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Intervation with Physical Activity and Dietary Adolescent Obese Individuals with A-typical Autism

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Abstract

The aim of this study is to reveal the effect and importance of physical activity and diet program in adolescence obese individuals with A-typical autism. One of the single-subject research models, the single-start multiple probe model was used. The population of the study consists of children with A-typical autism between the ages of nine (9) and fourteen (14) living in Isparta. The sample of the study consisted of one (1) child who voluntarily agreed to participate in the study. The study lasted for a total of seventeen (17) weeks, including the first week of pre-measurements and the implementation of an adapted physical activity and diet program for sixteen (16) weeks. As a data collection tool, the child's weight measurement was recorded with tanita before each study. The data obtained at the end of the application were analyzed by showing them on the graph. Since the number of participants participating in the study was one (1), the data obtained in the seventeen (17) week period were converted into points in accordance with the scale protocol and turned into a line chart to reveal the change that occurred. At the end of the research, no change was observed in body weight without applying physical activity and diet program to the participant in the first week. With the physical activity and diet program applied to the participant for sixteen (16) weeks, a decrease of five (5) kilograms in the participant's body weight was detected. Factors such as the frequency of physical activity of the participant, dietary habits, awareness of parents, socio-economic status, and psycho-social are thought to be effective in this decrease in body weight.
Keywords: Autism, Diet, Physical activity, Obesity

Ergenlik Dönemi A-tipik Otizmli Obez Bireylere Fiziksel Aktivite ve Diyetle Müdahale

Öz

Bu çalışmanın amacı, ergenlik dönemi A-tipik otizmli obez bireylere fiziksel aktivite ve diyet programı ile müdahalenin etkisini ve önemini ortaya koyabilmektir. Tek denekli araştırma modellerinden, tekli başlangıç çoklu yoklama modeli kullanılmıştır. Araştırmanın evrenini, Isparta ilinde yaşayan, dokuz (9) ile on dört (14) yaş aralığındaki A-tipik otizmli çocuklar oluşturmaktadır. Araştırmanın örneklemini ise, araştırmaya gönüllü olarak katılmayı kabul eden bir (1) çocuk oluşturmuştur. Araştırma ön ölçümlerin alındığı ilk hafta ve on altı (16) hafta uyarlanmış fiziksel aktivite ve diyet programının uygulanması olmak üzere toplamda on yedi (17) hafta sürmüştür. Veri toplama aracı olarak çocuğun kilo ölçümü her çalışma öncesinde tanita ile ölçülerek kaydedilmiştir. Uygulama sonunda elde edilen veriler, grafik üzerinde gösterilerek analiz edilmiştir. Araştırmaya katılan katılımcı sayısının bir (1) olması nedeniyle on yedi (17) haftalık süreçte elde edilen veriler ölçek protokolüne uygun şekilde nokta puana dönüştürülerek, meydana gelen değişimi ortaya koymak için çizgi grafiğe dönüştürülmüştür. Araştırma sonunda, katılımcıya ilk hafta fiziksel akitvite ve diyet programı uygulanmadan vücut ağırlığında bir değişiklik tespit edilmemiştir. Katılımcıya on altı (16) hafta boyunca uygulanan fiziksel aktivite ve diyet programı ile katılımcının vücut ağırlığında beş (5) kilogram azalma tespit edilmiştir. Katılımcının vücut ağırlığında beş (5) kilogramlık azalmada katılımcının fiziksel aktivite sıklığı, beslenme alışkanlıkları, ebeveynlerin farkındalığı, sosyo-ekonomik düzey ve psiko-sosyal gibi faktörlerin etkili olduğu düşünülmektedir.
Anahtar kelimeler: Diyet, Fiziksel aktivite, Obezite, Otizm

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INTRODUCTION

Autism spectrum disorder (ASD) is a pervasive developmental disorder that affects many areas such as motor, psycho-motor, sensory and cognitive development, and has limited repetitive behavior patterns, deficiencies in social interaction and communication skills with others, and shows its symptoms in the first three years from birth and after, continues throughout life and has genetic basis (Aydın & Özgen, 2018; Durmuş et al., 2021; Sansi & Nalbant,2019; Ünal & Uçar, 2017; Yıldırım, 2019). Pervasive developmental disorders are classified under five headings. These are autism, A-typical autism, asperger's syndrome, childhood fragmentation disorder, and rett's syndrome (Arslan & İnce, 2015; Kavlak, 2019). A-typical autism is also known as pervasive developmental disorder not otherwise specified. It is a diagnostic term used for individuals who begin to show symptoms after the age of three, or for whom observed symptoms are insufficient for diagnosis. A-typical autism is characterized by difficulties in communication skills, social interaction with others, obsessive behavior, attachment, and weakness in motor skills (Arslan & İnce, 2015; Kavlak, 2019; Yıldırım, 2019).

