
JOURNAL

of

Surgery and Medicine

I n t e r n a t i o n a l M e d i c a l J o u r n a l





[Home](#) / Editorial Team

Editorial Team

Editor-in-Chief

Yahya Kemal Çalışkan, MD

University of Health Sciences, Kanuni Sultan Suleiman Training And Research Hospital, Istanbul, Turkey

Research areas: Surgical science, Medical science

[Email](#)

Editors & Editorial Board

Selman Uranues, Prof., MD, FACS, FEBS

Sektion für Chirurgische Forschung

Medical University of Graz

Graz, Austria

[Website](#)

Kafil Akhtar, Prof., MD

Department of Pathology

JNMC, AMU, Aligarh-India

[Website](#)

Eric Revue, MD

Clinical Practice Committee

IFEM International Federation of Emergency Medicine

West Melbourne, Victoria, Australia

[Website](#)

Boris Sakakushev, Prof., MD

Division of General and Operative Surgery with Coloproctology

Medical University of Plovdiv

Plovdiv, Bulgaria

[Website](#)

Dimitrios Giakoustidis, Assoc. Prof., MD

First Department of Surgery, General Hospital Papageorgiou

Aristotle University of Thessaloniki

Thessaloníki, Greece

[Website](#)

Nancy Berenice Guzmán Martínez, MD

Department of Radiology and Molecular Imaging

Centro Médico ABC (The American British Cowdray Medical Center)

Mexico City, Mexico

[Website](#)

Sapana Verma, MD, PhD

Center for Liver and Biliary Sciences

New Delhi, India

[Website](#)

Wandong Hong, Assist. Prof., MD, PhD

Department of Gastroenterology and Hepatology

The First Affiliated Hospital of Wenzhou Medical University

Wenzhou, Zhejiang, China

[Website](#)

Mingyu Sun, Prof., MD, PhD

Institute of Liver Diseases

ShuGuang Hospital, Shanghai University of TCM.

Shanghai, China

[Website](#)

Moshiur Rahman, Assist. Prof., MD

Neurosurgery Department

Holy Family Red Crescent, Medical College,

Dhaka, Bangladesh

[Website](#)

Mauro Zago, MD

Policlinico San Pietro, Ponte San Pietro

BG, Italy

[Website](#)

Gouda Ellabban, Prof., MD

Faculty of Medicine, Suez Canal University

Ismailia, Egypt

[Website](#)

Juan Asensio, MD

Department of Surgery, Creighton University

Omaha, United States

[Website](#)

Antonio Sommariva, MD

Surgical Oncology Department, Istituto Oncologico Veneto

Padova, Italy

[Website](#)

Mehmet Serhan Er, Prof., MD

University of Akdeniz, Antalya, Turkey

Subjects: Orthopedics, Surgical science

[Website](#)

Fatih Sap, Prof., MD

MEDİPOL MEGA, Academic Medical Center Hospital

Pediatric Cardiology, Istanbul, Turkey

Subjects: Pediatrics, Medical science

[Website](#)

Yıldız Büyükdereli Atadag, MD

Sahinbey Baglarbasi Family Health Centre, Gaziantep, Turkey

Subjects: Medical sciences, Internal medicine, Family medicine

[Website](#)

Abdulkadir Aydin, MD

Family Medicine

Sakarya University, Education and Research Hospital, Sakarya, Turkey

Subjects: Medical sciences, Internal medicine, Family medicine

[Website](#)

Didem Kaya, MD

Uskudar Number 23. Family Health Centre, Istanbul, Turkey

Subjects: Medical sciences, Internal medicine, Family medicine

Ilyas Kudas, MD

University of Health Sciences, Sariyer Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey

Subjects: Hepatobiliary – Renal transplantation, General Surgery

Burak Turan, MD

University of Health Sciences, Kocaeli Derince Education and Research Hospital, Kocaeli, Turkey

Subjects: Cardiology, Medical science

Burak Guler, MD

Buyukcekmece Mimarsinan State Hospital, Istanbul, Turkey

Subjects: Otolaryngology - Head and neck surgery

Suleyman Kalcan, Assis. Prof., MD

Recep Tayyip Erdogan University, Department of Surgery, Rize, Turkey

Subjects: Surgical science

[Website](#)

Editorial Advisory Board

Hussein Faour, MD, FACS, FASMBS, SOEMBS

Department of Surgery

Royale Hayat Hospital

Kuwait City, Hawally, Kuwait

[Website](#)

Fahmi Khan, MB, BS, CABMs

Hamad Medical Corporation | HMC

Department of Medicine (Hamad General Hospital)

Doha, Qatar

[Website](#)

Elroy Patrick Weledji, Professor, BSc, MBBChBAO, MSc, FRCS(Edinburgh)

Department of Medicine

University of Buea

Buea, Cameroon

[Website](#)

Prasenjit Das, Professor, MD, DNB, MNAMS, MNASc

Department of Pathology

All India Institute of Medical Sciences

New Delhi, India

[Website](#)

Seyed Vahid Hosseini, Professor

Shiraz University of Medical Sciences, Shiraz, Iran

[Website](#)

This is an open-access journal distributed under the [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 \(CC BY NC ND\)](#) license.



Powered By  **SelSistem**[®]



Vol. 9 No. 1 (2025)



Research Article

Evaluation of patient awareness of 4v and 9v HPV vaccines: A Turkish survey

Patient awareness of 4v and 9v HPV vaccines

Tugba Akcaoglu , Elif Ucar , Ozan Dogan

1-5

[PDF](#) 276 102 [Citations](#) 0

Published: 2025-01-31

Determination of nutritional status of children with autism spectrum disorder and the effect of nutrition education on families

Nutrition status of autistic children and family education

Ayse Gokce Alp, Ayla Gülden Pekcan

6-14

[PDF](#) 60 28 [Citations](#) 0

Case Report

A case of brachial artery pseudoaneurysm requiring endovascular therapy twice

Recurrence of brachial artery pseudoaneurysm

Eiji Koyama, Kazuki Tobita, Hirokazu Miyashita, Shigeru Saito

15-17

[PDF](#) 24 19 [Citations](#) 0



Content on this website is licensed under the [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 \(CC BY NC ND\)](#) license.

Evaluation of patient awareness of 4v and 9v HPV vaccines: A Turkish survey

Tugba Akcaoglu^{1,2}, Elif Ucar³, Ozan Dogan⁴

¹ Department of Plastic & Reconstructive Surgery, Johns Hopkins University, School of Medicine, Baltimore, Maryland, The United States of America

² Department of Obstetrics & Gynecology, Istanbul Medipol University, School of Medicine, Istanbul, Turkey

³ Private Esencan Hospital, Istanbul, Turkey

⁴ Department of Obstetrics & Gynecology, Istanbul Nisantasi University, School of Medicine, Istanbul, Turkey

ORCID of the author(s)

TA: <https://orcid.org/0000-0002-0354-3292>

EU: <https://orcid.org/0000-0001-5302-4688>

OD: <https://orcid.org/0000-0002-0016-8749>

Corresponding Author

Tugba Akcaoglu

Department of Plastic & Reconstructive Surgery, Johns Hopkins University, School of Medicine, Baltimore, MD, USA

E-mail: takcaog1@jh.edu

Ethics Committee Approval

The study was approved by the Istanbul Medipol University Ethical Committee (number 361) on April 13th, 2023.

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

Financial Disclosure

The authors declared that this study has received no financial support.

Previous Presentation

The abstract of this study was accepted as a poster presentation by the Scientific Programme Committee for the XXIV FIGO World Congress of Gynecology and Obstetrics. The poster was presented by the corresponding author at the congress, which was held at Paris Convention Centre in Paris, France on October 9th–12th, 2023. The abstract was published in the International Journal of Gynecology & Obstetrics, Volume 163, Issue S1 on October 8th, 2023. (<https://doi.org/10.1002/ijgo.15055>)

Published

2024 December 26

Copyright © 2025 The Author(s)



This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).

<https://creativecommons.org/licenses/by-nc-nd/4.0/>



Abstract

Background/Aim: The 9-valent (9v) Human Papillomavirus (HPV) vaccine was implemented in Turkey in December 2022 and has just started to be applied. The vaccine is intended to protect against diseases caused by Human Papillomavirus (HPV) Types 6, 11, 16, 18, 31, 33, 45, 52, and 58. Awareness of vaccines in Turkey can be improved through physicians' and health workers' efforts, social media and other communication channels.

Methods: To guide awareness-raising efforts pertaining to vaccines, we asked our patients who applied for the HPV vaccine at the beginning of 2023 to answer a questionnaire. The survey was prepared to reflect vaccine-related awareness levels of patients applying for the 4v and 9v HPV vaccines.

Results: It is noteworthy that the monthly income of patients applying for the vaccine was below the national average. Doubts about the effectiveness of the vaccine and levels of anxiety about its side effects are still high. Less than half of individuals who applied for vaccination received gynecological exams and regular Pap smears. Patients were largely unaware that there were different vaccines against HPV, that the 9v HPV vaccine provides better protection than the 4v HPV vaccine, and that everyone, both male and female, can be vaccinated and can benefit from HPV vaccines.

Conclusion: Our findings revealed the social aspects involved in raising levels of vaccine awareness throughout Turkey. Overall, people still have doubts and concerns about HPV vaccination, and they are clearly worried about side effects. Physicians can take these concerns into consideration while providing clinical counseling in order to inhibit the spread of disease.

Keywords: vaccination, human papillomavirus, awareness

Introduction

Vaccines against Human Papillomavirus (HPV) have been available in Europe since 2006. Vaccines are very effective at preventing infections and disease caused by different types of HPV. The combination of HPV vaccination and screening with HPV testing is the most effective approach to cervical cancer prevention [1]. However, hesitancy about vaccination is a global problem. With the HPV 9-valent (9v) vaccine accessible in Turkey as of 2023, efforts to raise awareness of vaccines among Turkish patients have accelerated. We asked 101 patients who applied for the HPV vaccine to answer a questionnaire; the goal was to better understand patient awareness levels of vaccines among patients who applied for the 4-valent (4v) and 9v HPV vaccines. We discuss our results in light of five topics: the demographics of the patients, their level of knowledge, their willingness to receive a vaccine, the factors that motivate them to receive a vaccine, and their awareness level of vaccines.

Materials and methods

A questionnaire was completed by 101 patients who visited the Obstetrics and Gynecology clinic for HPV vaccination beginning in 2023. Our goal was to determine patient awareness of different types of HPV vaccines. Patient awareness was evaluated based on the patients' demographics and their knowledge of cancer and cancer-screening methods. We also evaluated the patients' habits of receiving regular gynecological check-ups and their awareness of Pap smear screening.

We estimated study size assuming suitability for an exploratory investigation of awareness of HPV vaccines and related screening practices. While the sample was not large enough to draw highly complex statistical inferences, it is considered adequate for identifying trends and comparing awareness levels across different demographic groups. We expect that our findings will offer valuable insights that can guide further research and inform clinical practice, especially in the realm of improving HPV vaccination outreach and education.

Throughout the entire process of data collection and result evaluation, we took care to ensure that no potential sources of bias were present. Patients were selected based on their willingness to participate, and the data analysis was conducted in a systematic, objective manner. This protocol strengthens the reliability of our results; we expect that our cohort is a valid representation of the target population of HPV vaccine-seeking patients in this clinical setting.

Statistical analysis

The data obtained in the research were evaluated using IBM SPSS (version 22), and the categorical data were described as numbers and percentages. Our analytical approach involved several key steps to assess the relationships between demographic features and HPV vaccine awareness. We used descriptive statistics to summarize the participants' demographic characteristics, such as their age, education level, socioeconomic status, and geographic location. Comparative analysis was used to explore associations between these demographic variables and the participants' knowledge and attitudes toward HPV vaccination. We used the chi-squared test to determine the statistical significance of these associations, and we focused on categorical

variables such as patient age, vaccine awareness, education level, and knowledge about a vaccine's effectiveness. Additionally, we made use of cross-tabulation to visually explore relationships between two categorical variables. Doing so providing a more detailed understanding of how factors such as age, education, and income intersect with awareness and perceptions of HPV vaccination. This multi-faceted approach allowed us to thoroughly evaluate the factors influencing vaccine awareness in the surveyed population.

Results

Patient demographics

All 101 patients who participated in the survey were female. Five patients (5%) were under the age of 18, and 58 patients (57%) were between the ages of 18 and 30. Twenty-five patients (25%) were between the ages of 31 and 40, and 10 patients (9%) were 41–50 years old. Finally, two patients (2%) were 51 years or older.

The majority of the patients were high school graduates (n=40, 40%), and 32 patients (32%) had a college degree. There were 12 (12%) primary school graduates, 11 (11%) elementary school graduates, and 6 individuals (6%) with a higher education degree (MD/PhD).

