

Case Report



Nutritional Intervention for a Korean Adolescent with Atopic Dermatitis: a Case Report

Sunghye Kim , Sung-Im Lee , Shin-Sook Kang

Department of Dietetics and Nutrition Services, Asan Medical Center, Seoul 05505, Korea

OPEN ACCESS

Received: Sep 17, 2021

Revised: Oct 12, 2021

Accepted: Oct 16, 2021

Correspondence to

Shin-Sook Kang

Department of Dietetics and Nutrition Services, Asan Medical Center, 88 Olympic-ro 43-gil, Songpa-gu, Seoul 05505, Korea.
E-mail: sskang@amc.seoul.kr

Copyright © 2021. The Korean Society of Clinical Nutrition

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORCID iDs

Sunghye Kim

<https://orcid.org/0000-0002-0244-7020>

Sung-Im Lee

<https://orcid.org/0000-0001-7204-6911>

Shin-Sook Kang

<https://orcid.org/0000-0002-8500-5403>

Conflict of Interest

The authors declare that they have no competing interests.

ABSTRACT

Atopic dermatitis (AD) is a common inflammatory skin disease in children worldwide but can affect individuals of all ages. Patients and parents of pediatric patients tend to restrict too much food because they think this aggravates or causes AD. However, there is a risk of nutrient deficiency owing to a lack of balanced diet. Herein, nutritional counseling was conducted to improve the eating habits of a patient with AD, promote nutritionally balanced meals, and consequently observe changes in the severity of AD. This report discusses the case of a 15-year-old male patient with AD who did not receive nutritional counseling previously but regularly ate breakfast and consumed fruits, beans, vegetables, and milk more frequently after counseling. His vegetable consumption increased from less than one plate a day before counseling to more than eight plates a day after counseling. This change was reflected in the nutritional quotient for adolescents (NQ-A) score. After consultation, eating habits improved, as indicated by a 1.2-, 2.4-, and 1.5-fold increase in NQ-A, diversity category, and balance category scores, respectively. The intake of protein, dietary fiber, vitamin A, vitamin D, vitamin K, vitamin C, niacin, calcium, potassium, magnesium, and water was inadequate before consultation and improved after consultation. The eating habits and severity of AD also improved after nutritional counseling. However, this result was not tested in a tightly controlled environment. It was difficult to conclude that only the eating habits affected the severity. Therefore, further research is needed.

Keywords: Atopic dermatitis; Nutrition therapy; Healthy diet; Adolescent

INTRODUCTION

Atopic dermatitis (AD) is one of the most common inflammatory skin diseases in children worldwide but can affect individuals of all ages. Skin barrier defects affect the deterioration of AD, suggesting that this may be the first gateway to an "atopic march," including food allergies, asthma, and rhinitis, which is important for prevention and early treatment early [1].

Many studies report that patients and parents tend to restrict too much food because they think this aggravates or causes AD [2]; however, there is a risk of nutrient deficiency due to a lack of a balanced diet [3]. In one study, more than 75% of patients reported that they

received dietary therapy to improve AD; however, surprisingly, only half of them reported that they had previously consulted a doctor or dietitian [4].

In Asan Medical Center in Seoul, Korea, patients with AD receive nutritional counseling in case of food allergies; however, it is extremely rare for them to receive counseling if they were only diagnosed with AD. Therefore, in this study, nutritional counseling was conducted to improve the eating habits of a patient with AD, promote nutritionally balanced meals, and consequently observe changes in the severity of AD.

The present study was approved by the Institutional Review Boards of Asan Medical Center and was performed in accordance with the Declaration of Helsinki (2010-1380).

CASE

AD and dietary guidelines

There are currently no guidelines for patients with AD in relation to dietary control. Prior to nutritional counseling, we searched for study findings on the correlation between AD and foods and nutrients.

The following study findings on AD and nutritional factors were found. The foods that promote AD include milk, eggs, gluten, sugar, food-coloring agents, food additives, and preservatives [5]. In Korea, a study using National Health and Nutrition Survey data from 17,497 adults found that the prevalence of AD had significant links with the consumption of ramen, meat, and processed foods [6]. However, many studies generally reported that avoiding these foods did not improve the symptoms, even immunoglobulin E (IgE)-mediated food allergies in patients with AD [7].

A 2012 Cochrane review evaluated the benefits of dietary supplements such as fish oil, vitamin D, and vitamin E supplements yielded improvements in eczema, which was reported with no evidence [8]. However, one randomized controlled trial reported significant improvements in vitamin D daily supplementation at 1,600 IU compared with placebo [9].