In individuals with ASD, deficiencies in motor skills are frequently observed at an early age (preschool). Individuals with ASD experience inadequacies in movement skills such as balance and coordination, walking, swimming, dancing, jumping rope, and playing ball (Elaltunkara, 2017; Sansi & Nalbant, 2019). Adolescent individuals with autism spectrum disorder have poor motor skills, including social and behavioral limitations, difficulties with motor coordination and balance, which makes it challenging for them to engage in physical activities and participate in them sufficiently compared to their typically developing peers (Dhaliwal et al., 2019; Durmuş et al., 2021; Khader, 2017; Srinivasan et al., 2014).

Reduced physical activity levels, prolonged screen time habits, and increased irregular eating habits in adolescents with autism spectrum disorder (ASD) can lead to many health problems, such as low bone density, overweight, and obesity (Dahlgren et al., 2021; Doreswamy et al., 2020; Gehricke et al., 2020). Compared to typically developing adolescents, adolescents with autism spectrum disorder have a %49 higher risk of obesity (Helsel et al., 2023). Obesity is associated with long-term physical and psychosocial consequences, including diabetes, insulin resistance, increased risk of cardiovascular disease, and depression. It can also have negative effects on physical, sensory, and social functioning, as well as academic performance (Dhaliwal et al., 2019; Srinivasan et al., 2014).

Physical activity practices play an important role in improving the symptoms and skill deficiencies associated with autism spectrum disorder. It has been found that physical activity helps to alleviate social, behavioral, cognitive, and motor impairments of autism in adolescent individuals, as well as contributes to academic performance. Additionally, such activities are suggested to contribute to the development of social and motor skills, improving balance, coordination, speed, and flexibility, and helping to prevent health problems such as obesity (Durmuş et al., 2021; Gehricke et al., 2020; Khader, 2017; Sansi & Nalbant, 2019).

Stereotipic sensory and motor behaviors seen in children with autism, difficulties related to oral motor skills such as chewing and swallowing, gastrointestinal problems, and physiological factors that directly or indirectly affect behavioral and nutritional problems can be defined. Children with neuro-developmental disorders such as autism and autism spectrum disorders

have more nutritional problems than healthy children. The most common nutritional problem is food selectivity, followed by food refusal and rapid eating (Doreswamy et al., 2020; Riccio, 2022; Tekkeli, 2021). Avoidance of various foods due to the texture or taste of the food, sensitivity to any food, changes in dietary habits are frequently encountered in children with autism (Arefilaleh, 2021; Çıtar, 2019; Dhaliwal et al., 2019). As a result of these issues, inadequate and imbalanced intake of nutrients, negative effects on the balance of vitamins and minerals such as iron deficiency and inadequate calcium intake, malnutrition, weakening of bones, and consumption of high-sugar and high-fat foods also increase the risk of obesity (Tekkeli, 2021). In addition to nutritional problems, gastrointestinal problems such as chronic constipation, diarrhea, and abdominal pain are also common in most children with autism spectrum disorder. Various nutritional and dietary therapy studies have shown benefits in treating these underlying conditions (Adams et al., 2018; Sanctuary et al., 2019).

There are many dietary treatment options that have been tried and are currently being tried in nutritional and dietary therapies. Some of these treatments include the gluten-free, casein-free diet, the Feingold diet, the ketogenic diet, the elimination allergy diet which eliminates basic allergenic foods, and the supplementation of vitamins, minerals, omega-3, and probiotics. (Döndüren, 2021; Kaynar & Yılmaz, 2020; Yıldırım, 2019). When considering the results obtained from scientific studies, it is seen that physical activity and diet are important for individuals with autism spectrum disorder throughout their lives. The aim of this study is to reveal the effect and importance of physical activity and diet program in adolescence obese individuals with A-typical autism.

METHODS

Research Model

A single-subject research design using a single-case multiple-baseline design was employed. The first step in single-subject designs is to collect and record baseline data (Karasar 2019; Özdamar, 2003; Sarı, 2015; Şata 2020).

Population and Sample

The population of the study consists of atypical autism children between the ages of nine (9) and fourteen (14) living in Isparta province. The sample of the study consists of one (1) child who volunteered to participate in the study. Written consent was obtained from the child's family to perform adapted physical activities and implement a diet program according to the child's needs.

Ethical Approval

Ethics committee approval was received for this study from Süleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee (E- 87432950.50.99-298104, Date:05.07.2022).