The monthly income of the patients was mostly below 10,000 Turkish Liras (TL) (\$515 in US Dollars at that time) (n=74, 73%). Twenty-two patients (22%) had a monthly income of more than 10,000 TL, and only five patients (5%) had a monthly income above 20,000 TL (\$1,030 US Dollars at that time).

Furthermore, 97% of the patients (n=98) lived in a city; just 3% (n=3) lived in a rural area (Table 1).

Table 1: Demographics of the patients who applied for HPV vaccination

Demographic Features		n (%)
Age	Under 18	5 (5)
	18–30	58 (57)
	31–40	25 (25)
	41–50	10 (9)
	51 or over	2 (2)
Sex	Female	101 (100)
	Male	0 (0)
Education Level	Primary School	12 (12)
	Elementary School	11 (11)
	High School	40 (40)
	College	32 (32)
	MD/PhD	6 (6)
Monthly Income	Less Than 10,000 TL	74 (73.3)
	10,000–20,000 TL	22 (22)
	More Than 20,000 TL	5 (5)
Place of Residence	City/Urban	98 (97)
	Rural	3(3)

Level of Knowledge

More than half of the patients who came to get vaccinated (60%) knew that there were more than 200 types of HPV, and 88% of them knew that HPV strikes globally and can affect people of any age. The majority of the patients (78%) were aware that HPV is generally sexually transmitted. Most of the patients (70%) furthermore knew that HPV is a serious disease that can be deadly. There was the most confusion around the issue of whether HPV affects fertility. A little more than half of the participants (57%) thought that HPV affects fertility. And 78% of the respondents thought that having an HPV infection would increase health costs. The most well-known symptom of HPV is warts (condyloma), roughly 89% of the patients were aware of it. And 86% of patients knew that some types of HPV can cause cervical cancer. Roughly 85% of patients believed that vaccination can protect against HPV

infection. Finally, about 83% of patients thought that cervical cancer could be prevented via the widespread use of vaccines (Table 2).

Table 2: Patients' knowledge of HPV

Knowledge		n (%)
There are more than 200 types of HPV viruses.	Yes/No	61 (60) / 40 (40)
HPV infection can occur worldwide and can affect any age group.	Yes/No	89 (88) / 12 (12)
HPV is usually transmitted to humans by sexual contact.	Yes/No	79 (78) / 22 (22)
HPV can be deadly.	Yes/No	71 (70) / 30 (30)
HPV affects fertility.	Yes/No	58 (57) / 43 (43)
HPV infection increases healthcare costs.	Yes/No	79 (78) / 22 (22)
Warts (condyloma) can be seen in patients infected with HPV.	Yes/No	90 (89) / 11 (11)
Some types of HPV can cause cervical cancer.	Yes/No	87 (86) / 14 (14)
It is possible to prevent HPV with vaccination.	Yes/No	86 (85) / 15 (15)
Cervical cancer can be prevented with the widespread use of vaccines.	Yes/No	81(83) / 17 (17)

Willingness

We also explored the willingness of the patients for vaccination. Although this questionnaire was administered to patients who applied for the vaccine; it is noteworthy that 57% of patients remarked that they were unaware of the vaccine (Table 3). Only 23% of patients were vaccinated before the new vaccine type (9v) was implemented in Turkey. The fact that 31% of individuals believed that the vaccine had no benefit and 35% believed that it was not safe suggests that roughly one out of every three people is not eager for the vaccination. About half of the respondents (43%) answered "I doubt the vaccine is effective", which shows that the fraction of people unwilling to receive the vaccine might be even higher. Furthermore, more than half of the respondents (57%) who had been vaccinated were worried about possible side effects. Efforts should accordingly be made to inform patients with evidence-based scientific data.

Table 3: Patient willingness to be vaccinated

Willingness		n (%)
I am informed about the vaccine.	Yes/No	43 (43) / 58 (57)
I've had the HPV vaccine before.	Yes/No	23 (23) / 78 (77)
I think the vaccine is beneficial.	Yes/No	70 (69) / 31 (31)
I think the vaccine is safe.	Yes/No	66 (65) / 35 (35)
I doubt the vaccine is effective.	Yes/No	43 (43) / 58 (57)
I am concerned about the possible side effects of the vaccine.	Yes/No	58 (57) / 43 (43)

Motivating Factors

Our goal was to understand patient motivation for getting vaccinated. We observed that the majority of patients (73%) were informed by their doctors and health workers (Table 4). Social media, TV, and advertisements were considered by 12%, 5%, and 1% of patients, respectively. Additionally, 9% of patients received the vaccination on the basis of a friend's recommendation. Over half of patients (69%) agreed that the vaccine protects against both warts (condyloma) and cervical cancer, 17% thought it protected them only from cervical cancer, and 5% thought that it protected them only from warts (condyloma). Roughly 9% of participants did not think that the vaccine conferred any protection. About half of patients (57%) noted that their getting vaccinated would not also protect their partner.

Table 4: Factors that motivate patients to get vaccinated

Motivators		n (%)
Where did you learn about the vaccine?	Social Media	12 (12)
	TV	5 (5)
	Ads	1 (1)
	Doctors or health workers	74 (73)
	Friend	9 (8.9)
What does the vaccine protect against?	Condyloma	5 (5)
	Cervical cancer	17 (17)
	None	9 (9)
	All	70 (69)
Do you think getting vaccinated will also protect your partner?	Yes	43 (43)
	No	58 (57)

Awareness Levels

We also sought to determine patient awareness of the importance of regular gynecological follow-ups, screening tests, and different vaccines.

Over half of patients (61%) did not know whether there were different vaccines developed to protect against HPV (Table 5). Only 36% of the patients stated that they received regular gynecological check-ups, and only 16% noted that they underwent regular Pap smear test screening (25% of patients stated that they were not sexually active). The majority of patients (67%) did not know whether the 9v HPV vaccine was more effective at preventing infections than the 4v HPV vaccine. Roughly the same fraction of patients (65%) did not know that both men and women can be vaccinated and benefit from the vaccine.

Table 5: Awareness of patients about HPV vaccines

Awareness		n (%)
There are different vaccines developed to protect against HPV.	Yes	26 (26)
	No	13 (13)
	I don't know	62 (61)
I receive regular gynecological checkups.	Yes	36 (36)
	No	65 (64)
I get Pap smears regularly.	Yes	16 (16)
	No	60 (59)
	I'm not sexually active.	25 (25)
The 9v HPV vaccine is more effective at preventing infections than the 4v HPV vaccine.	Yes	26 (26)
	No	7 (7)
	I don't know	68 (67)
Both men and women can be vaccinated and can benefit from the vaccine.	Yes	26 (26)
	No	9 (9)
	I don't know	66 (65)

Discussion

The United Kingdom switched to the 9v HPV vaccine in 2021, and it has been shown that replacing the 4v HPV vaccine with the 9v HPV vaccine can prevent a significant number of HPV-related cases/deaths amongst both women and men. Furthermore, the switch remains cost-effective in the range of 9v HPV vaccine price premiums [2]. With clinicians promoting the 9v HPV vaccine in Turkey, we wished to investigate patient of awareness HPV vaccines objectively using a cross-sectional survey.

Australia is viewed as a world leader in HPV vaccination. It was the first country to implement a fully funded national HPV vaccination program for girls in 2007 and boys in 2013. Although the program is perceived as quite successful, measures to further increase its impact and reduce potential threats are considered important [3]. Since a similar program has not been financed yet in Turkey, the motivation for people to get vaccinated largely stems from physicians and healthcare professionals.

The American Academy of Pediatrics (AAP) recommends starting an HPV vaccine sequence between the ages of 9 and 12 [4]. Our study showed that the parties interested in such vaccines in Turkey are mostly adults. One explanation for

that fact is that adequate information about HPV is still available in Turkey to children and adolescents.

According to the results of randomized controlled studies conducted in female patients aged 20–45 in China, both the 4v and 9v HPV vaccines are highly immunogenic and generally well tolerated [5]. Although robust data supporting that finding exist, we still note hesitancy among patients in our clinical practices. The primary concerns of our patients about the effectiveness of the vaccine are consistent with the data gathered from this survey.

In a cross-sectional study conducted in Ethiopia, people were known to have low knowledge of and low levels of willingness to receive HPV vaccines. Healthcare professionals should increase publicity about vaccination and inform families [6]. In the United States, a cross-sectional study was designed to increase the level of HPV education and knowledge among students receiving medical and dental education [7]. Another survey in the United States of women of reproductive age revealed low levels of knowledge and HPV vaccination rates [8]. Additionally, a cross-sectional study of students' knowledge of HPV vaccines in Algeria revealed the importance of establishing a social education policy to combat HPV-related cancers, particularly cervical cancer, and implementing a national HPV vaccination program targeting youth [9]. In Romania, a questionnaire was designed to investigate the attitudes of parents, high school students, medical students, and doctors about HPV vaccine. It has been emphasized that a community's adherence to appropriate preventive programs and information provided by health professionals are essential elements for reducing the risk of HPV-related cancers. Teachers and doctors are viewed as providers of relevant information about HPV infections. In this regard, sexual education classes and parent-teacher meetings could help spread the word about the basic features of HPV infections and preventive measures [10]. On the other hand, a cross-sectional study conducted with university students in Morocco investigated knowledge and awareness of HPV infection and awareness of cervical cancer. The results reveal that the participants did not possess sufficient knowledge about HPV infection and its complications [11].

It is believed that one of the factors affecting the low vaccination rate in the United States is parental exposure to misinformation on social media. To investigate that issue, a cross-sectional survey of 1,192 people was conducted in North Texas. The research team found that there was a need for interventions to improve web-based health literacy skills so that parents can protect their families from misinformation and make informed health decisions [12]. In our evaluation of a limited number of patients, the small number of participants under the age of 18 and the fact that the responders were generally informed by healthcare professionals are remarkable as distinguishing features of our community.

In 2022, a survey was conducted with 1438 female university students from four cities in China. It was found that confidence in the efficacy of vaccines, the perception of the risk of being infected with HPV, the price, and the distance/time are the factors that affect vaccine hesitancy [13]. Based on our study results, despite the high level of knowledge about infections, vaccine hesitancy still remains.

Limitations

Our cohort was entirely female, and we were accordingly unable to compare our findings with those of a study conducted in Switzerland that determined that vaccine hesitancy was more prevalent in men [14]. Additionally, our data were insufficient to evaluate school-age children with the implementation of a school-based immunization program in Singapore, the HPV vaccine coverage there increased [15].

Furthermore, our data were all compiled from a single center and derived from a limited number of patients. Demographic data such as socioeconomic status could be included in future studies.

Proposal for future research

We recommend focusing on critical knowledge gaps, understanding demographic influences on vaccination rates, and identifying strategies to overcome hesitancy and promote long-term health compliance. By prioritizing both HPV vaccinations and subsequent preventive care, the findings could lead to significant improvements in public health outcomes, help reduce the burden of HPV-related cancers and improve overall health and wellness across diverse populations.

Conclusion

Our findings provide valuable insights that can inform clinical practice and public health strategies. Our results indicate that HPV vaccination is most common among individuals of reproductive age, as well as those with a high school or undergraduate level of education. Interestingly, the majority of individuals seeking the vaccine reported having an income below average levels, which highlights a potential correlation between socioeconomic status and vaccination-seeking behavior.

While the participants demonstrated a strong awareness of the risks associated with HPV, particularly in relation to genital warts and cervical cancer, they remained uncertain about the vaccine's effectiveness. Many individuals expressed concerns about the safety of the vaccine, with anxiety over possible side effects being notably high. Additionally, fewer than half of patients who had received the HPV vaccine reported receiving regular gynecological exams or Pap smears, which suggests a gap in ongoing preventive care following vaccination.