Various studies have also been conducted to determine whether the microbiome and AD are correlated. Among them, studies investigating the role of probiotics that may affect the microbiome showed mixed results, suggesting that probiotics could be an option in treating AD [10]. Several studies have found no correlation between supplementation of probiotics and improvement of the disease [11].

The correlation of AD with one food, nutrient, diet, or probiotic does not have consistent results, therefore requiring further research. In this study, the subject was instructed to avoid related food only when diagnosed with IgE-mediated food allergies or to avoid food, especially when not, following the guidelines of the American Academy of Dermatology. In addition, nutritional counseling was conducted in accordance with the Youth Health Diet Guide (**Table 1**) and the general age-specific dietary guide for Korean nutrition standards in 2020. Dietary intake was investigated by a clinical dietitian via interview with the patient using 24-hour recall. Dietary habits were evaluated using the nutritional quotient for adolescents (NQ-A), which was developed to assess the overall dietary quality and food behavior of Korean adolescents. The NQ-A checklist consists of a total of 19 questions,

Table 1. Healthy dietary guidelines for Korean adolescents by the Ministry of Health and Welfare

List
1. Eat each food group evenly every day. <ul style="list-style-type: none"> - Eat rice; various side dishes, including vegetables; fish, and meat every day. - Eat fresh fruits and vegetables as a snack. - Drink more than 2 cups of milk every day.
2. Eat less salty and greasy food. <ul style="list-style-type: none"> - Eat less salty food and less salty soup. - Eat less instant food. - Eat less fried food and fast food.
3. Know your healthy weight right away and eat properly. <ul style="list-style-type: none"> - Know the weight of my health by my height. - Do physical activities actively for more than an hour every day. - Do not go on a diet to lose weight excessively. - Television viewing and computer games are limited to up to 2 hours a day.
4. Drink less non-water drinks. <ul style="list-style-type: none"> - Drink water often and enough. - Drink less soda and sweetened drinks. - Never drink alcohol.
5. Do not skip meals or overeat. <ul style="list-style-type: none"> - Do not skip breakfast. - Eat slowly on time. - Even if you are hungry, do not eat a lot at once.
6. Select hygienic food. <ul style="list-style-type: none"> - Do not eat junk food. - Check and select the nutrition label and expiration date of the food.

comprising 5 categories: balance, moderation, diversity, practice, and environment.

The scores for the NQ-A and each category are calculated according to the weight of the questionnaire items and are rated from 0 to 100, with a higher quality of meals and food-related behaviors indicating good results [12]. The Scoring Atopic Dermatitis (SCORAD) index was used to determine the severity of AD, which was classified as mild (score: < 15), moderate (score: $\geq 15, \leq 40$), and severe (score: > 40).

Case history

The subject was a 15-year-old male patient who first visited Asan Medical Center in 2020 owing to the persistence of moderate to severe AD during follow-up at other hospitals. Humidifier disinfectant exposure level 4 (extreme low exposure and normal pulmonary function), allergic rhinitis, and asthma were diagnosed; he had no cough, difficulty breathing, sputum, fever, or chest pain. Eczema was observed extensively on the face, earlobe, neck, upper chest, back, axilla, and legs. Avamys, Evoprim (gamma linolenic acid), and Ramnos (probiotics) were taken by the patient and continued until the second treatment. Blood tests showed the percentage of E-eosinophil to be 7.5% and IgE level to be 1,175 KU/L; after 7 months, of E-eosinophil percentage was 10.8%. Additional AD work-up showed positive sensitivities in *Dermatophagoiodes pteronyssinus*, *Dermatophagoiodes farinae*, common silver birch, and oak (**Table 2**). The subject of this study refused the blood test after 3 months, so the test could not be performed.