Data Collection

The 'Tanita' brand measurement tool was used as the data collection tool for measuring the participant's weight." The weight of the participant was measured using a Tanita scale and recorded during the first week of the study before the diet and physical activity program was given. From the second week onwards, the diet and physical activity program was implemented, and the participant's weight was measured using the Tanita scale before starting the weekly physical activity program. The study lasted a total of seventeen (17) weeks, including the first week when the initial measurements were taken, and sixteen (16) weeks of implementation of the adapted physical activity and diet program.

Implemented Physical Activity and Diet Program

The participant was given an 1800-calorie diet program in the first week of starting the program. When preparing the diet program, information was obtained from the participant's parent regarding the participant's eating habits, the meals served at the school cafeteria, and mealtimes, and a personalized diet program was given to the participant based on their needs. The sample program provided below is a one-day example program. The program was revised and updated based on the participant's weight monitoring and discussions with their parent, and the process continued.

Table 1. 1800 calorie diet program

Breakfast:
1 glass of milk
2 walnuts
Tomato and cucumber
Omlette made from 2 eggs
5 olives
2 slices of white cheese
1 slice of whole wheat bread
Mid-morning Snack: Ten almonds+ One serving of fruit
Lunch:
4 pieces of meatballs
3 tablespoons of rice/pasta
1 glass of buttermilk
2 slices of whole wheat bread
Salad
Afternoon Snack: A cup of yellow chickpeas+ A tablespoon of raisins
Dinner:
1 bowl of soup
6-7 tablespoons of vegetable dish
5 tablespoons of rice/pasta
4 tablespoons of yogurt
1 slice of whole wheat bread
Salad
Evening Snack: One serving of fruit+ A glass of milk
(The changes in the listed foods were explained to the parent and modified according to the participant's preference. For example: Three tablespoon of rice: A slice of bread).

Table 2. Example of a physical activity program

First Week
Ten minutes walk (2 kilometers speed on the treadmill)
Warm up moves (stretching) (5 minutes)
2*20 minutes light pace walking (3.5 kilometres speed on the treadmill)
Stretching movements (5 minutes)

Data Analysis

At the end of the intervention, the data obtained were analyzed by presenting them on a graph. Since there was only one (1) participant in the study, the data obtained over the seventeen (17) week period were converted from a scale protocol to a point score and then transformed into a line graph to demonstrate the changes that occurred (Özdamar, 2003).

RESULTS

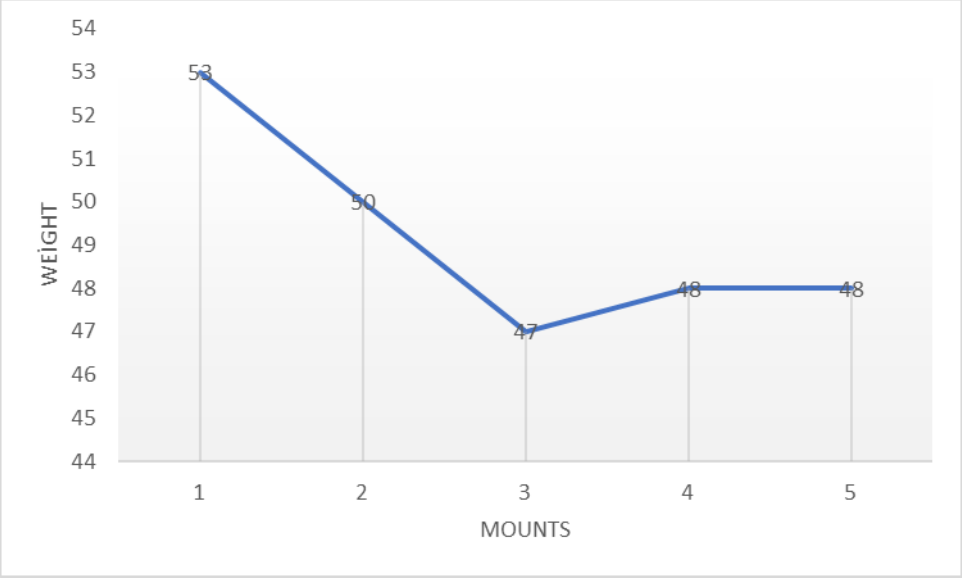

Figure 1. Line graph showing the weekly changes in weight values of the participant.

Looking at Figure 1, significant changes in weight fluctuations of the participant are observed week by week in the research.

DISCUSSION

In this section, the effect of physical activity and diet intervention on adolescents with atypical autism and obesity was investigated and discussed in relation to relevant literature.