References

- Joura EA, Kyrgiou M, Bosch FX, Kesic V, Nieminen P, Redman CW, et al. Human papillomavirus vaccination: The ESGO-EFC position paper of the European Society of Gynaecologic Oncology and the European Federation for colposcopy. *Eur J Cancer*. 2019 Jul;116:21-26. doi: 10.1016/j.ejca.2019.04.032. Epub 2019 Jun 1. PMID: 31163338.
- Owusu-Edusei K, Palmer C, Ovcinnikova O, Favato G, Daniels V. Assessing the Health and Economic Outcomes of a 9-Valent HPV Vaccination Program in the United Kingdom. *J Health Econ Outcomes Res*. 2022 Jun 6;9(1):140-150. doi: 10.36469/001c.34721. PMID: 35795155; PMCID: PMC9170517.
- Swift C, Dey A, Rashid H, Clark K, Manocha R, Brotherton J, et al. Stakeholder perspectives of Australia's national HPV vaccination program. *Vaccines (Basel)*. 2022 Nov 21;10(11):1976. doi: 10.3390/vaccines10111976. PMID: 36423072; PMCID: PMC9692920.
- O'Leary ST. Why the American Academy of Pediatrics recommends initiating HPV vaccine at age 9. *Hum Vaccin Immunother*. 2022 Nov 30;18(6):2146434. doi: 10.1080/21645515.2022.2146434. Epub 2022 Nov 20. PMID: 36404635; PMCID: PMC9746363.
- Shu Y, Yu Y, Ji Y, Zhang L, Li Y, Qin H, et al. Immunogenicity and safety of two novel human papillomavirus 4- and 9-valent vaccines in Chinese women aged 20-45 years: A randomized, blinded, controlled with Gardasil (types 6/11/16/18), phase III non-inferiority clinical trial. *Vaccine*. 2022 Nov 15;40(48):6947-6955. doi: 10.1016/j.vaccine.2022.10.022. Epub 2022 Oct 22. PMID: 36283897.
- Mihretie GN, Liyeh TM, Ayele AD, Belay HG, Yimer TS, Miskr AD. Knowledge and willingness of parents towards child girl HPV vaccination in Debre Tabor Town, Ethiopia: A community-based cross-sectional study. *Reprod Health*. 2022 Jun

- 10;19(1):136. doi: 10.1186/s12978-022-01444-4. PMID: 35689288; PMCID: PMC9188100.
7. Thanasuwat B, Leung SOA, Welch K, Duffey-Lind E, Pena N, Feldman S, et al. Human papillomavirus (HPV) education and knowledge among medical and dental trainees. *J Cancer Educ.* 2022 Aug 25;1-6. doi: 10.1007/s13187-022-02215-2. Epub ahead of print. PMID: 36002641; PMCID: PMC9402407.
 8. Villavicencio A, Kelsey G, Nogueira NF, Zukerberg J, Salazar AS, Hernandez L, et al. Knowledge, attitudes, and practices towards HPV vaccination among reproductive-age women in a HIV hotspot in the US. *PLoS One.* 2023 Jan 19;18(1):e0275141. doi: 10.1371/journal.pone.0275141. PMID: 36656804; PMCID: PMC9851547.
 9. Bencherit D, Kidar R, Otmani S, Sallam M, Samara K, Barqawi HJ, Lounis M. Knowledge and awareness of Algerian students about cervical cancer, HPV, and HPV vaccines: A cross-sectional study. *Vaccines (Basel).* 2022 Aug 29;10(9):1420. doi: 10.3390/vaccines10091420. PMID: 36146498; PMCID: PMC9505646.
 10. Voidăzan TS, Budianu MA, Rozsnyai FF, Kovacs Z, Uzun CC, Neagu N. Assessing the level of knowledge, beliefs, and acceptance of HPV vaccine: A cross-sectional study in Romania. *Int J Environ Res Public Health.* 2022 Jun 6;19(11):6939. doi: 10.3390/ijerph19116939. PMID: 35682518; PMCID: PMC9180695.
 11. El Mansouri N, Ferrera L, Kharbach A, Achbani A, Kassidi F, Rogua H, et al. Awareness and knowledge associated with human papillomavirus infection among university students in Morocco: A cross-sectional study. *PLoS One.* 2022 Jul 8;17(7):e0271222. doi: 10.1371/journal.pone.0271222. PMID: 35802731; PMCID: PMC9269923.
 12. Thompson EL, Preston SM, Francis JKR, Rodriguez SA, Pruitt SL, Blackwell JM, et al. Social media perceptions and internet verification skills associated with human papillomavirus vaccine decision-making among parents of children and adolescents: Cross-sectional survey. *JMIR Pediatr Parent.* 2022 Sep 14;5(3):e38297. doi: 10.2196/38297. PMID: 36103216; PMCID: PMC9520398.
 13. Huang Y, Chen C, Wang L, Wu H, Chen T, Zhang L. HPV vaccine hesitancy and influencing factors among university students in China: A cross-sectional survey based on the 3Cs model. *Int J Environ Res Public Health.* 2022 Oct 28;19(21):14025. doi: 10.3390/ijerph192114025. PMID: 36360905; PMCID: PMC9657119.
 14. Kiener LM, Schwendener CL, Jafflin K, Meier A, Reber N, Schärli Maurer S, et al. Vaccine hesitancy and HPV vaccine uptake among male and female youth in Switzerland: A cross-sectional study. *BMJ Open.* 2022 Apr 21;12(4):e053754. doi: 10.1136/bmjopen-2021-053754. PMID: 35450894; PMCID: PMC9024257.
 15. Vijaya K, Goei AHY. Improved population coverage of the human papillomavirus vaccine after implementation of a school-based vaccination programme: The Singapore experience. *Singapore Med J.* 2022 May 13. doi: 10.11622/smedj.2022053. Epub ahead of print. PMID: 35546141.

Disclaimer/Publisher's Note: The statements, opinions, and data presented in publications in the *Journal of Surgery and Medicine (JOSAM)* are exclusively those of the individual author(s) and contributor(s) and do not necessarily reflect the views of JOSAM, the publisher, or the editor(s). JOSAM, the publisher, and the editor(s) disclaim any liability for any harm to individuals or damage to property that may arise from implementing any ideas, methods, instructions, or products referenced within the content. Authors are responsible for all content in their article(s), including the accuracy of facts, statements, and citations. Authors are responsible for obtaining permission from the previous publisher or copyright holder if re-using any part of a paper (e.g., figures) published elsewhere. The publisher, editors, and their respective employees are not responsible or liable for the use of any potentially inaccurate or misleading data, opinions, or information contained within the articles on the journal's website.

Determination of nutritional status of children with autism spectrum disorder and the effect of nutrition education on families

Ayşe Gökçe Alp ¹, Ayla Gülden Pekcan ²

¹ Department of Nutrition and Dietetics, Toros University, Mersin, Turkey

² Department of Nutrition and Dietetics, Lokman Hekim University, Ankara, Turkey

ORCID  of the author(s)

AGA: <https://orcid.org/0000-0001-9931-3362>

AGP: <https://orcid.org/0000-0002-2037-3037>

Corresponding Author

Ayşe Gökçe ALP

Toros University, Faculty of Health Sciences,
Department of Nutrition and Dietetics, 33140, Mersin,
Turkey

E-mail: dytagokcealp@gmail.com

Ethics Committee Approval

The study was approved by the Hasan Kalyoncu University Non-Invasive Research Ethics Committee on 02.05.2017, with reference number 2017-05.

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

Financial Disclosure

The authors declared that this study has received no financial support.

Previous Presentation

*This article is derived from the master thesis of the first author.

Published

2025 January 15

Copyright © 2025 The Author(s)



This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).
<https://creativecommons.org/licenses/by-nc-nd/4.0/>



Abstract

Background/Aim: Autism and autism spectrum disorder (ASD) are neurodevelopmental disorders that present with a wide range of behaviors and symptoms. These behaviors are lifelong and often lead to difficulties in social interaction, verbal and non-verbal communication, and repetitive actions. This study aimed to determine the nutritional status and anthropometric measurements of autistic children and to assess the impact of nutrition education provided to parents in a private education center in Gaziantep, Turkey.

Methods: A three-month intervention study was conducted at the Hasan Kalyoncu University Special Education and Research Centre on ten male and four female autistic children aged 4-9 years (7.2 ± 1.37 years). Nutrition education was provided to the families at the onset, as well as at the first, second, and third month marks. A questionnaire was employed to ascertain the demographic characteristics and dietary habits of the children. At the onset of the study and at the conclusion of the three-month intervention, the participants were asked to record their food intake over a seven-day period. Anthropometric measurements and body composition were evaluated at the beginning of the study and at months one, two, and three. The body mass index (BMI), waist-to-hip circumference ratio (WC), and waist-to-height ratio (WHtR) were calculated. At the conclusion of the study, the Children's Eating Behavior Inventory (CEBI) and the Gastrointestinal Severity Index (GI) questionnaires were administered to the families. The intake of energy, fiber, vitamins D, B₁, folate, iron, and calcium were found to be below the recommended daily allowances.

Results: The percentage of energy contribution from fat was found to be high. The mean change in the differences between height ($P=0.001$), body weight ($P=0.021$), hip ($P=0.001$), neck ($P=0.001$), and head circumferences ($P=0.004$), body fat mass ($P=0.001$), and body fat percentage ($P=0.001$) were found to be statistically significant within three months and at 4-6 years but not at 7-9 years. Overall, 53.1% of children had at least one gastrointestinal (GI) symptom. The mean GI score was 5.6. The most common symptoms were diarrhea (64.3%), flatulence (57.1%), abdominal pain (50.0%) and constipation (35.7%).

Conclusion: Numerous studies demonstrate that nutritional education can lead to significant positive outcomes for children with autism spectrum disorder (ASD). To maximize these benefits, it is essential to integrate dietitians into the support team, as they can greatly enhance families' understanding of the nutritional needs of autistic children. In this and similar studies, it is very difficult to control and regulate nutrition in children with autism, because despite all efforts, parents are often unable to control their children's nutrition due to tantrums and behavioral problems. It is imperative that doctors and parents work with nutritionists and dietitians to help these children stay fit and improve their quality of life by eating healthily.

Keywords: autism spectrum disorder, autism, nutrition education, nutritional status, anthropometry

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition that typically emerges in early childhood and affects social [1], communicative, and behavioral development. First described in 1943 by Leo Kanner, ASD is characterized by traits such as repetitive behaviors, social isolation, difficulty with verbal and non-verbal communication, and intense focus on specific interests [2]. The symptoms vary in severity and can range from mild to severe, affecting individuals differently over time. Terms like "autistic disorder," "Asperger's syndrome," and "high/low functioning autism" are used to describe various manifestations of ASD, but they do not necessarily reflect a child's abilities [3,4]. In Turkey, the term "autistic individual" refers to those with early childhood limitations in communication and social interaction, who require specialized education services [5].

The purpose of this study was to assess the nutritional status and anthropometric measurements of autistic children in a special education institution in Gaziantep, Turkey and evaluate the impact of nutrition education provided to their families [6]. The study aims to offer recommendations to improve the nutritional health of autistic children as part of a broader social responsibility initiative [7].

Researchers have investigated the impact of environmental factors on children with autism, in addition to genetic risks. These studies aim to understand the reasons behind the increase in autism diagnoses and determine potential solutions. One area of focus has been the composition of microbiota and microbial metabolites in children with autism, which have been found to be abnormal compared to typically developing children. Children with autism have also reported gastrointestinal disorders and food selectivity. Understanding the relationship between the microbiota-gut-brain axis and autism, as well as the connection between nutrition and autism, has provided a new perspective. It has been suggested that nutrition may play a role in the development of autism and could be an effective treatment by reducing symptoms [8]. Various nutritional approaches have been explored, including gluten-free and casein-free diets, ketogenic diets, antioxidant diets, Feingold diets, body ecology diets, elimination allergy diets, and vitamin and mineral supplements [9]. The aim of this study was to evaluate the nutritional status and anthropometric measurements of autistic children studying in a special education institution in Gaziantep and to determine the effect of nutrition education given to families. In line with the results obtained, it is aimed at developing suggested solutions for improving the nutritional status of autistic children and transform this into a social responsibility project.

Materials and methods

Research place, time, and sample selection

This research was conducted from May to December 2017. It was carried out with 14 children (ten boys, four girls) aged 4-9 years with autistic disorder. The study also included their families who were citizens of the Republic of Turkey and the children studying at Hasan Kalyoncu University Special Education and Research Centre in Gaziantep Province. The

research continued for three months for each child. This was an intervention study.

Ethical aspects of the study

Permission for the study was obtained from Hasan Kalyoncu University Non-Interventional Research Ethics Committee on February 05, 2017, number 2017-05. Permission was obtained from Gaziantep Metropolitan Municipality, where Hasan Kalyoncu University Special Education and Research Center is located.

Institution permission

Hasan Kalyoncu University Special Education Center was contacted during the design and planning stages of the study, and necessary permissions were obtained from the center director. Prior to the beginning of the study, the center secretary was contacted, and special appointments were made for the parents. Children and parents were not taken out of the center during the study.

Family information and consent form

Since children constituted the sample in the study, the "Family Information and Consent Form" was explained to the families before the study, and they signed it in agreement. In the center where the study was conducted, the patients were given preliminary information about the research, and the study was continued with the parents and children who wanted to stay until the completion of the study.

Population and sample of the study

The study was conducted on ten boys and four girls who were diagnosed with autism by a physician at Hasan Kalyoncu University Special Education and Research Centre. The prevalence of autism spectrum disorder is one to two per thousand people. The autism spectrum spans a wide range, exhibiting large differences between individuals. This makes it difficult to homogenize the sample, as different subgroups (e.g., mild autism and severe autism) may need to be studied separately. Since most individuals with autism are children, ethical guidelines require parental consent for individuals to participate in research. This is another factor that limits the sample size. In addition, the sensitivity and special needs of individuals with autism may limit participation in research. Although the subheadings of autism vary, behavioral differences make it difficult to work in a large sample. Therefore, the sample size in this study is limited, as is the case in similar studies. At the same time, the parents of the children were trained four times (at baseline, first, second, and third months) on healthy eating, and behavioral changes of children were determined.

