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The effect of eight-week nutrition education on nutrition knowledge, nutrition literacy, and mediterranean diet in Turkish adolescents

El efecto de la educación nutricional de ocho semanas sobre el conocimiento nutricional, la alfabetización nutricional y la dieta mediterránea en adolescentes turcos

Short title: Nutritional outcomes of nutrition education in adolescents

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KEY MESSAGES

- Adolescents' having the knowledge and experience required for healthy food selection helps the development of healthy eating habits, and this helps prevent many chronic diseases, e.g., obesity.
- Nutrition education intervention may help improve adolescents' self-evaluation of nutrition knowledge. However, it is not sufficient to improve nutrition literacy and the Mediterranean diet.
- When planning dietary interventions to improve adolescents' diet or eating behaviors, it is suggested to consider individual factors related to adolescents, as well as internet and social media fields and the school/home food environment.

ABSTRACT

Introduction: Adolescence, when nutritional decisions are mostly made individually, is a critical period in which eating habits are orientable. This study aims to evaluate the effectiveness of nutrition education on nutrition knowledge, nutrition literacy, and the Mediterranean diet in Turkish adolescents in the first year of high school.

Methods: This study was conducted in 47 students aged 14-16 at a high school in Ankara, Türkiye. Experimental design with pretest-posttest was used. The students were educated for eight weeks after the pre-test administration. Post tests were administered after the eight-weeks intervention. Follow-up tests were administered in the sixteenth week, eight weeks after the administration of the post tests. The Mediterranean Diet Quality Index for Children and Adolescents (KIDMed), Adolescent Nutrition Literacy Scale (ANSL), and self-assessment of nutrition knowledge were compared at 3-time points: pre-education, post-education, and follow-up. All the forms were used in paper format in a class setting during regular school instruction time.

Results: Most of those who self-assessed their pre-education nutrition knowledge as insufficient/did not know evaluated their post-education (57.1%; $p=.027$) and follow-up (50%; $p=.013$) nutrition knowledge as sufficient. However, there was no significant difference between pre-education ANSL item scores and post-education and follow-up ($p>.05$). None of the KIDMed items showed a significant change in the desired direction (showing healthier nutrition), either ($p>.05$). Among the KIDMed items, only the change (in the negative direction) for "Has cereals or grains for breakfast" was statistically significant ($p=.044$ for pre-post and $p=.010$ for pre-follow-up test differences).

Conclusions: Nutrition intervention improved adolescents' self-reported nutrition knowledge. However, it was insufficient to improve nutrition literacy and the Mediterranean diet. When planning dietary interventions to improve adolescents' diet or eating behaviors, it is suggested to consider individual factors related to adolescents, as well as internet and social media fields and the school/home food environment.

Keywords: KIDMed, Mediterranean Diet, nutrition education, nutrition knowledge, nutrition literacy.

RESUMEN

Introducción: La adolescencia, cuando las decisiones nutricionales se toman mayoritariamente de forma individual, es un período crítico en el que los hábitos alimentarios son orientables. Este estudio tiene como objetivo evaluar la eficacia de la educación nutricional sobre el conocimiento nutricional, la alfabetización nutricional y la dieta mediterránea en adolescentes turcos en el primer año de escuela secundaria.

Metodología: Este estudio se realizó en 47 estudiantes de entre 14 y 16 años de una escuela secundaria en Ankara, Türkiye. Se utilizó un diseño experimental con pretest-postest. Los estudiantes recibieron educación durante ocho semanas después de la administración de la prueba previa. Se administraron pruebas posteriores después de la intervención de ocho semanas. Las pruebas de seguimiento se administraron en la semana dieciséis, ocho semanas después de la administración de las pruebas posteriores. El Índice de Calidad de la Dieta Mediterránea para Niños y Adolescentes (KIDMed), la Escala de Alfabetización Nutricional de Adolescentes (ANSL) y la autoevaluación de conocimientos nutricionales se compararon en tres momentos: preeducación, posteducación y seguimiento. Todos los formularios se utilizaron en formato papel en un entorno de clase durante el horario regular de instrucción escolar.