When examining Figure 1, a significant change in the participant's weight by weeks can be observed with a five (5) kilograms decrease in body weight due to the physical activity and diet program applied for seventeen (17) weeks. It can be said that factors such as the limited physical activity of the participant to only one (1) day, resistance to abandoning routine eating habits, parental awareness, socio-economic level, and psychosocial factors are planted in the five (5) kilograms weight loss of the individual. Cürebal et al., (2012) state that many issues such as the socio-demographic characteristics of the family, the structural characteristics of the

child, the psychiatric conditions of the parents, and mother-child communication are related to changes in the child's eating habits (Girli et al., 2015).

It can be said that the participant's eating habits were a major factor in their weight loss. In this study, it was observed that not only the participant's eating habits but also the family's eating habits, meal patterns, and lifestyles could affect the participant's nutrition. As the participant had a large family, it was learned from interviews with the mother that she could not always adhere to the special diet program for the child and that the family's meals were organized differently than for the child. As a result, it was found that there were deviations from the mealtimes in the program and that the participant could not consume some of the foods on the diet list at times. Kırcali et al., (2022) conducted a study on *eating behaviors, obesity status, and nutrition-related problems experienced by families of children with autism spectrum disorder (ASD).* They found that the majority of children with ASD had at least one food they could not consume, and that their nutrition was often influenced by their household. Aponte and Romanczyk (2016) conducted a study to *assessment of feeding problems in children with autism spectrum disorder* and found that the feeding behaviors of siblings affected children with ASD. They noted that if siblings did not like certain foods, children with ASD also refused to eat those foods. It is thought that these situations, as in the case of the participant, also lead to high levels of food selectivity in children with autism spectrum disorder. Limited studies conducted in Turkey confirm that children diagnosed with ASD exhibit food selectivity and refusal behaviors due to this condition (Meral, 2017). Girli et al. (2015), conducted a study to *evaluate the nutritional status of children with autism spectrum disorder* and reported that some of the children with autism are inclined to reject certain foods and new foods. Kaynar and Yılmaz (2020), conducted a study to *determine the nutritional status of children with autism spectrum disorder* and found that a large majority of children between the ages of 7-14 had at least one eating problem, and the most common eating problem was refusing to try new foods. Bandini et al., (2010) conducted a study on *food selectivity in children with autism spectrum disorders and typically developing children*. They stated that children diagnosed with autism exhibited more selective eating compared to typically developing children, which supports the idea presented in the study.

In this study, it was observed that the participant was reluctant to consume beneficial foods such as meat, yogurt, chicken, fish, and vegetables, while preferring packaged foods, pizza, excessive amounts of bread, and rice pilaf. It is thought that this situation may have slowed down the weight loss of the participants. In the study *evaluation of the nutritional status and eating behaviors of children with autism* by Önal (2017), parents stated that most of their children with autism constantly desire to consume unhealthy, high-calorie foods such as chocolate, snacks, chips, and pasta. The same study revealed that the foods the children did not want to consume at all were vegetables, cheese, legumes, and fish. This situation is believed to have potentially slowed down weight loss in the participants. Kaynar and Yılmaz (2020) have reported in their previous study, which was mentioned earlier, that children hardly consume essential foods such as milk, yogurt, red meat, fish, and green leafy vegetables. According to Şengüzel et al. (2020), in their study on *the effect of eating habits and nutrition status on children with autism spectrum disorder,* children were reported to be selective in their consumption of vegetables, fruits, milk, yogurt, and cheese foods. In their study, Raspini et al. (2020) examined *dietary patterns and weight status in Italian preschoolers with autism spectrum disorder and typically developing children*. They found that children with autism spectrum disorders consumed higher amounts of simple sugars and processed foods and lower amounts of proteins, vegetables, and fruits compared to typically developing children. The literature and this study highlight that children with autism spectrum disorder tend to crave and

consume unhealthy foods that are high in sugar and fat, while showing reluctance to consume healthy foods that should be part of their daily diet. These findings can be considered as one of the reasons why children with autism spectrum disorder are prone to obesity.