Data collection materials

A questionnaire was completed by the parents of the children regarding demographic characteristics and eating habits. Anthropometric measurements of the individuals were assessed, using the Children's Eating Behavior Inventory (CEBI) [10] and the Gastrointestinal Severity Index (GI Severity Index) [11]. The CEBI is a questionnaire that can be answered by families in approximately 15 minutes. It includes a total of 40 eating and meal-related questions, which are scored on a 5-point Likert scale (never, rarely, occasionally, frequently, and always). A total score of 41 points or more was defined as an eating problem. The GI severity index is a 0 to 17-point assessment. A score of seven or above indicates severe symptom status in the child. Along this

line, the occurrence of GI symptoms in children was determined through consultation with the families. The 24-hour food consumption records of the children were taken. Before starting the study, consent was obtained using a volunteer information form.

Questionnaire Form

At the beginning of the study, general information, including characteristics of the individuals (age, gender, history of obesity, diseases, etc.), eating habits (number of main and intermediate meals, skipping meals, food preferences, etc.), the CEBI, and the GI Severity Index questionnaires were applied.

Children’s Eating Behavior Inventory

The Children’s Eating Behavior Inventory is the most comprehensive assessment tool used to detect eating behavior in children. In the adaptation study, it was shown that the factor structure, validity, and reliability of the Turkish adaptation of the CEBI were compatible with the original study of Wardle et al. [10]. This Likert-type questionnaire consists of 8 subscales and 35 questions regarding malnutrition, food selectivity, and eating behavior habits in children. It was adapted for Turkish children in 2011.

24-Hour Food Consumption Record

At the beginning of the study and again following the nutrition education given to the parents (at the third month), 24-hour food consumption records of children were assessed for seven consecutive days. Average daily energy and nutrient intake and average daily food consumption amounts were calculated from the 7-day, 24-hour food consumption records and repeated twice [12]. Daily energy and nutrient intake were evaluated according to the results of the Turkish Nutrition Guideline-2015 (TÜBER-2015) [13]. Recommended daily energy and nutrient reference values according to age and gender are provided in Table 1.

Table 1: Reference Values for Daily Energy and Nutrient Intakes (TÜBER 2015) [13]

Energy and Nutrients	E	Age (year)					
		4	5	6	7	8	9
Energy (kcal) K		1235	1307	1380	1456	1534	1615
	E	1157	1224	1286	1352	1428	1517
Protein (g) K		13.8	15.5	18.0	20.4	23.0	25.9
Protein E%		5-20	5-20	5-20	5-20	5-20	5-20
Oil(g)		35-45	35-45	35-45	35-45	35-45	35-45
Saturated fat (g)		<7%	<7%	<7%	<7%	<7%	<7%
DPN (g)		<14%	<14%	<14%	<14%	<14%	<14%
CSA(g)		<10%	<10%	<10%	<10%	<10%	<10%
Oil E%		20-35	20-35	20-35	20-35	20-35	20-35
Cholesterol (mg)		300	300	300	300	300	300
Carbohydrate (g)		130	130	130	130	130	130
Carbohydrate E%		45-60	45-60	45-60	45-60	45-60	45-60
Pulp (g)		14	14	14	16	16	16
Vitamin A (mcg)		300	300	400	400	400	400
Vitamin E (mg)		9	9	9	9	9	9
Vitamin D (mcg)		15	15	15	15	15	15
Vitamin B1 (mg)		0.6	0.6	0.6	0.6	0.6	0.9
Vitamin B2 (mg)		0.6	0.6	0.6	0.6	0.6	0.9
Niacin (mg)		6.7	6.7	6.7	6.7	6.7	6.7
Vitamin B6 (mg)		0.6	0.6	0.6	0.6	0.6	1
Folate (mcg)		140	140	140	200	200	200
Vitamin B12 (mcg)		1.5	1.5	1.5	1.5	1.5	1.5
Vitamin C (mg)		30	30	45	45	45	45
Calcium (mg)		800	800	800	800	800	800
Magnesium (mg)		230	230	230	230	230	230
Iron (mg)		7	7	7	11	11	11
Zinc (mg)		5.5	5.5	5.5	7.4	7.4	7.4

Anthropometric Measurements

Height, body weight, waist, hip, and neck circumferences of the children were measured at the onset of the study and body composition (body fat percentage, body fat mass) was determined by a bioelectrical impedance analysis (BIA) using the Tanita model. Anthropometric measurements and body composition

determinations were repeated at baseline, and at the first, second, and third months. Body mass index, waist/hip circumference ratio, waist circumference/height ratio were calculated [12].

Statistical analysis

Descriptive statistics were given as number (n) and percentage (%) for categorical variables, mean (\bar{x}), standard deviation (SD) and median values for numerical variables. Analyses were performed using SPSS 22 for windows. $P < 0.05$ was considered significant. The suitability of the variables for normal distribution was tested using the Shapiro-Wilk test. The student’s t-test was used two independent groups for normally distributed variables and the Mann-Whitney U test compared non-normally distributed variables in two groups. The paired t-test was used to compare normally distributed dependent measurements, and the chi-square test compared categorical variables. The Computer Assisted Nutrition Program, Nutrition Information Systems Package Program (BEBIS) computer version was used in the evaluation of food consumption [14].

Results

Energy and Nutrient Intakes of Children

When children in both age groups were analyzed in terms of nutrient consumption, the consumption of foods in the milk and yogurt group increased in both the 4-6 and 6-9 age groups in the third month of nutrition education compared to the baseline. Likewise, there was an increase in meat and cheese consumption compared to baseline.

In the legume group, a decrease was observed in both age groups in the third month. The number of oilseeds decreased in the 4-6 age group and increased in the 6-9 age group.

Similarly, bread consumption decreased in the 4-6 age group and increased in the 6-9 age group (Table 2).

Table 2: Energy and Nutrient Intakes of Children for 4-6 years

Nutrients	average	Startup		average	3.months	
		SD	median		SD	median
Milk and dairy products						
Milk	86.7	17.69	97.5	104.5	66.94	100.0
Yogurt	26.7	17.45	31.0	24.6	21.75	23.0
Cheese-cottage cheese	6.5	3.59	8.0	6.4	4.03	8.5
meat, eggs, (legumes, oilseeds						
Red meat	6.1	8.06	2.5	12.5	12.78	9.0
Chicken, turkey, etc.	9.0	13.67	0.0	4.8	7.45	0.0
Fish meat	0.0	0.00	0.0	0.0	0.00	0.0
Offal	1.7	2.61	0.0	1.5	3.35	0.0
Egg	18.6	4.89	21.0	22.3	6.29	26.0
Dried legumes	14.0	13.25	9.5	8.0	9.19	5.5
Oilseeds	2.1	3.58	0.5	1.4	1.26	1.0
Bread and cereals						
Bread	29.1	5.44	32.0	19.4	12.79	14.5
Other cereals	0.0	0.00	0.0	0.0	0.00	0.0
Fresh vegetables and fruits						
Green leafy vegetables	5.3	7.50	2.5	5.9	5.02	4.5
Other vegetables	0.2	0.37	0.0	2.0	3.21	0.5
Potato	14.5	15.27	9.0	21.5	15.28	25.0
Citrus fruits	1.5	1.71	1.0	11.5	16.24	5.0
Other fruits	24.1	24.40	17.5	26.9	24.40	24.0
Fats and sugars						
Total oil	13.0	2.21	14.0	18.4	5.83	21.0
Total solid fat	4.6	1.83	5.0	3.9	0.94	4.0
Margarine	1.3	1.80	0.5	3.2	1.26	3.5
Butter	3.4	1.97	3.5	0.8	0.69	1.0
Sugar	5.0	1.12	6.0	8.8	5.59	8.5
honey jam molasses	5.0	1.12	6.0	6.3	3.65	5.0
Drinks						
Water	659.1	122.65	677.0	635.9	129.95	710.0

Assessment in Terms of Energy and Nutrients

For the 4-6 year group:

Children's energy and nutrient intakes were assessed using seven-day food consumption records at both the beginning and the end of the third month of the study. Children's average daily energy intake at the start of the study was 971.8±197.49 kcal, while at three months, it was 954.5±209.83 kcal. These intakes represented 64.7% and 63.6% of the recommended daily energy intake.

At both baseline and three months, the recommended daily intake of protein, vitamins A, E, B2, B6, B12, and zinc were adequate for the children. However, the requirements for energy, vitamins D, B1, niacin, folic acid, vitamin C, calcium, and iron were unmet (Table 2).

For the 6-9 year group:

At the beginning of the study, the mean daily energy intake of the children was 845.9±192.24 kcal, which met 56.4% of the recommended daily energy consumption. By the third month of the study, the mean daily energy intake had decreased slightly to 833.9±144.37 kcal, meeting 55.6% of the recommended intake.

Both the daily recommended intake of protein and vitamins A, E, B2, B6, and B12 were met at baseline and after three months. However, the requirements for vitamins D, B1, niacin, folic acid, vitamin C, and minerals such as calcium, iron, and zinc were not met (Table 3).

Table 3: Energy and Nutrient Intakes of Children for 6-9 years

Nutrients	Startup			3.months		
	average	SD	median	average	SD	median
Milk and dairy products						
Milk	88.5	35.72	86.0	64.1	37.25	58.0
Yogurt	16.6	13.61	15.5	23.2	28.99	9.0
Cheese-cottage cheese	5.7	7.40	2.0	7.1	5.49	7.5
meat, eggs, legumes, oilseeds	5.5	6.26	3.0	6.0	6.21	5.0
Red meat	3.5	5.02	0.0	3.9	5.49	0.0
Chicken, turkey, etc.	0.00	0.00	0.0	0.0	0.00	0.0
Fish meat	0.5	1.32	0.0	0.8	1.64	0.0
Offal	24.2	10.36	23.0	25.3	8.28	29.0
Egg	12.0	15.98	6.5	8.1	8.87	7.5
Dried legumes	1.0	1.32	0.5	1.7	2.38	0.5
Oilseeds						
Bread and cereals	28.1	8.84	34.0	33.2	9.25	34.0
Bread	0.00	0.00	0.0	0.0	0.00	0.0
Other cereals						
Fresh vegetables and fruits	3.6	2.90	3.5	1.6	1.32	1.5
Green leafy vegetables	0.1	0.33	0.0	0.2	0.43	0.0
Other vegetables	15.9	16.36	13.5	24.4	14.93	28.0
Potato	1.8	2.32	1.0	4.8	9.62	1.0
Citrus fruits	21.8	13.58	22.5	42.8	35.24	43.0
Other fruits						
Fats and sugars	16.5	9.14	15.0	12.2	5.29	12.5
Total oil	3.9	2.71	3.5	6.3	2.54	6.5
Total solid fat	2.3	1.65	2.0	2.7	1.36	2.5
Margarine	1.7	1.92	1.5	3.7	2.09	4.0
Butter	7.1	6.34	6.0	7.1	5.12	7.5
Sugar	7.1	6.34	6.0	5.6	4.31	5.0
honey jam molasses						
Drinks	714.8	102.82	783.0	682.3	190.9	720.5

Anthropometric Measurements

According to the results of the study, significant changes were observed in height ($P<0.001$; $P=0.011$) and body weight ($P=0.002$; $P=0.021$) at the first, second, and third months for the

4-6 years and 7-9 years age groups compared to the baseline values. No significant changes were found between the mean baseline values of BMI and the other months of measurements ($P=0.261$; $P=0.652$) When compared with the baseline values, a significant ($P=0.006$; $P<0.001$) change was observed in hip circumference values in both the 4-6 and 7-9 age groups. When waist hip ratio baseline values were compared with other months, no significant change was observed in the 4-6 age group ($P=0.628$), but a significant change was observed in the 7-9 age group ($P=0.04$). When the mean values of waist-height ratios at baseline were compared with the other months, no significant change was observed in either age group ($P=0.797$; $P=0.608$). The mean neck circumference when compared with baseline values with first, second, and third month values ($P=0.002$) and head circumference ($P=0.001$; $P=0.004$) change values were found to be significant.

The mean values of body fat percentage were compared with the values of the other months and significant changes were observed in both age groups ($P<0.001$ and $P=0.002$, respectively). The mean baseline values of body fat mass were the same as the other months and significant changes were observed in both age groups ($P<0.001$ and $P<0.001$, respectively) (Table 4).