Before counseling

In the first nutritional consultation, the patient's height was 173.2 cm; weight, 71.6 kg; body mass index (BMI), 23.9 kg/m²; weight for height, 112.9%; height for age 101.6%; and SCORAD index, 49.7 (severe) (**Table 2**). The patient ate breakfast 2 to 3 times a week and consumed 2 different kinds of vegetables at less than one plate a day; fruits and beans 3 to 4 times a week; milk 3 to 4 times a week; convenience store or school canteen products

Table 2. Anthropometric and biochemical data

Variables	Before	After 3 mon
Height (cm)	173.2	173
Weight (kg)	71.6	73.5
BMI (kg/m ²)	23.9	24.6
Weight for height (%)	112.9	115.9
Height for age (%)	101.6	101.1
SCORAD index	49.7	29.6
E-eosinophil (%)	9.5	-
Eosinophil count (/μL)	730	-
Total IgE level (KU/L)	1,773	-
Specific IgE level (class, kUA/L)		
<i>D. pteronyssinus</i>	6, > 100	-
<i>D. farinae</i>	6, > 100	-
Dog dander	0, 0.35	-
Oak	4, 35.4	-
Common silver birch	5, 64.2	-
Humulus japonicus	0, 0.27	-
Glucose level (mg/dL)	101	-
Total protein level (g/dL)	8	-
Albumin level (g/dL)	4	-
Creatinine level (mg/dL)	0.78	-
Uric acid level (mg/dL)	5.8	-
Triglyceride level (mg/dL)	100	-
Total cholesterol level (mg/dL)	142	-
HDL-cholesterol level (mg/dL)	44	-
LDL-cholesterol level (mg/dL)	91	-
AST level (IU/L)	18	-
AST level (IU/L)	9	-
Alkaline phosphatase level (IU/L)	113	-
Zinc level (ug/dL)	106.7	-

BMI, body mass index; SCORAD, Scoring Atopic Dermatitis; IgE, Immunoglobulin E; *D. pteronyssinus*, *Dermatophagoides pteronyssinus*; *D. farinae*, *Dermatophagoides farinae*; HDL, high-density lipoprotein; LDL, low-density lipoprotein; AST, aspartate aminotransferase.

once a week, but no fish, ramen, snacks, sweets, beverages, caffeinated drinks, and late-night snacks. The patient reported that he did not usually eat side dishes evenly. His NQ-A score was 49.2; environment category score, 24.4; diversity category score, 29.5; balance category score, 33.6; and moderation category score, 95.8. The patient consumed 2,832 kcal. Compared with the requirement, his calorie intake was 105%; protein intake was 80%, and fat intake was 153%. Compared with the 2020 Dietary Reference Intakes for Koreans, the dietary fiber intake was 34.8%; this was short of the requirement, because only one plate of kimchi and one plate of white rice a day and few other vegetables were eaten. Patients' intake of vitamin A, vitamin D, vitamin K, vitamin C, niacin, calcium, potassium, and magnesium was insufficient, but more than doubled thiamin and vitamin B12 intake owing to consumption of grilled pork belly and more than tripled sodium intake owing to stew, noodles and dumpling soup (**Table 3**).

During counseling, the importance of breakfast and how to eat a simple and balanced breakfast increase the frequency of consumption of tofu, eggs, and shrimp instead of fatty meat to manage weight and reduce fat intake were explained. The patient was also encouraged to drink 2 cups of milk or yogurt a day to increase calcium intake and increase water intake to more than 6 cups. We also recommended that he eat mixed grain rice and introduce consuming soup with increased vegetables, shabu-shabu, bibimbap, ssambap, sandwiches, and packaged salad. He was also instructed to eat solid ingredients when eating soup or shabu-shabu to reduce sodium intake. The patient promised to improve his eating habits and food consumption.

Table 3. Intake of nutrients before and 3 months after counseling

Nutrients	Amount of nutrient intake		%KDRIs	
	Before	After 3 mon	Before	After 3 mon
Energy (kcal/day)	2,759.0	2,627.0	102.2	97.3
C:P:F ratio (%)	53:14:33	59:19:21	-	-
Carbohydrate (g/day)	364.0	388.6	-	-
Protein (g/day)	97.4	127.9	-	-
Fat (g/day)	101.5	62.4	-	-
Fiber (g/day)	10.4	46.9	34.7	156.3
Soluble fiber (g/day)	1.3	3.7	-	-
Insoluble fiber (g/day)	7.1	32.6	-	-
Vitamin A (µg RAE/day)	268.3	966.6	31.6	113.7
Vitamin D (µg/day)	1.5	11.0	15.0	110.0
Vitamin E (mg/day)	15.1	29.9	125.8	249.2
Vitamin K (µg/day)	50.7	543.9	63.4	679.9
Vitamin C (mg/day)	13.9	195.2	13.9	195.2
Thiamine (mg/day)	3.0	3.5	230.8	269.2
Riboflavin (mg/day)	1.3	4.0	76.5	235.3
Niacin (mg/day)	10.7	38.1	62.9	224.1
Vitamin B6 (mg/day)	2.9	4.3	193.3	286.7
Folate (µg/day)	411.2	926.6	102.8	231.7
Vitamin B12 (µg/day)	6.2	15.7	258.3	654.2
Pantothenic acid (mg/day)	4.3	7.4	86.0	148.0
Calcium (mg/day)	280.0	875.8	31.1	97.3
Phosphorus (mg/day)	1,117.5	1,973.7	93.1	164.5
Sodium (mg/day)	4,787.2	2,010.0	319.1	134.0
Chlorine (mg/day)	17.5	590.7	0.8	25.7
Potassium (mg/day)	1,948.6	4,596.7	55.7	131.3
Magnesium (mg/day)	87.0	287.2	21.2	70.0
Iron (mg/day)	11.4	34.3	81.4	245.0