Another factor that affects weight loss is physical activity. Since the participant was able to engage in physical activity only once a week due to various reasons (such as school hours), it can be said that limiting physical activity to one day has affected the individual's weight loss below the expected values. Despite all these limitations, it has been found that the adapted physical activity and diet program was effective in the participant's weight loss. The physical activity was found to provide physical benefits and contribute to some motor skills such as balance, strength, etc. to the participant. Mccoy vd., (2016) conducted a study *comparison of obesity, physical activity, and sedentary behaviors between adolescents with autism spectrum disorders and without*. They found that adolescents with autism spectrum disorder had lower levels of physical activity and higher rates of obesity compared to the other group. In the study t*he efficacy of a 9-month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism,* Pitetti et al., (2007) reported that a 9-month treadmill walking program resulted in increased walking speed, frequency, and calorie expenditure, as well as decreased body mass index (BMI) in severely obese adolescents with autism. In a study titled *physical activity, dietary habits and overall health in overweight and obese children and youth with intellectual disability or autism,* Hinckson et al., (2013) examined the effects of a physical activity program on nutrition habits and overall health in children and youth with intellectual disabilities or autism. They found an increase in walking distance and a decrease in body mass index and waist circumference. However, they noted that exercise education alone was insufficient in reducing body fat percentage and should be combined with a diet program. Arslan and İnce (2015) conducted a study on *the effects of a 12-week exercise program on gross motor skills in children with atypical autism.* The study found that exercise increased muscle strength in children and had a positive effect on running speed and agility parameters. This supports the literature and parallels the findings of the study. In their study titled *socialization effect of physical activity in students who need special education* Ilkım et al. (2018), determined that a 16-week physical activity program positively influenced the socialization of students who need special education. Zhao and Chen (2018), conducted a study to examine the impact of a structured physical activity program on social interaction and communication in children with autism. In their research, they found that a 12-week structured physical activity program positively influenced social interaction and communication skills, rapid response and expressive frequency in children with autism. Yarımkaya and İlhan (2020), determined in their study that physical acitivity had positive effects on communication deficits in children with autism.

Köksal and Erciyes (2021) conducted a study on *the assessment of psychosocial problems in families of children diagnosed with autism.* The study revealed that parents, especially mothers, felt weak, unhappy, guilty, helpless, and lonely in terms of their mental health. Similarly, Bendixen et al., (2011) conducted a study *effect of a father-based in-home intervention on perceived stress and family dynamics in parents of children with autism.* They found that there were differences in stress and coping between mothers and fathers, with mothers being more stressed and prone to depression. However, they also found that mothers were more accustomed to the challenges of raising a child with autism due to their role in caregiving and having more frequent contact with the child. In the study *evaluation of the problems and psychological status of families with autistic children* by Top (2009), it was suggested that the

integration of family members was not fully achieved, supporting the results of Köksal and Erciyes (2021). The study also found that the psychosocial status of the participant's parent (mother) influenced their approach due to the disintegrated family structure.

The participant's socioeconomic status is considered as another factor that affects their compliance with the diet and physical activity program. It has been observed that economic reasons are effective in the procurement of some foods in the diet program and the frequency of participation in the physical activity program. Ilkım et al., (2021), conducted a study titled evalution of sports awareness of parents of individuals with autism participating in sports clubs where they suggested that the participation of individuals with autism in sports clubs is influenced by the gender, educational backgraound, personal engagement in sports and interst in sports of their parents.In their study on the experiences of families raising children with autism, Khiavi et al., (2021) stated that the first problem parents brought up was financial issues. In parallel, Yassıbaş (2015) in his study, *in-depth look at the life experiences of parents with children with autism spectrum disorder,* found that half of the participants expressed difficulties in meeting the needs arising from their children's ASD. Similarly, Akkuş et al. (2020), in their study *living with autism spectrum disorder: Experiences of families*, reported that the financial burden created by the interventions required after the diagnosis of ASD and the economic difficulties caused by this situation were expressed by the majority of the participants in their study. Acharya and Sharma (2021) conducted a study on the *lived experiences of mothers raising children with autism in chitwan district, Nepal,* and found that mothers faced economic difficulties in providing regular follow-up, treatment, therapy, and play materials for their children. They pointed out that the lifestyle of the participants and their parents could be influenced by socio-economic factors, supporting the idea that socio-economic factors can affect the lifestyle of the participants and their parents.

CONCLUSION

In conclusion, in the intervention study with physical activity and diet program for atypical autistic obese individuals in adolescence, it has been found that a personalized physical activity and diet program based on individual needs is effective in weight loss. Indeed, considering the benefits of physical activity and healthy eating, it can be said that balanced nutrition and regular and sufficient physical activity can help prevent various health problems, especially obesity, improve social and motor skills, and contribute to physical fitness. It can be emphasized that parents also play a major role in ensuring the individual's nutrition and participation in physical activity.

Suggestions

- Parents should be sufficiently informed about healthy eating and physical activity by experts.
- Considering the socio-economic conditions of parents, a personalized diet program should be prepared by a specialist based on the needs of individuals with autism.
- Low-cost, non-specialized physical activity programs that can be fun for individuals with autism can be prepared to ensure their active participation in physical activity.
- Providing socio-economic and psychosocial support to parents is believed to improve both the quality of life of individuals with autism and their parents.

- It has been found that sufficient resources and studies cannot be accessed when scanning the literature on a-typical autism. Contribution to the literature can be made with a wider and more comprehensive study.