Table 4: On the 3rd Month: Distribution of Anthropometric Measurements of Children According to Z-Score Values (%)

Age Group (years)	n	Very weak/ stunted ≥ -2SD < -2SD	Weak/ Stunted ≥ -1SD < -1SD	Normal ≥ -1SD < -1SD	Overweight/ long ≥1SD <2SD	Obese/ very long ≥2SD
Body weight for age (%)						
4-6	6	-	-	1	5	-
7-9	8	-	2	4	2	-
Total	14	-	2	5	7	-
Height for age (%)						
4-6	6	-	-	1	3	2
7-9	8	1	-	3	3	1
Total	14	1	-	4	6	3
Body mass index for age (%)						
4-6	6	-	1	2	3	-
7-9	8	-	3	4	1	-
Total	14	-	4	6	4	-

Body Weight for Age, Height for Age, and BMI for Age

At the beginning of the study, we evaluated the body weight, height, and BMI according to the age of all participating children. Initially, one child was classified as very underweight (below -2 SD); two were underweight (greater than or equal -2 SD); five were of average weight; and six were slightly obese based on body weight z-score values. In terms of height z-scores, one child was found to be very short (stunted), five were short, seven were average, and one was tall. According to BMI values for age, one child was underweight, seven were average, and six were slightly obese (Table 1).

At the end of the third month, we reassessed all the children. According to the updated body weight z-score values, two children were underweight, five were average, and seven were slightly obese. For height z-scores, one child remained very short, three were average, five were tall, and five were very tall. Finally, based on BMI values for age, four children were underweight, six were average, three were slightly obese, and one was classified as obese (Table 5).

In this study, nutritional education was provided to the children and their families for three months. In autistic children, families have difficulties in directing their children toward healthy nutrition. It is necessary to change food selectivity in children. When compared with the baseline values at the first, second, and

third months in all children, in the 4-6 and 7-9 year age groups, the study assessed height at ($P<0.001$); body weight ($P=0.006$; $P<0.001$); hip circumference ($P=0.002$; $P=0.021$); neck circumference ($P=0.002$); head circumference ($P=0.001$; $P=0.004$); and body fat percentage ($P<0.001$). When waist-hip ratio baseline values were compared with other months, no significant change was observed in the 4-6 age group ($P=0.628$), but a significant change was observed in the 7-9 group ($P=0.04$

No significant change was found between the mean baseline values of BMI ($P=0.261$; $P=0.652$) and the waist-height ratio ($P=0.797$; $P=0.608$) in the 4-6 and 7-9 age groups, respectively, compared with the baseline values in the first, second, and third months in all children.

Gastrointestinal Severity Index (GI Severity Index)

According to the Gastrointestinal Severity Index results of the study, 53.1% of the children had at least one GI system symptom. The mean GI system score was 5.6 points per child (≥ 7 points for severe conditions). The most common symptoms in children were diarrhea (64.3%), flatulence (57.1%), abdominal pain (50.0%), and constipation (35.7%) (Table 5).

Table 5: Statistical Evaluation of Changes in Anthropometric Measurements of Children at Baseline and 1st, 2nd and 3rd Months According to Age Groups

Anthropometric measurements	Boy-Girl	
	4-6 years <i>P</i> -value	7-9 years <i>P</i> -value
Height length		
Start - Month 1	<0.001	<0.001
Start - Month 2	<0.001	<0.001
Start - Month 3	<0.001	<0.001
Body Weight		
Start - Month 1	0.002	0.021
Start - Month 2	0.002	0.021
Start - Month 3	0.002	0.021
BKI		
Start - Month 1	0.261	0.652
Start - Month 2	0.261	0.652
Start - Month 3	0.261	0.652
Waist Circumference		
Start - Month 1	<0.001	0.002
Start - Month 2	<0.001	0.002
Start - Month 3	<0.001	0.002
Hip Circumference		
Start - Month 1	0.006	<0.001
Start - Month 2	0.006	<0.001
Start - Month 3	0.006	<0.001
Waist / Hip Ratio		
Start - Month 1	0.628	0.040
Start - Month 2	0.628	0.040
Start - Month 3	0.628	0.040
Waist to Height Ratio		
Start - Month 1	0.797	0.608
Start - Month 2	0.797	0.608
Start - Month 3	0.797	0.608
Neck Circumference		
Start - Month 1	0.002	0.002
Start - Month 2	0.002	0.002
Start - Month 3	0.002	0.002
Head circumference (cm)		
Start - Month 1	<0.001	0.004
Start - Month 2	<0.001	0.004
Start - Month 3	<0.001	0.004
Body Fat Percentage		
Start - Month 1	<0.001	<0.001
Start - Month 2	<0.001	<0.001
Start - Month 3	<0.001	<0.001
Body Fat Mass		
Start - Month 1	<0.001	<0.001
Start - Month 2	<0.001	<0.001
Start - Month 3	<0.001	<0.001

The mean GI score was 5.6 points. The most common symptoms in children were diarrhea (64.3%), flatulence (57.1%), abdominal pain (50.0%), and constipation (35.7%). The proportion of children with 0-1 bowel movements per day was 35.7%, and the proportion with 2-3 bowel movements per day was

64.3%. None of the children had four or more bowel movements per day.

The proportion of children with normal stool density was 78.6%; the proportion of children with watery stools was 21.4%; and none of the children had very watery stools. The proportion of children with normal fecal odor was 14.3%, 64.3% had foul odor, and none had very foul odor. Abnormal odors were determined in 21.4% of the children.

The percentage of children with normal flatulence was 42.9%. Those with flatulence more than three days a week was 42.9%, and the proportion of children with daily flatulence was 14.2%. Fifty percent of the children had no complaints of abdominal pain, 42.9% had moderate pain, and 7.1% had moderate to severe pain. While 35.7% of the children had no complaints of unexplained daytime irritability, 57.2% of the children reported having this one to two times weekly, while 7.1% of the children indicated having this three or more times a week. While 78.6% of the children never woke up at night, the proportion of those who woke up one to two times a week was 21.4%. A total of 14.2% of the children had problems with abdominal cramps (Table 6).

Table 6: Gastrointestinal Severity Index Scoring of Children and Distribution of Children according to Symptoms

Gastrointestinal Severity Index	Score	Number of children	%	Score	
Symptoms					
Constipation	>5 times stool/week	0	1	7.1	0.0
	3-4 times stool/week	1	8	57.2	0.6
	0-2 stools/week	2	5	35.7	0.7
				1.3	
Diarrhea	Average	0	5	35.7	0.0
	Stool 0-1 times daily	1	9	64.3	0.6
	Stool 2-3 times daily	2	0	0	0.0
				0.6	
Average fecal density	4 or more stools per day	0	11	78.6	0.0
	Average	1	3	21.4	0.2
	Normal	2	0	0	0.0
				0.2	
Fecal odor	Watery	0	2	14.3	0.0
	Very watery diarrhea	1	9	64.3	0.6
	Average	2	3	21.4	0.4
				1.0	
Stomach gas	Normal	0	6	42.9	0.0
	Scented	1	6	42.9	0.4
	Abnormal odor	2	2	14.2	0.3
				0.7	
Abdominal pain	Average	0	7	50.0	0.0
	Normal	1	6	42.9	0.4
	More than 3 days a week	2	1	7.1	0.2
				0.6	
Unexplained daytime irritability	Frequency per day	0	5	35.7	0.0
	Average	1	8	57.2	0.5
	Nothing.	2	1	7.1	0.2
				0.7	
Night awakening	Moderate pain	0	11	78.6	0.0
	Moderate to severe pain	1	3	21.4	0.2
	Average	2	0	0.0	0.0
				0.2	
Abdominal stiffness	Nothing	0	12	85.8	0.0
	1-2 times/week	1	2	14.2	0.1
	3 or more/week				0.1
Severity Index		0	60	46.9	0.0
		1	54	42.2	3.7
		2	14	10.9	1.9
Total			128	100.0	5.6

Since the GI Severity Index questionnaire was administered only once at the beginning of the study, no statistical interpretation could be made about how gastrointestinal complaints had changed by the end of the study. Considering the opinions of parents, especially the mothers, it can be said that diarrhea and vomiting decreased in children after nutrition education; accordingly, food rejection disappeared, and food diversity increased.

Children's Eating Behavior Inventory (CEBI)

The CEBI shows the distribution of eating and meal-related problems. According to CEBI scoring, children often and always had eating problems. The proportion of those who stated that they were not able to receive the program was determined to be 30.5%. The total score was 102.8 points.

The mean CEBI scores of girls were higher than boys in terms of negative eating behaviors during meals, but this difference was not statistically significant ($t = -1.426$; $P = 0.179$). In terms of negative eating behavior outside mealtimes, the mean scores of girls were higher than boys, but this difference was not statistically significant ($t = -0.287$, $P = 0.779$). In regard to maternal opinions and behaviors, the mean scores of girls were higher than boys, but this difference was not statistically significant ($t = -0.381$; $P = 0.710$). In terms of children's behavior during meal preparation, the mean scores of girls were higher than boys, but this difference was statistically significant ($t = -0.769$; $P = 0.457$). The mean score of girls in terms of negative situations occurring during meals was significantly higher than the mean score of boys ($t = 2.718$; $P = 0.019$).

According to Table 2 regarding the relationship between nutrients and CEBI, there was no statistically significant relationship between energy and CEBI scores. However, there was a statistically significant correlation between the percentage of energy from protein and positive eating behavior ($r = -0.632$, $P < 0.05$) and negative eating behaviors during meals ($P = 0.632$, $P < 0.05$). There was a statistically significant inverse relationship between vitamin B₁₂ and positive eating behavior ($r = -0.614$, $P < 0.05$) (Table 7).

In terms of positive eating attitude, the mean score of the 7-9 age group was higher than that of the 4-6 age group, but this difference was not statistically significant ($t = -0.574$; $P = 0.576$). In regard to negative eating behaviors during meals, the mean score of the 4-6 age group was higher than the 7-9 age group, but this difference was not statistically significant ($t = 0.349$; $P = 0.733$).

In terms of negative eating behavior outside mealtimes, the mean scores of the 4-6 age group were higher than the 7-9 age group, but this difference was not statistically significant ($t = 0.349$; $P = 0.733$) (Table 7).

Table 7: Comparison of CEBI Scores of Children According to Age Groups

	Age (year)	n	median	SD	t test	P-value
Positive eating behavior	4-6	6	3.50	0.713	-0.574	0.576
	7-9	8	3.75	0.867		
Negative eating behavior during meals	4-6	6	1.83	0.667	0.349	0.733
	7-9	8	1.73	0.454		
Negative eating behavior outside mealtimes	4-6	6	2.33	0.333	0.395	0.700
	7-9	8	2.25	0.427		
The mother's opinion and behavior	4-6	6	3.14	0.488	0.622	0.546
	7-9	8	2.98	0.467		
Preparing the child's food	4-6	6	2.83	0.279	0.661	0.521
	7-9	8	2.58	0.886		
Behavior during	4-6	6	1.50	0.548	0.473	0.645*
	7-9	8	1.38	0.443		

t test, * $P < 0.05$

Table 8 displays the correlation between nutrients and CEBI sub-dimensions, as well as the GI severity index. Based on the information provided in the table, it is evident that there is no statistically significant relationship between energy intake and CEBI scores. However, there are statistically significant relationships between the percentage of energy derived from protein and both positive eating behavior ($r = -0.632$, $P < 0.05$) and

negative eating behavior during meals ($r = 0.632$, $P < 0.05$). Additionally, there is an inversely significant relationship between vitamin B₁₂ intake and positive eating behavior ($r = -0.614$, $P < 0.05$) as shown in Table 8.

Table 8: Relationship Between Nutrients and CEBI Sub-dimensions and GI Severity Index

Nutrients	Positive Eating Behavior	Negative eating behavior during meals	Negative behaviors outside of mealtime	Mother's views and behaviors	Child's food preparation behaviors	Negative situations that occur during meals
Energy	-0.225	-0.066	-0.064	0.029	-0.181	-0.124
Protein	-0.422	0.199	0.057	0.210	-0.219	0.002
Protein %	-0.632*	0.621*	0.454	0.429	-0.039	0.235
Fat	-0.382	0.203	-0.103	0.213	-0.269	0.009
Fat %	-0.131	0.186	-0.358	0.231	-0.242	0.122
CHO	-0.016	-0.337	0.023	-0.303	-0.124	-0.284
CHO %	0.358	-0.452	0.129	-0.402	0.363	-0.225
Fiber	-0.377	-0.109	-0.277	-0.055	-0.341	-0.054
Vitamin A	-0.281	0.235	0.410	0.509	-0.097	-0.174
Vitamin E	-0.257	-0.122	-0.377	-0.258	-0.405	-0.249
Vitamin D	-0.136	-0.106	-0.253	0.067	-0.080	-0.365
Thiamin	-0.372	-0.136	-0.242	-0.011	-0.270	-0.040
Riboflavin	-0.660*	0.202	0.028	0.082	-0.413	-0.061
Niacin	-0.373	0.099	-0.060	0.190	-0.163	0.080
Vitamin B6	-0.375	-0.016	-0.178	0.131	-0.167	0.157
Folate	-0.377	-0.122	-0.365	-0.044	-0.355	-0.113
Vitamin B12	-0.614*	0.484	0.030	0.332	-0.389	0.084
Vitamin C	-0.288	0.063	0.002	0.370	-0.052	0.239
Calcium	-0.364	-0.029	0.250	0.115	-0.337	-0.230
Magnesium	-0.404	-0.093	-0.158	0.029	-0.224	-0.002
Iron	-0.451	-0.029	-0.153	0.109	-0.271	0.089
Zinc	-0.518	0.190	0.125	0.1510	-0.298	0.014

Spearman Coefficient of Rho, * $P < 0.05$

Discussion

Numerous studies have been conducted to evaluate the anthropometric measurements, eating habits, and diet quality of children diagnosed with autism spectrum disorder (ASD) [3,8,13]. Nutritional therapies, as well as alternative and complementary therapies, are often utilized to address autism and its associated symptoms in children [15-23]. However, there has been no research focused on the eating habits and anthropometric measurements of autistic children in Gaziantep.