Resultados: La mayoría de los que autoevaluaron sus conocimientos nutricionales previos a la educación como insuficientes/no sabían evaluar sus conocimientos nutricionales posteducación (57,1%; $p=0,027$) y de seguimiento (50%; $p=0,013$) como suficientes. Sin embargo, no hubo diferencias significativas entre las puntuaciones de los ítems ANSL antes de la educación y las posteriores a la educación y el seguimiento ($p>0,05$). Ninguno de los ítems de KIDMed mostró tampoco un cambio significativo en la dirección deseada (mostrando una nutrición más saludable) ($p>0,05$). Entre los ítems de KIDMed, sólo el cambio (en la dirección negativa) para "Tiene cereales o granos para el desayuno" fue estadísticamente significativo ($p=0,044$ para las diferencias en las pruebas pre-post y $p=0,010$ para las diferencias pre-seguimiento).

Conclusiones: La intervención nutricional mejoró el conocimiento nutricional autoinformado por los adolescentes. Sin embargo, fue insuficiente para mejorar la alfabetización nutricional y la dieta mediterránea. Al planificar intervenciones dietéticas

para mejorar la dieta o las conductas alimentarias de los adolescentes, se sugiere considerar factores individuales relacionados con los adolescentes, así como los campos de Internet y las redes sociales y el entorno alimentario de la escuela y el hogar.

Palabras clave: KIDMed, Dieta Mediterránea, educación nutricional, conocimientos nutricionales, alfabetización nutricional.

INTRODUCTION

Adolescence, when nutritional decisions are often made individually, is a critical period in which eating habits can be directed¹. Along with ongoing unhealthy eating, weight gain is reported to start early in high school². Failure to take preventive measures may lead to the emergence of diseases (such as obesity and obesity-related diseases) that negatively affect lifelong health³. Adolescents' friends and the food environment at school are known to be essential factors in their food selection⁴. In a food environment where healthy and unhealthy foods are available, adolescents should have sufficient knowledge about nutrition to make the right choices⁵.

Adolescents' having the knowledge and experience required for healthy food selection helps the development of healthy eating habits, and this helps prevent many chronic diseases, e.g., obesity^{6,7}. Nutrition literacy, which emphasizes the importance of skills and capacity related to nutrition as well as food and nutrition knowledge, is effective in making conscious food choices and improving adolescent dietary behaviors⁸⁻¹⁰.

The Mediterranean diet is recommended for adolescents, especially in Mediterranean countries, to provide healthy body weight and a better metabolic profile, and to reduce the risk of cardiovascular disease with its antioxidant content¹¹⁻¹³. Nutrition education is an effective way to improve Mediterranean diet quality in adolescents¹⁴. However, the impact of nutrition education aimed at improving nutrition knowledge and literacy on adherence to the Mediterranean diet in adolescents still needs to be investigated.

This study aims to evaluate the effectiveness of nutrition education intervention, based on National Dietary Guidelines compatible with the Mediterranean diet and its principles, on nutrition knowledge, nutrition literacy, and the Mediterranean diet in Turkish adolescents in the first year of high school.

METHODS

Setting

This study was conducted in a high school affiliated with the Ministry of Education between October 2019 and March 2020 in Ankara, Türkiye. A research permit was obtained from the Ankara Provincial Directorate of National Education dated 27/02/2019. Ethics

committee approval was obtained from the Ethics Committee of Ankara University, dated 18/06/2019, numbered 14/225. The study was based on volunteerism, and the students were included after giving informed consent. In addition, approval was obtained from the families of the students.

Procedure

Pretest-posttest was used. In the beginning, the gender and age information of the students were recorded, and the educational status of the parents was questioned.

The students were educated for eight weeks after the pre-test administration. Post-tests were administered after eight weeks after the intervention. The follow-up tests were administered at the sixteenth week, eight weeks after administration of the post-tests.

Mediterranean Diet Quality Index for Children and Adolescents (KIDMed), Adolescent Nutrition Literacy Scale, and self-assessment of nutrition knowledge were compared at 3-time points: pre-test (pre-education), post-test (post-education), and follow-up. All the forms were used in paper format in a class setting during regular school instruction time.

Intervention

The present nutrition intervention was based on social cognitive theory and employed a pre/post-test design. The duration of the education in the study was programmed to be a one-course hour per week for eight weeks. Each week, a PowerPoint presentation prepared on that topic was held. The intervention process was supported by brochures. At the end of each education session, students were given brochures summarizing the education provided. During and after the education sessions, the students were encouraged to ask questions about the subject to continue the education interactively. While preparing educational presentations and brochures, the information in the Türkiye Dietary Guideline and principles of the Mediterranean diet was taken as a basis¹⁵. Nutrition education sessions was provided by a nutritionist.