Resarch Limitations

In this study, a single-subject research model was used. In the single-subject research model, a small number of samples can be used. Therefore, the number of samples was limited to one person. In the single-subject research model, since the sample size is not suitable for the presentation of the findings with a table, the representation of the findings is reflected in line graphs.

Conflict of Interest: There are no personal or financial conflicts of interest among the authors regarding the scope of the study.

Authors' Contribution: Study Design; HA, GK –Data Collection; GK –Statistical analysis; HA –Manuscript Preparation; GK, HA.

Ethical Approval
Ethics Committee: Süleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee
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REFERENCES

Adams, J. B., Audhya, T., Geis, E., Gehn, E., Fimbres, V., Pollard, E. L., Mitchell, J., Ingram, J., Hellmers, R., Laake, D., Matthews, J. S., Li, K., Naviaux, J. C., Naviaux, R. K., Adams, R. L., Coleman, D. V., & Quig, D. W. (2018). Comprehensive nutritional and dietary intervention for autism spectrum disorder a randomized, controlled 12-month trial. *Nutrients*, *10*(3), 369. https://doi.org/10.3390/nu10030369

Acharya, S., & Sharma K. (2021). Lived experiences of mothers raising children with autism in chitwan district, Nepal. *Autism Research and Treatment, 6.* https://doi.org/10.1155/2021/6614490

Akkuş, P. Z., Saygın, B. B., Bahadur, E. İ., Çak, T., & Özmert, E. N. (2020). Living with autism spectrum disorder: Family experiences, *Journal of Pediatric Disease, 15* (4), 272-279. https://doi.org/10.12956/tchd.731752

Aponte, C. A., & Romanczyk, R. G. (2016). Assessment of feeding problems in children with autism spectrum disorder. *Resarch in Autism Spectrum Disorders, 21,* 61-72. https://doi.org/10.1016/j.rasd.2015.09.007

Arefilaleh, S. (2021). *Determination of the effects of healthy nutrition on zonulin values and symptoms related to autism in children with autism*. Master Thesis, Ondokuz Mayıs University, Graduate Education Institute, Department of Nutrition Sciences, Samsun.

Arslan, E., and İnce, G. (2015). The effects of 12 weeks exercise program on the level of gross motor skill of the children with atypical autism. *International Journal of Sport Exercise and Training Science, 1(1),* 51-62. https://doi.org/10.18826/ijsets.66769

Aydın, D., and Özgen, Z. E. (2018). The role of nurses in autism spectrum disorders and early diagnosis in children. *Gümüşhane University Journal of Health Sciences, 7*(3), 93-101.

Bandini, L. G., Anderson, S. E., Curtin, C., Cermak, S., Evans, E. W., Scampini, R., Maslin, M., & Must, A. (2010). Food selectivity in children with autism spectrum disorders and typically developing children. *The Journal of Pediatrics*, *157*(2), 259-264. https://doi.org/10.1016/j.jpeds.2010.02.013

Bendixen, R. M., Elder, J. H., Donaldson, S., Kairalla, J. A., Valcante, G., Ferdig, R. E. (2011). Effects of a father-based in-home intervention on perceived stress and family dynamics in parents of children with autism. *The American Journal of Occupational Therapy*, *65*(6), 679-687. https://doi.org/10.5014/ajot.2011.001271

Çıtar, M.E., (2019). *Assessment of nutritional status and dietary antioxidant capacities in individuals with autism spectrum disorder*. Unpublishing Master Thesis, Gazi University, Health Sciences Institute, The Department of Nutrition and Dietetics, Ankara.

Dahlgren, J., Healy, S., MacDonald, M., Geldhof, J., Palmiere, K., & Haegele, J. (2021). Physical activity and screen time among youth with autism: A longitudinal analysis from 9 to 18 years. *Autism*, *25*(4), 1090–1099. https://doi.org/10.1177/1362361320981314.

Dhaliwal, K. K., Orsso, C. E., Richard, C., Haqq, A.M., & Zwaigenbaum, L. (2019). Risk factors for unhealthy weight gain and obesity among children with autism spectrum disorder. *International Journal of Molecular Sciences, 20*(13), 3285. https://doi.org/10.3390/ijms20133285

Doreswamy, S., Bashir, A., Guarecuco, J. E., Lahori, S., Baig, A., Narra, L. R., Patel, P., & Heindl, S. E. (2020). Effects of diet, nutrition, and exercise in children with autism and autism spectrum disorder: A Literature Review. *Cureus*, *12*(12), 1-7. https://doi.org/10.7759/cureus.12222

Döndüren, E. (2021). *A prospective cohort study on the effects of a gluten-free casein-free diet on body mass index, autism severity, and behavior in children with autism spectrum disorder.* Master Thesis, Üsküdar University, Health Sciences Institute, Department of Neuroscience, İstanbul.