This study aimed to assess the food consumption patterns and anthropometric measurements of children aged 4 to 9 years with autistic disorder who attend a special education center in Gaziantep Province. Additionally, a three-month nutrition education program was provided to the families of these children to help define their nutritional status and evaluate the impact of the instruction.

Nutrition education for both the child and their family is crucial for children with autism [24]. This research is significant as it serves as a preliminary study to identify the nutritional challenges faced by autistic children in Turkey.

Energy and Nutrient Intakes of Autistic Children

Various studies have been conducted to determine the intake of macro and micronutrients, which have separate functions in the functioning of the human body [25-32]. In this study, children's energy and nutrient intakes were evaluated by using seven-day food consumption records, at the beginning and at the end of the third month.

Milk and yogurt consumption at baseline and at three months were 113.4 mL and 129.4 mL, respectively, in children aged 4-6 years. The consumption of cheese was very low. In the 7-9 age group, it was 105.1 and 87.3 mL, respectively. Cheese consumption was also very low in children aged 7-9 years. Consumption of fresh vegetables and fruits were inadequate in children aged 4-6 and 7-9 years according to Türkiye Nutrition

Guide (TUBER) [13]. According to the TUBER recommendations, children aged 4-6 and 7-9 years should consume 2.5 and 3 portions of milk and milk products, respectively; meat and meat products, eggs and legumes, 1.0-1.5 and 1.5 servings, respectively; vegetables, 2 and 2-2.5 servings, respectively; and fruits 1.5 and 2 servings, respectively. It is also recommended that children consume 2.5-3 and 3-4 servings of bread and cereals daily. In this study, all age groups' food consumption were below the daily recommended amounts.

Cermak et al. [24], in a systematic review, reported that early childhood is a period of recognizing new foods, tastes, and foods with structural differences. It has also been stated that parents of autistic children often describe their children as "picky eaters", that is, they refuse to consume various foods. It has also been emphasized that this selectivity in children with autism is even stricter in early childhood. Zimmer et al. [25] found that the selective attitudes of autistic children toward food had a statistically significant effect on nutrient deficiency. When healthy developing children are compared with autistic children, it is stated that food intake and inadequate nutrient intake are affected by many factors in autistic children. They found that the consumption of protein, calcium, vitamin D and vitamin A in autistic children was insufficient for their needs, and their magnesium intake was above the need compared to healthy children. Selective nutrition was considered insufficient in food variety, consumption of energy-dense foods, intake of fresh vegetables and fruits, and excessive in consumption of sugar-sweetened beverages. Sun et al. [26] conducted a study on 53 controls and 53 autistic children aged 4-6 years and determined that the intake of vitamins A, B6, zinc, and calcium was 80% less than the requirement in both groups of children. Although vitamin C and calcium consumption were insufficient in both groups, it was found to be significantly lower in autistic children than in healthy children. Serum zinc levels were found to be lower than average in both groups. Serum calcium, vitamin A and folate levels were also significantly lower in children with autism than in the control group.

Herndon et al. [27] conducted a study in children with autism and control group. They reported that children with autism consumed less vitamin B6 and E, less milk and dairy products, and less calcium. It was suggested that intake was especially low when a gluten-free, casein-free (GFCF) diet was applied. In both control and autistic children, it was reported that they could not meet the daily requirement especially in this case and their daily intake of fiber, calcium, vitamin B6, iron, vitamin E, and vitamin D was low. These data concur with the results of this study.

In a study conducted by Attlee et al. [28] with 23 autistic children, it was determined that 84.2% of the children were malnourished according to dietary reference intake (DRI) in terms of energy, 42.1% protein and iron, 73.7% carbohydrate, 84.2% fat, 94.7% fiber and vitamin A, 100.0% vitamin D and calcium, and 78.9% vitamin C intake. All study data are similar to the results of this study.

Bat [29] found that zinc deficiency was not observed in 50 autistic children between the ages of 6 and 15 in Turkey, and that zinc intake was more than needed for children aged 7-9 (171.0%). It was 84.0% for ages 10-13 and 87.0% for ages 14-15. Calcium deficiency was mostly seen in girls aged 9-13 years,

while 74.0% of calcium requirements were met in children aged 7-9 years. Johnson et al. [30] found that autistic children consumed significantly insufficient vitamin K compared to the control group in their study with 19 autistic and control groups. Bandini et al. [31] conducted a study with 53 autistic children and found that the children's consumption of vitamin D, vitamin E and calcium was insufficient. They found a significant deficiency in calcium and vitamin D levels compared to healthy children. In their study, Bauset et al. [32] determined that autistic children consumed significantly more vitamin E than healthy children. In their research, Bicer and Alsaffar [33] found that most children aged 4-18 years consumed less calcium, zinc, vitamin B6 and folate. It is thought that the vitamin-mineral levels of individuals with autism are lower than average individuals and the cause of this deficiency may be related to gastrointestinal problems, chronic diarrhea/constipation, dietary restrictions, or the immune system. In addition, it was observed that both cellular methylation and glutathione-mediated antioxidant defense system were deficient in these individuals. Therefore, it is thought that vitamin B₁₂ supplementation, which is an important cofactor in transmethylation and transsulfuration metabolism, will increase this capacity. Increased oxidative stress in autism has made the use of antioxidant vitamins, such as vitamins C and E widespread in the treatment process [17].

Anthropometric Measurements of Children

In his study, Bhattacharjee [34] found height, body weight, and body mass index values as 162.96 cm, 62.56 kg, and 23.14 kg/m² for the control group, respectively, and 153.6 cm, 40 kg, 16.82 kg/m² for autistic children. When the control group and autistic children were compared, significantly lower body mass index and body weight were found in autistic children. Bauset et al. [35] found that the mean body mass index value of the children was 15.85±2.07 kg/m² in their study on 40 autistic children. When these values were compared with healthy children, it was determined to be significantly lower. Mills et al. [36] compared autistic children with healthy children and determined the body weight z-scores of autistic children as 0.91±1.13 and a ratio of 0.41±1.11 in the control group. Autistic children had a statistically significant higher weight than healthy children. The body mass index z-score values of the control group and autistic children were determined as 0.24±1.17 and 0.85±1.19, respectively. Sun et al. [26] conducted a study with 53 autistic children, 45 boys and 8 girls, aged 4-6 years, and their mean body mass index z-score values were found to be 1.06, which was significantly higher than those with average development. In this study, nutrition training was given to children and families for three months. In autistic children, there are difficulties in directing families to a healthy diet. It is necessary to be able to change food selectivity in children.

Wang et al. [37] found that gastrointestinal problems were seen in 42.0% of children in their study conducted with 589 autistic children. When this ratio was compared with the control group, it was found to be statistically significant. In these studies, the most common gastrointestinal problems were constipation (20%) and chronic diarrhea (19%). Mazefsky et al. [38] reported that 61% of the children experienced gastrointestinal symptoms at least once, and emotional and behavioral problems were common in children, although this varied greatly. Ericson et al. [39]

reported that constipation was the most common gastrointestinal health problem in children (42%) in their study of 100 autistic children. Molloy et al. [40] investigated gastrointestinal health problems in their study of 137 autistic children and found that the rate of those with at least one GI problem was 24 to 81%. The most common GI problem was diarrhea at a rate of 17%. In this study, the symptoms seen due to the small number of samples showing differences. A symptom score of ≥ 7 points is considered severe. In this study, the score was found to be lower than the severe value of 5.6.

It was observed that the boys' scores were higher than the girls in terms of positive eating attitude, but this difference was not statistically significant. Girls' behavior scores on food preparation were higher than boys. Although there was no significant difference in terms of gender regarding food preparation in the original scale, it is thought that the emergence of this difference in the study is due to cultural differences. As required by the Turkish family structure, Turkish girls are more active in setting the table and helping their mothers than Turkish boys, as the work done at home is mostly done by women. The mean scores of girls were higher than boys' in terms of negative eating behaviors during meals, but the difference was not statistically significant. The mean scores of girls were higher than boys but were not statistically significant in terms of negative eating behavior outside mealtime, mother's opinions and behaviors, and child's behavior during food preparation. The mean score of the girls was significantly higher than the average score of the boys in terms of the negative situations that occurred during the meal.

While mothers' positive attitudes, beliefs, and behaviors about healthy eating enable children to consume healthy food, their negative behaviors enable children to consume unhealthy foods. Children who frequently encounter healthy foods in the family environment will increase their healthy food consumption habits. The mother's level of education can affect her awareness of positive eating behavior and choosing healthy foods.

Children and adolescents with a high level of maternal education take in more carbohydrates, protein, fiber, vitamin A and calcium, and consume more vegetables and dairy products. The level of education of mothers is inversely proportional to the excess sugar intake of preschool children and the energy that young people get from excess fats. While the use of fatty milk is higher in families with parents whose education level is lower than high school, the use of low-fat milk is more common among children of university-educated parents. One study determined that young and low-educated mothers preferred relatives and friends as a source of information [41]. This situation causes the formation of poor feeding behaviors in the child. Among the causes of inadequate and unbalanced nutrition in children, the education level of the parents has a significant effect. Eating habits formed in preschool significantly affect future eating habits, and the most important models for children are parents.

The positive and negative behaviors of the parents during and outside mealtime are taken as an example by the children; the eating behavior of the child develops within the framework of the parents' behaviors. In this sense, the table setting, food rules, and food choices that mothers with a high level of education create at home will be more appropriate than for mothers with a lower level

of education, and this will ensure that the child creates positive behaviors and has adequate and balanced nutrition. In the original test, according to the results of this comparison, it was seen that children diagnosed with autism had more eating behavior problems than those with typical development. However, children with autism who participated in the study ranged in age from 2 to 12 years [42]. Malhi et al. [43] studied 63 ASD and 50 normally developing (NG) children in northern India. Seventy-nine percent of families of children with ASD and 64% of families with NG stated that there was a problem with their child's eating behavior. Children with ASD had high CEBI scores (97.28) and the mean eating problem was 6.42 points. It was found that children with ASD consumed less food, especially fruit and vegetables, compared to NG children. Protein potassium, copper, and folate intakes were also low.

It was further determined that the average nutrient needs of children with ASD did not meet the 83 recommendations, especially in terms of thiamine, vitamin C and copper. In this study, according to the CEBI scores, the rate of those who stated that they had frequent or constant eating problems was determined as 30.5%. The total score was 102.8 points. In this study, children with autism were 6-9 years old and received inclusive education. It is thought that the narrowing of the age range may create a different result. The age of six is the period when the child can comfortably exhibit the behavior of eating on his own. When the fact that children with autism included in the study were also at this age is associated with the fact that they were diagnosed with mild autism, it is thought that it is a typical result that they do not have more eating behavior problems than children with average development.

Limitations

The sample size of the study and the absence of a control group can be considered limitations of the study.

Conclusion

This study was conducted on 14 children aged 4-9 years with autism spectrum disorder attending the Special Education and Research Centre of Hasan Kalyoncu University, Gaziantep, as well as their families. The average age of the children was 7.2 years; 71.4% were boys and 28.6% were girls. Half of the mothers were high school graduates, while 42.6% of the fathers were university graduates. The adequacy of children's diets in meeting energy, vitamin, and mineral requirements varied by age group. Although all children received breast milk, they did not receive vitamin D and iron supplements, although national supplementation programs exist in Turkey. This indicates a gap in compliance with the health guidelines. The adequacy of children's diets to meet energy, vitamin and mineral requirements varies depending on the age group of the child, suggesting a potential nutritional concern or the need for more targeted interventions based on age-specific needs.

This research also encompasses the physical development of children. Significant changes in height and body weight were observed in the 4-6 age group by the third month. In the 7-9 age group, while certain changes were noted, significant differences were found in the waist-to-hip ratio. Gastrointestinal symptoms were observed in 53.1% of the children, with diarrhea, gas, and abdominal pain being the most common symptoms. Regarding eating behaviors, the average scores of girls were found

to be higher than those of boys, but these differences were not statistically significant. This study sheds light on the nutritional and developmental processes of children with autism spectrum disorder. The further studies are needed to evaluate the nutritional status of autistic children in Turkey.