%KDRIs, percent ratio of energy and nutrients to the recommended intake in the 2020 Dietary Reference Intakes for Koreans; C:P:F ratio, carbohydrate:protein:fat percent ratio; RAE, retinol activity equivalents.

Three months after counseling

After 3 months, the patient's height was 173 cm; weight, 73.5kg; BMI, 24.6 kg/m²; weight for height, 115.9%; height for age, 101.1%; and SCORAD index, 22.6 (moderate) (**Table 2**). The frequency of not eating breakfast was reduced to once a week; eating fruits and tofu increased to 3 to 4 times a week; and drinking milk increased to once a day, but not fish; he also ate more than eight plates of 4 different kinds of vegetables a day. He reported that he ate various side dishes; still did not eat ramen, snacks, sweets, or late-night snacks; and bought food once a week at convenience stores or the school canteen. The patient's NQ-A score increased to 61.2; the diversity category score increased 2.4 times to 70.5; and the balance category score increased 1.5 times to 50.8 (**Table 4**). The patient ate 2 to 3 plates of salad per meal, including 1 to 2 plates of solid ingredients, such as vegetables, when eating soup or noodles, and vegetable sticks as a snack to eat more than eight plates of vegetables a day. Instead of greasy meat, he often ate chicken breasts, boiled eggs, and tofu in a salad and

Table 4. Scores of the NQ-A and each category before and 3 months after counseling

NQ factor	Before	After 3 mon
NQ-A (score)	49.2	61.2
Category (score)		
Balance	33.6	50.8
Moderation	95.8	95.8
Diversity	29.5	70.5
Practice	43.9	43.9
Environment	24.4	34.6

NQ-A, nutritional quotient for adolescents.

drank 300 mL of milk a day and 400 to 500 mL of water twice a day. Compared to the amount needed, the calories intake was 97%, protein intake was 105%, and fat intake was 95%. The patient's intake of vitamin A, vitamin D, vitamin K, vitamin C, niacin, calcium, potassium, and magnesium, all of which were insufficient in the first consultation, were fully taken, and the sodium intake was still higher than the standard intake of 1,500 mg/day but decreased by 0.42 times from the previous consultation (**Table 3**).

DISCUSSION

The subject of this case study was a patient with AD who had no experience in nutritional counseling but who ate breakfast and consumed fruits, beans, vegetables, and milk more frequently after counseling. In particular, vegetables were consumed at less than one plate a day before counseling, which increased to more than eight plates a day after counseling. This change was reflected in the NQ-A score; after consultation, an improvement in the eating habits was observed as indicated by the increased NQ-A, diversity category, and balance category scores by 1.2, 2.4, and 1.5 times, respectively. The intake of protein, dietary fiber, vitamin A, vitamin D, vitamin K, vitamin C, niacin, calcium, potassium, magnesium, and water, which had been lacking before consultation, was found to have improved.

Before the consultation, the patient's NQ-A score was 49.2; diversity category score, 29.5; balance category score, 33.6, which were lower than those 56.0, 55.6, and 58.6, respectively, in a previous case in an adolescent in Korea. Meanwhile, the Korean youth's moderation score was 48.1, while our patient's score was 95.8, indicating a very high score [12]. It is believed that avoiding a variety of foods without any clear evidence may have affected the strengthening of poor eating habits. However, a relatively high moderation score was found in our patient with AD, who seemed to have been trained to avoid processed foods and street foods since childhood.