The subject titles were grouped under eight headings: (1) Adequate and Balanced Nutrition: To comprehend the importance of healthy nutrition, to be aware of the consequences of unhealthy nutrition, and to comprehend regular meal consumption. (2) Macronutrients: To learn the foods containing carbohydrates, protein, and fat and the

beneficial and harmful nutritional sources of these nutrients. (3) Micronutrients and water: To learn the foods containing vitamins and minerals and diseases that may occur in their absence. (4) Food Groups: To the knowledge of food groups, their nutrient contents, and foods that can be consumed interchangeably from the same food group (such as eating eggs instead of meat if meat is unavailable). (5) Adolescent nutrition: To know the importance of adolescent nutrition in terms of its effects on the whole life process. (6) Nutritional needs of adolescents: To inform adolescents about how much they should consume daily from each food group and the portions of the foods they need to consume to meet their needs. (7) Food safety and reading the nutrition label: To get information about the key points to be considered while purchasing, storing, cooking, and consuming food, the information on the food label, and how this information should be interpreted. (8) Consequences of unhealthy diet: To understand that nutrition is essential for all ages and health problems (such as obesity, anemia, and dental caries) that may occur when consuming unhealthy foods (such as fast food and junk food).

These topics prepared concerning the Türkiye Dietary Guidelines are also compatible with the principles of the Mediterranean Diet. When adolescents consume sufficient amounts of food from each food group, as explained in the fourth, fifth, and sixth chapters, they also meet the recommended food amounts in line with the Mediterranean Diet. The importance of using olive oil, which is also a part of the Mediterranean diet, is explained in line with the recommendations of the Türkiye Dietary Guidelines. In addition, the harms of fast food, pastry, sweets, and sugar consumption, which are recommended to be reduced within the scope of the Mediterranean diet, are explained in the eighth topic. Moreover, the importance of breakfast is described in the first topic within the scope of Mediterranean diet recommendations for children. The topics were determined to complement each other and support the general nutrition knowledge of the adolescent.

Essential information was given to increase nutrition literacy for students to understand better what was explained during nutrition education sessions and in the period after these sessions. For example, the basic terms of nutrition (nutrient, food groups, carbohydrate, protein, fat, antioxidant, etc.) were explained under each relevant topic so that they could understand information about nutrition, food, and diet. Also, they were informed about where to access accurate and reliable sources about nutrition. Information was given on

the recommendations of international organizations regarding nutrition and related topics (for example, vegetable and fruit consumption and physical activity recommendations of the World Health Organization). The acquisition of nutrition literacy aimed to motivate students to learn more about nutrition topics later in life and provide the skills, knowledge, and confidence for this.

Thus, the basis of the study was to develop students' basic nutritional knowledge and to make them understand the effects of foods on health and to use this information for their own food choices. The study was designed with the theory that nutrition-related behaviors that are beneficial and harmful to health will be adopted by students through education, so that students will increase their knowledge of healthy nutrition and reflect this knowledge in their behavior.

Instruments

Diet quality was measured using the Mediterranean Diet Quality Index for Children and Adolescents (KIDMed), developed by Serra Majem et al. (2004)¹⁶. to determine compliance with the Mediterranean Diet in children and adolescents. It is a special version of the Mediterranean Diet Quality Index for youth, so "KID" is in front of the acronym. Because Türkiye is a Mediterranean country, and Mediterranean-style eating habits are in many ways parallel to recommendations in the Türkiye Dietary Guidelines, the Mediterranean Diet Quality Index is preferred in this study. In KIDMed, which has 16 questions, each is answered "Yes" or "No", there are 12 questions about eating habits following the Mediterranean diet and four questions not following the Mediterranean diet. Questions following the diet were given +1 point if the answer was "Yes" questions not following the diet were given -1 point if the answer was "Yes" and 0 points when the questions were answered no¹⁶.

The Adolescent Nutrition Literacy Scale (ANLS) was used to determine nutrition literacy. The scale was developed by Ndahura¹⁷ and validated in Turkish by Türkmen et al.¹⁸. It is a Likert-type scale of 22 items. For the answers to be given to the items in the scale, there are five options: "I do not agree at all", "I do not agree", "I am undecided", "I agree", and "I completely agree", and each option is scored from 1 to 5, respectively. Ten items are scored in reverse on the scale¹⁸.

Students were asked to evaluate their nutrition knowledge in 3 categories: insufficient, sufficient, and did not know.

Data analysis was performed in the Statistical Package for the Social Sciences (SPSS) program. Descriptive statistics were shown as median and lower-upper values, and categorical data as numbers and percentages. For continuous data, the Paired-sample t-test, and for categorical data, the Mc-Nemar test was used to compare pre-tests with post-tests and follow-up tests. The results were evaluated at a 95% confidence interval, and the significance level was $p < 0.05$.