Acknowledgements

The authors would like to thank the individuals who participated in this study for their cooperation.

References

1. Drmic IE, Halfon N, Soltani A, et al. Life course health development in autism spectrum disorders. In: Halfon N, editor. Handbook of life course health development. Springer; 2017. p. 237-74. doi: 10.1007/978-3-319-47143-3_11.
2. Kanner L. This week's citation classics. *Currents Contents*. 1979;2:14-18.
3. Weatherhead KL. Exploring the experiences of children with autism spectrum disorder participating in a therapeutic social group. [MA thesis]. Victoria (BC): University of Victoria; 2017. Available from: <https://dspace.library.uvic.ca/bitstream/handle/1828/8474/Weatherhead.pdf?sequence=3&isAllowed=y> [Accessed 20 Apr 2020]
4. Sanders SJ, Ercan-Sencicek AG, Hus V, Luo R, Murtha MT, Moreno-De-Luca D, et al. Multiple recurrent de novo CNVs, including duplications of the 7q11.23 Williams syndrome region, are strongly associated with autism. *Neuron*. 2011;70(5):863-5.
5. Cavkaytar A, Özkan ŞY, Ergenekon Y, Çolak A, Kaya Ö, Cavkaytar S. Otizm Spektrum Bozukluğu. "Otizm Spektrum Bozukluğu Ulusal Eylem Planı Taslağı Çerçevesinde Gerçekleştirilecek Olan Farkındalık ve Bilgilendirme Seminerleri Projesi." Aile ve Sosyal Politikalar Bakanlığı Engelli ve Yaşlı Hizmetleri Genel Müdürlüğü; 2015. Available from: http://eyh.aile.gov.tr/data/58a444546914076e085f98ab/otizm_spektrum_bozuklugu.pdf [Accessed 20 Apr 2018].
6. Tanaka JW, Wolf JM, Klaiman C, Koenig K, Cockburn J, Herlihy L, et al. Using computerized games to teach face recognition skills to children with autism spectrum disorder: the Let's Face It! program. *J Child Psychol Psychiatry*. 2010;51(8):944-52. doi: 10.1111/j.1469-7610.2010.02258.x
7. Özyayın L, Çolak A. Okul öncesi öğretmenlerinin kaynaştırma eğitimine ve okul öncesi eğitimde kaynaştırma eğitimi hizmet içi eğitim programına ilişkin görüşleri. *Kalem Eğitim ve İnsan Bilimleri Dergisi*. 2011;1(1):189-226. doi: 10.23863/kalem.2017.6
8. Berding K, Donovan SM. Microbiome and nutrition in autism spectrum disorder: current knowledge and research needs. *Nutr Rev*. 2016;74(12):723-36. doi: 10.1093/nutrit/nuw048
9. Önal S, Uçar A. Otizm spektrum bozukluğu tedavisinde beslenme yaklaşımları. *Ankara Sağlık Bilimleri Dergisi*. 2017;6(1):179-94. doi: 10.1501/Asbd_00000000070
10. Ünlü H. Okul öncesi dönem çocukları için yeme performansı değerlendirme performansının Türk çocuklara uyarlanması. [Yüksek lisans tezi]. İstanbul: Marmara Üniversitesi Eğitim Bilimleri Enstitüsü; 2011.
11. Schneider CK, Melmed RD, Barstow LE, Enriquez FJ, Ranger-Moore J, Ostrem JA. Oral human immunoglobulin for children with autism and gastrointestinal dysfunction: a prospective, open-label study. *J Autism Dev Disord*. 2006;36(8):1053-64. doi: 10.1007/s10803-006-0141-y
12. Pekcan G. Beslenme durumunun saptanması. Baysal A, editör. *Diyet I Kitabı*. 9. baskı. Ankara: Hatiboğlu
13. Sağlık Bakanlığı. Türkiye Beslenme Rehberi (TÜBER)-2015. Ankara: TC. Sağlık Bakanlığı Yayın No: 1031; 2016. Şu adresten ulaşılabilir: <http://beslenme.gov.tr>.
14. BeBiS (Beslenme Bilgi Sistemi) bilgisayar yazılımı programı versiyonu 8. 2017.
15. Gaesser GA, Angadi SS. Gluten-free diet: imprudent dietary advice for the general population? *J Acad Nutr Diet*. 2012;112(9):1330-33. doi: 10.1016/j.jand.2012.06.009.
16. Brentani H, Paula CSD, Bordini D, Rolim D, Sato F, Portolese J, et al. Autism spectrum disorders: an overview on diagnosis and treatment. *Braz J Psychiatry*. 2013;35:S62-72. doi:10.1590/1516-4446-2013-S104.
17. Çekici H, Sanlier N. Otizm spektrum bozukluğunun yönetiminde güncel beslenme yaklaşımları: Bir derleme. *Nutr Neurosci*. 2017;1-11.
18. Johnson CP, Myers SM. Identification and evaluation of children with autism spectrum disorders. *Pediatrics*. 2007;120(5):1183-15. doi: 10.1542/peds.2007-2361
19. Herbert MR, Buckley JA. Autism and dietary therapy: case report and review of the literature. *J Child Neurol*. 2013;28(8):975-82. doi: 10.1177/0883073813488668
20. Pennesi CM, Klein LC. Effectiveness of the gluten-free, casein-free diet for children diagnosed with autism spectrum disorder: based on parental report. *Nutr Neurosci*. 2012;15(2):85-91. doi: 10.1179/1476830512Y.0000000003
21. Gogou M, Kolios G. Are therapeutic diets an emerging additional choice in autism spectrum disorder management? *World J Pediatr*. 2018;1-9. doi: 10.1007/s12519-018-0164-4
22. Negggers Y. Dietary interventions in autism. Available from: <https://www.researchgate.net/publication/221915783.2011.20/04/2018>. doi: 10.12968/bjnn.2024.0035
23. Christison GW, Ivany K. Elimination diets in autism spectrum disorders: any wheat amidst the chaff? *J Dev Behav Pediatr*. 2006;27(2):S162-71. doi: 10.1097/00004703-200604002-00015
24. Adams JB, Holloway C. Pilot study of a moderate dose multivitamin/mineral supplement for children with autistic spectrum disorder. *J Altern Complement Med*. 2004;10(6):1033-9. doi: 10.1089/acm.2004.10.1033
25. Bafra LT, Kargin T. Investigating the attitudes of elementary school teachers, school psychologists and guidance research center personnel on the process of preparing the individualized educational program and challenges faced during the related process. *Educ Sci Theory Pract*. 2009;9(4):1959-72. doi: 10.5897/ERR2021.4217
26. Sun C, Xia W, Zhao Y, Li N, Zhao D, Wu L. Nutritional status survey of children with autism and typically developing children aged 4-6 years in Heilongjiang Province, China. *J Nutr Sci*. 2013;2(16):1-8. doi: 10.1017/jns.2013.9
27. Herndon A, DiGiuseppi C, Johnson S, Leiferman J, Reynolds A. Does nutritional intake differ between children with autism spectrum disorders and children with typical development? *J Autism Dev Disord*. 2009;39:212-22. doi: 10.1007/s10803-008-0606-2
28. Attlee A, Kassem H, Obaid RS. Physical status and feeding behavior of children with autism. *Indian J Pediatr*. 2015;10:12098-15. doi: 10.1007/s12098-015-1696-4
29. Bat Z. 6-15 yaş arasındaki otizm spektrum bozukluğu olan çocukların beslenme durumunun değerlendirilmesi. [master's thesis]. İstanbul: Haliç Üniversitesi; 2012.
30. Johnson C, Handen B, Mayer C, Sacco K. Eating habits and dietary status in young children with autism. *J Dev Phys Disabil*. 2008;20(5):437-48. doi: 10.1007/s10882-008-9111-y
31. Bandini L, Anderson S, Curtin C, Cermak S, Evans W, Scampini R, et al. Food selectivity in children with autism spectrum disorders and typically developing children. *J Pediatr*. 2010;157(2):259-264. doi: 10.1016/j.jpeds.2010.02.013
32. Bauset S, Gonzalez A, Garcia I, Sanchis A, Varela M. Nutritional status of children with autism spectrum disorders. *J Autism Dev Disord*. 2015;45:203-12. doi: 10.1007/s10803-014-2205-8
33. Bicer A, Alsaffar A. Body mass index, dietary intake, feeding problems of Turkish children with autism spectrum disorder (ASD). *Res Dev Disabil*. 2013;34(11):3978-87. doi: 10.1016/j.ridd.2013.08.024
34. Bhattacharjee S. Study of anthropometric parameters along with postural changes in blood pressure in children with autistic spectrum disorders. *Int J Basic Appl Physiol*. 2012;1(1):88-92. doi: 10.1023/b:jadd.000006001.00667.4c
35. Bauset S, Zazpe I, Mari A. Are there anthropometric differences between children with autism and healthy children? *J Child Neurol*. 2015;28(10):1226-32. doi: 10.1177/0883073812458832
36. Mills JL, Hediger ML, Molloy CA, Chrousos GP, Manning P, Yu KF, et al. Elevated levels of growth-related hormones in autism and autism spectrum disorder. *Clin Endocrinol (Oxf)*. 2007;67(2):230-7. doi: 10.1111/j.1365-2265.2007.02868.x
37. Wang L, Tancredi D, Thomas D. The prevalence of gastrointestinal problems in children across the United States with autism spectrum disorders from families with multiple affected members. *J Dev Behav Pediatr*. 2011;32(5):351-60. doi: 10.1097/DBP.0b013e31821bd06a
38. Mazefsky C, Schreiber D, Olino T, Minshew N. The association between emotional and behavioral problems and gastrointestinal symptoms among children with high-functioning autism. *Autism*. 2015;18(5):493-501. doi: 10.1177/1362361313485164
39. Erickson C, Stigler K, Corkins M, Posey D, Fitzgerald J, McDougle C. Gastrointestinal factors in autistic disorders: A critical review. *J Autism Dev Disord*. 2005;35(6):713-27. doi: 10.1007/s10803-005-0019-4
40. Molloy CA, Manning CP. Prevalence of chronic gastrointestinal symptoms in children with autism and autistic spectrum disorders. *Autism*. 2003;7(2):165-71. doi: 10.1177/1362361303007002004
41. Rissignol DA, Frye RE. Evidence linking oxidative stress, mitochondrial dysfunction, and inflammation in the brain of individuals with autism. *Front Physiol*. 2014;5:150. doi: 10.3389/fphys.2014.00150
42. Archer LA, Szatmari P. Eating and Mealtime Problems in Young Autistic Children: Prevalence and Correlates. Available from: https://archive.org/stream/ERIC_ED342150/ERIC_ED342150_djvu.txt. Published 25 May 2018. doi: 10.1177/1362361321995631
43. Malhi P, Venkatesh L, Bharti B, Singhi P. Feeding problems and nutrient intake in children with and without autism: A comparative study. *Indian J Pediatr*. 2017;84(4):283-8. doi: 10.1007/s12098-016-2285-x.

Disclaimer/Publisher's Note: The statements, opinions, and data presented in publications in the Journal of Surgery and Medicine (JOSAM) are exclusively those of the individual author(s) and contributor(s) and do not necessarily reflect the views of JOSAM, the publisher, or the editor(s). JOSAM, the publisher, and the editor(s) disclaim any liability for any harm to individuals or damage to property that may arise from implementing any ideas, methods, instructions, or products referenced within the content. Authors are responsible for all content in their article(s), including the accuracy of facts, statements, and citations. Authors are responsible for obtaining permission from the previous publisher or copyright holder if re-using any part of a paper (e.g., figures) published elsewhere. The publisher, editors, and their respective employees are not responsible or liable for the use of any potentially inaccurate or misleading data, opinions, or information contained within the articles on the journal's website.

A case of brachial artery pseudoaneurysm requiring endovascular therapy twice

Eiji Koyama, Kazuki Tobita, Hirokazu Mityashita, Shigeru Saito

Department of Cardiology, Shonan Kamakura General Hospital, Kamakura, Kanagawa, Japan

ORCID of the author(s)

EK: <https://orcid.org/0000-0002-9384-6560>
KT: <https://orcid.org/0000-0002-1913-6894>
HM: <https://orcid.org/0000-0003-1562-9437>
SS: <https://orcid.org/0000-0002-5985-4815>

Abstract

Brachial artery pseudoaneurysm (BAP) is a complication that can result from trauma, iatrogenic injury, or drug abuse, and can have serious consequences for the limb and overall health, including hemorrhage, nerve injury, venous edema, loss of limb function, and rupture. This paper describes a case of BAP that developed following the first hemostasis procedure and required a second endovascular therapy (EVT) procedure. The patient in this case had an iatrogenic brachial artery pseudoaneurysm (BAP) that appeared 10 days after coronary angiography. The patient experienced swelling and pain in the left upper limb, prompting emergency hemostasis with EVT. Percutaneous thrombin injection was administered, along with balloon inflation, and angiography confirmed successful hemostasis. However, 16 days after the initial EVT, the patient returned to the hospital with the same symptoms, and a recurrence of BAP was observed on duplex ultrasound. Stent graft implantation was required due to vessel structure disruption detected by intravascular ultrasound imaging. Following stent graft deployment, a final angiogram showed that the pseudoaneurysm had disappeared, and the patient experienced no complications for three months. This case highlights the importance of observing vascular structure with intravascular ultrasonography (IVUS) to predict successful hemostasis, and suggests that additional therapy should be considered when the structure is disrupted.