Durmuş, K., Sarol, H., & Gürkan, R. K. (2021). Autism spectrum disorder and physical activity. *Journal of Human Sciences*, *18*(4), 691-703. https://doi.org/10.14687/jhs.v18i4.6257

Elaltunkara, C. (2017). *The effects of 16 week sports training on autistic child children's physical abilities*. Master Thesis, Bartın University, Institute of Educational Sciences, Departmant of Physical Educatin and Sport, Bartın.

Girli, A., Özgönenel, S. Ö., Sarı, H. Y., & Ardahan, E. (2015). Nutritional status, eating behaviours and parental attitudes of children with an autism. *Child and Civilization, 1*(7), 87-99.

Gehricke, J. G., Chan, J., Farmer, J. G., Fenning, R. M., Steingberg-Epstein, M., Misra, M., Parker, R. A., & Neumeyer, A. M., (2020). Physical activity rates in children and adolescents with autism spectrum disorder compared to the general population. *Research in autism spectrum disorders, 70,* Article 101490. https://doi.org/10.1016/j.rasd.2019.101490

Helsel, B. C., Foster, R. N. S., Sherman, J., Steele, R., Ptomey, L. T., Montogomery, R. İ., Wahburn, R. A., & Donnely, J. E. (2023). The family nutrition and physical activity survey: comparisons with obesity and physical activity in adolescents with autism spectrum disorder. *J Autism Dev. Disord., 53,* 89–95. https://doi.org/10.1007/s10803-021-05415-9

Hinckson, E. A., Dickinson, A., Water, T., Sands, M., & Penman, L. (2013). Physical activity, dietary habits and overall health in overweight and obese children and youth with intellectual disability or autism. *Research in Developmental Disabilities, 34*(4), 1170-1178. https://doi.org/10.1016/j.ridd.2012.12.006

Ilkım, M., Özoğlu, F., & Kalaycı, M. C. (2021). Evaluation of sports awareness of parents of individuals with autism attending to sports clubs. *Int J Life Sci Pharma Res, 14,* 76-80.

Ilkım, M., Tanir, H., & Özdemir, M. (2018). Socialization effect of physical activity in students who need special education. *Asian Journal of Education and Training*, *4*(2), 128-131. https://doi.org/10.20448/journal.522.2018.42.128.131

Jones, R. A., Downing, K., Rinehart, N. J., Barnett, L. M., May, T., McGillivray, J. A., Papadopolous, N. V., Skouteris, H., Timperio, A., & Hinkley, T. (2017). Physical activity, sedentary behavior and their correlates in children with autism spectrum disorder: A Systematic Review. *PloS one*, *12*(2), e0172482. https://doi.org/10.1371/journal.pone.0172482

Kavlak, B. (2019). The *effect of regular physical activity programs applied to children with autism on some motor features.* Master Thesis, Kocaeli University, Health Sciences Instute, Department of Physical Education and Sports, Kocaeli.

Karasar, N. (2019). *Bilimsel araştırma yöntemi: Kavramlar ilkeler teknikler.* Nobel.

Kaynar, A. N., and Yılmaz, H.Ö. (2020). Determination of nutritistional status in children with autism spectrum disorder. *Gümüşhane University Journal of Health Sciences, 9*(2), 151-162.

Khader, W. (2017). *Physical activity participation ın children with autism spectrum disorder in different communities: A Comparative Study*. PhD thesis, Marmara University, Health Sciences Instute, Department of Physical Education and Sports, İstanbul.

Khiavi, F.F., Zahiri, M., Amiri, E., Dindamal, B., & Pirani, N., (2021). The experiences of families raising austistic children: A Phenomenological Study. *Journal of Educaiton and Health Promotion*, *10*(78). https://doi.org/ 10.4103/jehp.jehp_837_20

Kırcali, B.Ö., Demir, F., Demir, N., & Üründü, H. (2022). Obesity status, eating behavior in children with autism spectrum disorder and the nutritional problems experienced by families. *Karya Journal of Health Science, 3*(2), 50-55. https://doi.org/10.52831/kjhs.1057471

Köksal, M., and Erciyes, C. (2021). Evaluation of psycho-social problems in the families of children diagnosed with autism. *Aydın Sağlık Dergisi*, *7*(3), 235-254. https://doi.org/10.17932/IAU.ASD.2015.007/asd_v07i3005

McCoy, S.M., Jakicic, J. M., & Gibbs, B. B. (2016). Comparison of obesity, physical activity, and sedentary behaviors between adolescents with autism spectrum disorders and without. *J Autism Dev Disord, 46*, 2317–2326. https://doi.org/10.1007/s10803-016-2762-0

Meral, B. F. (2017). Feeding problems and evidence-based behavioral interventions in children with autism spectrum disorder. *Ankara University Faculty of Educational Sciences Journal of Special Education*, *18*(3), 493-508. https://doi.org/10.21565/ozelegitimdergisi.323301

Önal, S. (2017). *Assessment of the nutritional status and feeding behaviors of children with autism.* Master Thesis, Ankara University, Health Sciences Instute, The Department of Nutrition and Dietetics, Ankara.