Individual eating habits are usually formed in infancy and childhood and are determined in adolescence; they are known to be difficult to improve once they are formed [13]. For the improvement of eating habits, it is recommended to receive nutritional counseling as soon as possible; however, the subject of this study was aged 15 years, and the first nutritional counseling was performed late. However, the patient's eating habits improved better than expected after consultation; he is supported by other study findings that middle school patients with AD were following the hospital's principles more accurately than normal groups [14]. In other words, even after eating habits have already formed, it was found that patients with AD have sufficient potential to improve if they receive nutritional counseling. Since AD is difficult to cure completely, the treatment period is considerable, and constant management is needed. The process should be established so that schools and health centers can continue conducting consultations in the future.

The SCORAD index children who were not trained to consume vegetables, fruits, and fish was reported to be significantly lower than that in those who were; such training of consumption of these kinds of food was able to decrease the severity of AD [15]. In this case study, the patient had improved eating habits, nutrient imbalance, and severity of AD after nutritional counseling. However, this result was not tested in a tightly controlled environment, making it difficult to conclude that only the eating habits affected the severity. Therefore, further research is needed.

REFERENCES

1. Hill DA, Spergel JM. The atopic march: critical evidence and clinical relevance. *Ann Allergy Asthma Immunol* 2018;120:131-7.
[PUBMED](#) | [CROSSREF](#)
2. Wensink M, Timmer C, Brand PLP. Atopic dermatitis in infants not caused by food allergy. *Ned Tijdschr Geneesk* 2008;152:4-9.
[PUBMED](#)
3. Kim J, Kwon J, Noh G, Lee SS. The effects of elimination diet on nutritional status in subjects with atopic dermatitis. *Nutr Res Pract* 2013;7:488-94.
[PUBMED](#) | [CROSSREF](#)
4. Johnston GA, Bilbao RM, Graham-Brown RA. The use of dietary manipulation by parents of children with atopic dermatitis. *Br J Dermatol* 2004;150:1186-9.
[PUBMED](#) | [CROSSREF](#)
5. Katta R, Schlichte M. Diet and dermatitis: food triggers. *J Clin Aesthet Dermatol* 2014;7:30-6.
[PUBMED](#)
6. Park S, Choi HS, Bae JH. Instant noodles, processed food intake, and dietary pattern are associated with atopic dermatitis in an adult population (KNHANES 2009–2011). *Asia Pac J Clin Nutr* 2016;25:602-13.
[PUBMED](#)
7. Das A, Panda S. Role of elimination diet in atopic dermatitis: current evidence and understanding. *Indian J Paediatr Dermatol* 2021;22:21-8.
[CROSSREF](#)
8. Bath-Hextall FJ, Jenkinson C, Humphreys R, Williams HC. Dietary supplements for established atopic eczema. *Cochrane Database Syst Rev* 2012:CD005205.
[PUBMED](#) | [CROSSREF](#)
9. Amestejani M, Salehi BS, Vasigh M, Sobhkhiz A, Karami M, Alinia H, Kamrava SK, Shamspour N, Ghalehbaghi B, Behzadi AH. Vitamin D supplementation in the treatment of atopic dermatitis: a clinical trial study. *J Drugs Dermatol* 2012;11:327-30.
[PUBMED](#)
10. Kim SO, Ah YM, Yu YM, Choi KH, Shin WG, Lee JY. Effects of probiotics for the treatment of atopic dermatitis: a meta-analysis of randomized controlled trials. *Ann Allergy Asthma Immunol* 2014;113:217-26.
[PUBMED](#) | [CROSSREF](#)
11. Makrgeorgou A, Leonardi-Bee J, Bath-Hextall FJ, Murrell DF, Tang ML, Roberts A, et al. Probiotics for treating eczema. *Cochrane Database Syst Rev* 2018:CD006135.
[CROSSREF](#)
12. Kim H, Lee J, Hwang J, Kwon S, Chung HR, Kwak T, et al. Development of NQ-A, nutrition quotient for Korean adolescents, to assess dietary quality and food behavior. *J Nutr Health* 2017;50:142-57.
13. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. *J Am Diet Assoc* 2002;102:S40-51.
[PUBMED](#) | [CROSSREF](#)
14. Lee HJ, Cho YR, Park JE. Comparative study on life style according to the existence of atopic dermatitis in middle school student. *J Korean Soc Sch Health* 2005;18:93-104.
15. Lee H, Ahn K, Han Y, Chung SJ. Effects of nutrition education promoting vegetable, fruit, and fish intake on the severity of atopic dermatitis in children: Results from a one-year follow up study. *Korean J Community Nutr* 2013;18:515-24.