RESULTS

A total of 47 students aged 14-16 participated in the study. Most students were male. Parents' education level was high school or higher for most of the students. Most students were in the normal BMI class (Table 1).

Table 1. Descriptive information.

	N=47
Gender, n (%)	
Female	15 (31.9)
Male	32 (68.1)
Age, median (min-max)	14 (14-16)
Mother education, n (%)	
High school or higher	27 (57.5)
Secondary school and below	20 (42.5)
Father education, n (%)	
High school or higher	30 (63.8)
Secondary school and below	17 (36.2)
*BMI classification, n (%)	
Severe thin	2 (4.3)
Thin	5 (10.6)
Normal	29 (61.7)
Overweight	4 (8.5)
Obese	7 (14.9)

*BMI: Body Mass Index

The students were asked to self-assess the level of nutrition knowledge pre-, post-, and follow-up education, and the results were presented in Table 2. Accordingly, most of those who evaluated their pre-education nutrition knowledge as insufficient/do not know (n=28) assessed their post-education knowledge as sufficient (57.1%). For follow-up, this rate dropped to the level of 50%. Compared to pre-education (pre-test), the difference between post-education (post-test) and follow-up rates was statistically significant ($p < .05$). Nutrition education was effective in changing the nutrition knowledge of students who evaluated their nutrition knowledge as insufficient/do not know, in a positive way according to their self-evaluations.

Table 2. Differences between pre-education self-assessment of nutrition knowledge and post-education and follow-up

Self-assessment of nutrition knowledge		Total (n)	Post-education		Follow-up	
			Insufficient/Do not know n (%)	Sufficient n (%)	Insufficient/Do not know n (%)	Sufficient n (%)
Pre-education	Insufficient/Do not know	28	12 (42.9)	16 (57.1)	14 (50.0)	14 (50.0)
	Sufficient	19	5 (26.3)	14 (73.7)	3 (15.8)	16 (84.2)
Total		47	17	30	17	30
			$X^2=4.762, p=.027^*$		$X^2=5.882, p=.013^*$	

*McNemar test results

Differences between pre-education ANSL item scores with post-education and follow-up were displayed in Table 3. Each items were scored from 1 (I do not agree at all) to 5 (I completely agree) in ANLS. Therefore, the differences between the pre-test and post-test and the pre-test and follow-up test were expected to show a positive change for regular items and a negative change for reverse items (marked with * in the table). The study's results showed that, of the 12 regular items, the scores obtained in five items between pre-post tests and four between pre-follow-up tests showed a change in the intended direction (positive). Meanwhile, of the ten reversed items, the scores obtained in four items between pre-post tests and five between pre-follow-up tests showed a change in the intended direction (negative). However, it was determined that these changes were not significant for any of the items ($p > .05$).

Table 3. Differences between pre-education item scores of the Adolescent Nutrition Literacy Scale (ANSL) and post-education and follow-up.

ANLS items	Pre/post difference			Pre/follow-up difference		
	Mean (SD)	95% CI of the difference (lower; upper)	p**	Mean (SD)	95% CI of the difference (lower; upper)	p**
*1. I find it difficult to understand the language used by nutrition, health and food experts.	-.128 (1.30)	-.508; .253	.503	-.191 (1.33)	-.582; .199	.329
*2. I find it difficult to understand the technical words used by nutrition, health and food experts.	-.234 (1.56)	-.693; .225	.310	-.234 (1.52)	-.681; .213	.297
*3. I find it difficult to understand the information I read about nutrition, food and diet.	.064 (1.42)	-.353; .481	.759	-.085 (1.25)	-.452; .281	.642
*4. I find it difficult to know how I should change my diet when I get dietary advice from the doctor, nurse or dietitian.	.021 (1.50)	-.418; .461	.923	.043 (1.49)	-.394; .480	.845
*5. When I read information about nutrition, food or diet I need someone to help me understand it.	-.085 (1.76)	-.600; .430	.741	.149 (1.44)	-.275; .573	.483
*6. I am not familiar with World Health Organization (WHO) recommendation for daily intake of fruits and vegetables.	.149 (1.63)	-.329; .627	.534	.043 (1.49)	-.394; .480	.845
*7. When I read an article about nutrition, food or diet I find words that I don't know.	-.149 (1.52)	-.595; .297	.504	-.170 (1.61)	-.642; .301	.471
8. I have gathered information about diet from various sources that I think is relevant for me.	-.021 (1.76)	-.539; .496	.934	-.234 (2.13)	-.859; .391	.455
9. I use the internet when I am looking for information about nutrition such as diet.	.191 (1.92)	-.372; .755	.497	-.149 (1.64)	-.631; .333	.537
10. I discuss about diet with my friends, family and relatives.	.000 (1.32)	-.387; .387	1.000	.191 (1.48)	-.244; .627	.381
11. I have changed my eating habits based on the information about diet that I have gathered.	.064 (1.80)	-.464; .592	.809	-.191 (1.84)	-.731; .348	.479
12. I often read material about what constitutes a balanced diet.	.106 (1.46)	-.323; .536	.621	.128 (1.66)	-.361; .616	.601
13. I can easily contact dietary experts (for example doctor, nurse or dietitian) about healthy nutrition.	-.085 (1.68)	-.578; .408	.730	.043 (1.96)	-.532; .617	.882
14. I would readily get involved in political issues targeted at improving people's diet in Türkiye.	-.085 (1.65)	-.570; .400	.726	-.170 (1.61)	-.642; .301	.471
15. I am willing to take an active role in measures aimed at promoting a healthier diet at my school.	.043 (1.64)	-.439; .524	.860	-.021 (1.57)	-.481; .439	.926
16. I expect my school to serve healthy food.	.277 (1.77)	-.242; .795	.288	-.191(1.75)	-.706; .323	.458