Önal, S., and Uçar, A., (2017). Nutritional approaches in the treatment of autism spectrum disorder. *Ankara Health Sciences Journal, 6*(1), 179-194. https://doi.org/10.1501/Asbd_0000000070

Özdamar, K. (2003). *Modern bilimsel araştırma yöntemleri.* Kaan Kitabevi.

Pitetti, K.H., Rendoff, A.D., Grover, T. & Beets, M.W. (2007). The efficacy of a 9-month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism. *J Autism Dev Disord*, 37, 997–1006. https://doi.org/10.1007/s10803-006-0238-3

Raspini, B., Prosperi, M., Guiducci, L., Santocchi, E., Tancredi, R., Calderoni, S., Morales, M. A., Morelli, M., Simione, M., Fiechtner, L., Muratori, F., & Cena, H. (2021). Dietary patterns and weight status in Italian preschoolers with autism spectrum disorder and typically developing children. *Nutrients*, *13*(11), 4039. https://doi.org/10.3390/nu13114039

Riccio, S. (2022). Feeding problems: Autism spectrum disorder. *BU Journal of Graduate Studies in Education, 14(*1), 23-26.

Sanctuary, M. R., Kain, J. N., Chen, S.Y., Kalanetra, K., Lemay, D. G., Rose, D. R., Yang, H. T., Tancredi, D. J, Bruce German, J., Slupsky, C.M., Ashwood, P., Mills, D.A., Smilowitz, J.T., & Angkustsiri, K. (2019). Pilot study of probiotic/colostrum supplementation on gut function in children with autism and gastrointestinal symptoms. *PloS one*, *14*(1), Article e0210064. https://doi.org/10.1371/journal.pone.0210064

Sansi, A., and Nalbant, S. (2019). Effects of inclusive physical activity program on physical fitness levels of students with and without autism spectrum disorder. *Kilis Yedi Aralik University Journal of Physical Education and Sport Sciences 3*(2), 30-39.

Sarı, H. (2015). Uygulamalı davranış analizi (eğitimciler için). İçinde H. Sarı (Ed.), *Tek denekli araştırmalar* (9. Basımdan Çeviri). Nobel.

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. https://doi.org/10.2522/ptj.20130157

Şata, M. (2020). Nicel araştırma yaklaşımları. İçinde E. Oğuz (Ed.), *Eğitimde araştırma yöntemleri* (ss.77-97). Eğiten Kitap.

Şengüzel, S., Cebeci, A. N., Ekici, B., Gönen, İ., & Tatlı, B. (2020). Impact of eating habits and nutritional status on children with autism spectrum disorder. *Journal of Taibah University Medical Sciences*, *16*(3), 413–421. https://doi.org/10.1016/j.jtumed.2020.11.010

Tekkeli, Ş. (2021). *Effect of gluten-free casein-free diet on gastrointestinal symptoms in children with autism spectrum disorder.* Master Thesis, İstanbul Medipol University, Health Sciences Instute, The Department of Nutrition and Dietetics, İstanbul.

Top, F.Ü. (2009). The evaluation of the problems and psychological states of the families who have autistic children: A Qualitative Research. *J. Child*, *9*(1),34-42.

Yarımkaya, E., and İlhan, E. L. (2020). The effect of peer-mediated physical activıties on communication deficit of children with autism spectrum disorder. *Journal of Physical Education & Sports Science*, *14*(2), 233-245.

Yassıbaş, U. (2016). *A comprehensive look into the experiences of parents whose children have autism spectrum disorder.* Master Thesis, Anadolu University, University Graduate School of Educational Sciences, Department of Special Education, Eskişehir.

Yıldırım, G. (2019). *Autistic children investigation of autism and nutritional level.* Master Thesis, İstanbul Okan University, Health Sciences Institute, The Department of Nutrition and Dietetics, İstanbul.

Zhao, M., and Chen, S. (2018). The effects of structured physical activity program on social interaction and communication for children with autism. *BioMed research international*, *2018*, Article 1825046, https://doi.org/10.1155/2018/1825046.