Keywords: pseudoaneurysm, balloon tamponade, stent graft, IVUS, endovascular therapy, complication

Corresponding Author

Kazuki Tobita

Department of Cardiology, Shonan Kamakura General Hospital, 1370-1 Okamoto, Kamakura, 247-8533, Japan
E-mail: oni9318583@gmail.com

Informed Consent

The authors stated that the written consent was obtained from the patient presented with images in the study.

Conflict of Interest

No conflict of interest was declared by the authors.

Financial Disclosure

The authors declared that this study has received no financial support.

Published

2025 January 15

Copyright © 2025 The Author(s)



This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).

<https://creativecommons.org/licenses/by-nc-nd/4.0/>

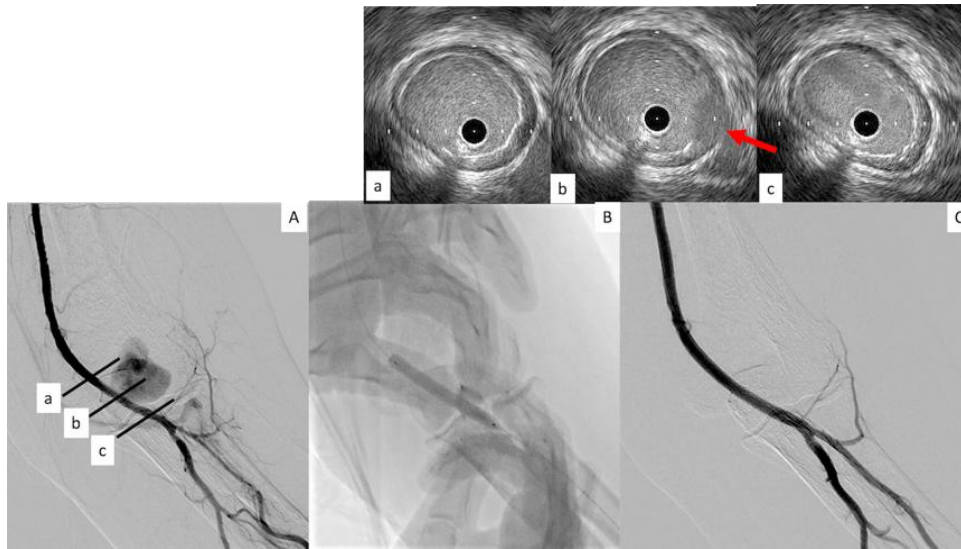


Introduction

Brachial artery pseudoaneurysm (BAP) is a complication that can result from trauma, iatrogenic injury, or drug abuse, and can have serious consequences for the limb and overall health. These consequences may include hemorrhage, nerve injury, venous edema, loss of limb function, and rupture [1,2]. Treatment options for BAP include external compression, thrombin injection, surgical treatment, or endovascular procedures. Previous clinical results have shown that a combination of thrombin injection and endovascular procedure was effective for treating femoral artery pseudoaneurysm [3], so this approach is often used for BAP as well. Pseudoaneurysm recurrence is rare.

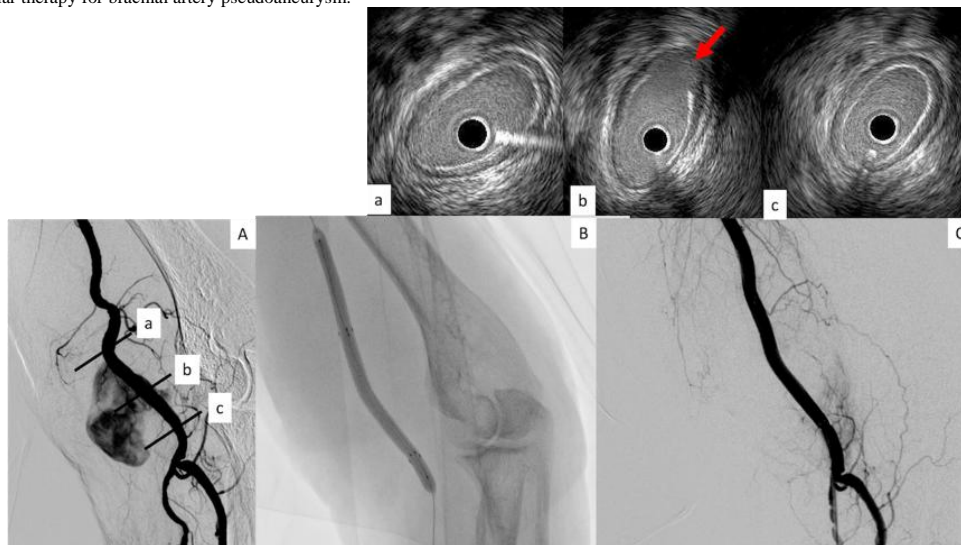
In this case study, we present a case of BAP that developed following the initial hemostasis procedure and required a second endovascular therapy (EVT) procedure.

Figure 2: First endovascular therapy for brachial artery pseudoaneurysm.



A: Initial angiography. B: Endovascular balloon inflation and percutaneous thrombin injection. C: Final angiography. a-c: Intravascular ultrasonography

Figure 3: Second endovascular therapy for brachial artery pseudoaneurysm.



A: Initial angiography. B: Treatment with deployment of a stent graft and balloon inflation. C: Final angiography. a-c: Intravascular ultrasonography

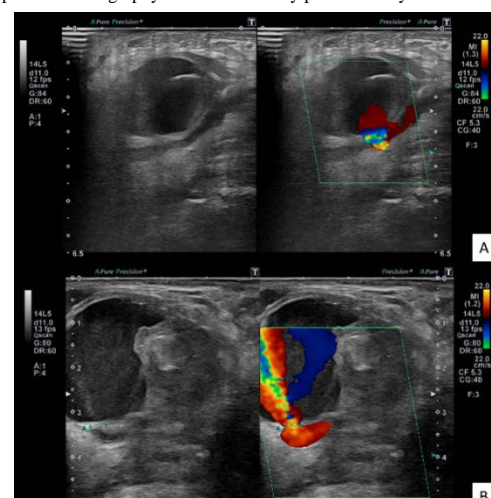
Case presentation

An 85-year-old woman with hypertension, hyperlipidemia, and diabetes was admitted for coronary angiography as part of the evaluation of severe aortic stenosis. The patient did not receive antithrombotic therapy. Angiography was carried out through the left brachial artery with a 5 Fr slender sheath (Terumo, Tokyo, Japan) and was successfully completed. The puncture site was compressed using Tometakun (Xemex, Toyama, Japan) for 4 hours, and she was discharged from the hospital without any bleeding complications. Ten days later, she returned to the hospital due to swelling and pain in her left upper limb. Duplex ultrasonography revealed a pseudoaneurysm (BAP) measuring 3.9 cm in diameter (Figure 1-A). Consequently, emergency hemostasis with EVT was decided upon.

EVT was performed through the left radial artery using a 4 Fr short introducer sheath (Terumo, Tokyo, Japan). Angiography showed a pseudoaneurysm in the neck (Figure 2-A). A 0.014" guidewire was advanced into the distal axillary artery. Vascular lumen and disruption of vascular structure were assessed using intravascular ultrasonography (IVUS) (Figure 2-B). Percutaneous thrombin injection of 2000 IU was administered, along with balloon inflation using SHIDEN HP 5.0 mm x 40 mm (Kaneka, Tokyo, Japan) (Figure 2-B). Angiography confirmed

successful hemostasis (Figure 2-C), and the patient did not experience any further bleeding episodes or complications post-procedure. She was discharged on the same day. However, 16 days later, she returned to the hospital with swelling and pain in her left upper limb. Duplex ultrasonography revealed a pseudoaneurysm measuring 4.6 cm in diameter (Figure 1-B). Consequently, she was admitted to the emergency room for urgent repeat EVT.

Figure 1: Duplex ultrasonography for brachial artery pseudoaneurysm.



A: Before 1st endovascular therapy (EVT). B: Before 2nd EVT.

The second EVT was performed through the same access site as the initial procedure, using a 6 Fr short introducer sheath (Terumo, Tokyo, Japan). Angiography revealed a pseudoaneurysm measuring 4.3 cm in diameter (Figure 3-A). Due to vessel structure disruption and the recurrent nature of the pseudoaneurysm, we determined that stent graft implantation was necessary (Figure 3-B). A 5.0 mm x 50 mm long VIABAHN stent graft (W.L. Gore & Associates, Flagstaff, AZ, USA) was deployed across the neck of the pseudoaneurysm and post-dilated with a 5.0 mm x 100 mm semi-compliant balloon (Figure 3-B). The final angiogram demonstrated resolution of the pseudoaneurysm (Figure 3-C). Follow-up duplex ultrasonography the next day confirmed closure of the pseudoaneurysm. The patient was discharged and remained free of complications for 3 months.

Discussion

We encountered a case of iatrogenic BAP that required a second EVT due to the recurrence of pseudoaneurysm after the initial combined treatment of endovascular balloon inflation and percutaneous thrombin injection.

BAP is a rare complication with a low incidence (0.3%) following transbrachial artery catheterization [4]. Surgical repair is an option for BAP but can be challenging in older patients with atherosclerotic vessels. Recent reports have shown that the combination of endovascular balloon inflation and percutaneous thrombin injection is effective in treating iatrogenic femoral pseudoaneurysms [3]. Thrombin injection with EVT is a minimally invasive procedure.

The etiology of pseudoaneurysm formation includes incomplete hemostasis, anticoagulation therapy, or coagulopathy [5]. In this case, the patient did not receive antiplatelet or anticoagulation therapy, and atherosclerotic changes were confirmed in the brachial arteries, possibly contributing to the recurrence of the pseudoaneurysm in the late phase.

In this case, IVUS confirmed the disruption of the vascular structure. An incomplete vascular wall structure may not adequately maintain hemostasis post-treatment, leading to a recurrence of the pseudoaneurysm in the late phase. Closer follow-up should have been conducted when vessel wall disruption was observed. Future studies with more cases of BAP are needed to establish optimal treatment strategies. Additionally, IVUS studies may be necessary to investigate the impact of vascular structure disruption on endovascular hemostasis for pseudoaneurysms.

Conclusion

We encountered a case of BAP that required EVT twice. Monitoring the vascular structure with IVUS may help predict successful hemostasis, and additional therapy should be considered when the structure is disrupted.

References

1. Yetkin U, Gurbuz A. Post-traumatic pseudoaneurysm of the brachial artery and its surgical treatment. *Texas Heart Institute Journal*. 2003;30(4):293-7.
2. Kemp K, Radwan R, Shingler G, Davies C. Brachial artery pseudoaneurysm. *BMJ Case Rep*. 2014;2014.
3. Hayakawa N, Kodera S, Miyauchi A, Hirano S, Sahashi S, Ishibashi N, et al. Effective treatment of iatrogenic femoral pseudoaneurysms by combined endovascular balloon inflation and percutaneous thrombin injection. *Cardiovasc Interv Ther*. 2022;37(1):158-66.
4. Armstrong PJ, Han DC, Baxter JA, Elmore JR, Franklin DP. Complication rates of percutaneous brachial artery access in peripheral vascular angiography. *Annals of Vascular Surgery*. 2003;17(1):107-10.

5. Tisi PV, Callam MJ. Treatment for femoral pseudoaneurysms. The Cochrane database of systematic reviews. 2013(11):CD004981.

Disclaimer/Publisher's Note: The statements, opinions, and data presented in publications in the *Journal of Surgery and Medicine (JOSAM)* are exclusively those of the individual author(s) and contributor(s) and do not necessarily reflect the views of JOSAM, the publisher, or the editor(s). JOSAM, the publisher, and the editor(s) disclaim any liability for any harm to individuals or damage to property that may arise from implementing any ideas, methods, instructions, or products referenced within the content. Authors are responsible for all content in their article(s), including the accuracy of facts, statements, and citations. Authors are responsible for obtaining permission from the previous publisher or copyright holder if re-using any part of a paper (e.g., figures) published elsewhere. The publisher, editors, and their respective employees are not responsible or liable for the use of any potentially inaccurate or misleading data, opinions, or information contained within the articles on the journal's website.