. Turkish Family Physician, 3(2), 10-16.

Pawlowski, W., & Hamilton, G. (2008). Talking to Your Adolescents about STDs, HIV, & Sex. Stages of Adolescent Developmenthttp :// www.proyectoideas.jsi.com/Docs/OCC%20Notes%20Feb.%202008.pdf

Reid, G., & Collier, D. (2002). Motor behavior and the autism spectrum disorders-Introduction. PALAESTRA-MACOMB ILLINOIS-, 18(4), 20-27.

Rimmer, J. H., & Braddock, D. (2002). Health promotion for people with physical, cognitive, and sensory disabilities: An emerging national priority. American Journal of Health Promotion, 16(4), 220-224. https://doi.org/10.4278/0890-1171-16.4.220

Roehr, B. (2013). American psychiatric association explains DSM-5. Bmj, 346. https://doi.org/10.1136/bmj.f3591

Saygın, & Karacabey. (2004). Aerobik egzersizin sağlık ilişkili fiziksel uygunluk özelliklerine etkisi. Fırat Üniversitesi Doğu Araştırmaları Dergisi, 2(2), 1-5.

Saygin, Ö., Polat, Y., & Karacabey, K. (2005). Çocuklarda hareket eğitiminin fiziksel uygunluk özelliklerine etkisi. Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi, 19(3), 205-212.

Stanish, H., Curtin, C., Must, A., Phillips, S., Maslin, M., & Bandini, L. (2015). Enjoyment, barriers, and beliefs about physical activity in adolescents with and without autism spectrum disorder. Adapted physical activity quarterly, 32(4), 302-317. https://doi.org/10.1123/APAQ.2015-0038

Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B.,Albert C., Hergenroeder M.D., Must ,A., Nixon P.A., Pivarnik, J. M., Rowland, T., Trost, S., Trudeau., F. (2005). Evidence based physical activity for school-age youth. The Journal of pediatrics, 146(6), 732-737. https://doi.org/10.1016/j.jpeds.2005.01.055

Şimşek, F. (2017). 10-16 Yaş Grubu Otizmli Çocuklarda Stretching Çalışmalarının Denge Performansı Üzerine Etkisi. İstanbul Gelişim Üniversitesi Sağlık Bilimleri Enstitüsü,

Şipal, M. (1989). Eurofit bedensel yetenek testleri el kitabı. TC Başbakanlık GSGM Dış İlişkiler Dairesi Başkanlığı Yayını, Yayın (78).

T.C.SağlıkBakanlığı. (2009). Gençlere Yönelik Üreme Sağlık Hizmetleri Katılımcı Kitabı. Ana Çocuk Sağlığı ve Aile Planlaması Genel Müdürlüğü.

Taner, İ. (2020). Otizm spektrum bozukluğu olan bireylerde spor eğitiminin fiziksel uygunluk, öz bakım, sosyal ve akademik becerilere etkisi. Sakarya University.

Tohumotizm. (2018). Terapi yöntemleri. https://www.tohumotizm.org.tr/otizm/terapi-yontemleri/

Tohumotizm. (2020). Terapi yöntemleri. https://www.tohumotizm.org.tr/otizm/tedavi-yontemleri/terapi-yontemleri/

Turan, S. (2021). Late adolescence: Moral disengagement. Sportive, 4(2), 1-11. https://doi.org/10.53025/sportive.877254

Tyler, K. (2014). Physical activity and physical fitness of school-aged children and youth with autism spectrum disorders. Autism research and treatment, 2014. https://doi.org/10.1155/2014/312163

UNICEF. (2011). The state of the world's children 2011-executive summary: Adolescence an age of opportunity: Unicef.

Uzun, A., Akbulut, A., Erkek, A., Pamuk, Ö., & Bozoğlu, M. S. (2020). Effect of age on speed and agility in early adolescence. International Journal of Applied Exercise Physiology, 9(8), 168-175.

Uzun, A., & Boyalı, E. (2020). Ergenlik Dönemleri ve Spor. Gece Kitaplığı. 123-132

WHO. (2003). Promoting the health of young people in custody. https://www.euro.who.int/__data/assets/pdf_file/0006/99015/e81703.pdf

Winnick, J. P., & Short, F. X. (1999). The Brockport physical fitness test manual: Human Kinetics.

Winnick, J. P., & Short, F. X. (2014). Brockport physical fitness test manual: a health-related assessment for youngsters with disabilities: Human Kinetics.

Yuan, Y. Q., Wang, M. J., Zhang, Q. X., Zhang, Y., Wang, X. L., Hou, X., Zhang, S.H., Liu, Y. (2022). Physical activity levels of children and adolescents with intellectual disabilities in Northern China. Journal of Applied Research in Intellectual Disabilities. https://doi.org/10.1111/jar.12976

Ziyagil, M., Türkmen, M., Sivrikaya, H., Eliöz, M., & Çebi, M. (2010). The relatıonshıp among physıcal and functıonal characterıstıcs of 14 to 17 years old male and female students ın samsun. Spor ve performans araştırmaları dergisi, 1(1), 50-59.