17. I try to influence others (for example my family and friends) to eat healthy food.	-.106 (1.55)	-.561; .349	.640	.043 (1.62)	-.432; .517	.857
18. It is important for me that the school canteens have a good selection of healthy food.	-.128 (1.68)	-.620; .364	.604	-.404 (1.53)	-.853; .044	.076
*19. I tend to be influenced by the dietary advice I read in newspapers, magazines etc.	.213 (1.38)	-.193; .619	.297	.298 (1.73)	-.210; .806	.244
*20. I tend to be influenced by the dietary advice I get from my family, friends.	.064 (1.62)	-.412; .540	.788	.277 (1.64)	-.204; .757	.253
*21. I believe that the media's presentation of scientific findings about nutrition is correct.	.128 (1.35)	-.267; .523	.519	-.106 (1.55)	-.561; .349	.640
22. When I read information about nutrition, diet or food it is important to me that it is based on scientific evidence.	-.191 (1.73)	-.699; .316	.451	-.489 (1.99)	-1.073; .094	.098

*Reversed items

**Paired-samples t-test scores

The primary result of this study was that there was no change in eating behavior. As displayed in Table 4, when considered in terms of the items in KIDMed where healthy eating habits were stated and positive changes were expected, of the 12 regular items, the scores obtained in 4 items between pre-post tests and six between pre-follow-up tests showed a change in the intended direction (positive). Of the four reversed items, the scores obtained in two items between pre-post tests and all between pre-follow-up tests showed a change in the intended direction (negative). Yet, among these items, only the change (in the negative direction) for the item "Has cereals or grains (bread, etc.) for breakfast" was statistically significant ($p=.044$ for the difference between pre-post tests and $p=.010$ for the difference between pre-follow up tests).

Table 4. Differences between pre-education item scores of Mediterranean Diet Quality Index for Children and Adolescents (KIDMed) and post-education and follow-up.

KIDMED items	Pre/post difference			Pre/follow-up difference		
	Mean (SD)	95% CI of the difference (lower; upper)	p**	Mean (SD)	95% CI of the difference (lower; upper)	p**
1. Takes a fruit or fruit juice every day	-.085 (.351)	-.188; .018	.103	-.043 (.415)	-.164; .079	.485
2. Has a second fruit every day	.021 (.531)	-.135; .177	.785	-.043 (.624)	-.226; .141	.642
3. Has fresh or cooked vegetables regularly once a day	.021 (.489)	-.122; .165	.767	.043 (.658)	-.151; .236	.660
4. Has fresh or cooked vegetables more than once a day	-.064 (.528)	-.219; .091	.411	.000 (.626)	-.184; .184	1.000
5. Consumes fish regularly (at least 2–3 times per week)	.128 (.494)	-.017; .273	.083	.149 (.589)	-.024; .322	.090
*6. Goes more than once a week to a fast-food (hamburger) restaurant	.064 (.567)	-.103; .230	.445	-.021 (.571)	-.189; .146	.799
7. Likes pulses and eats them more than once a week	-.170 (.637)	-.357; .017	.073	-.170 (.601)	-.347; .006	.058
8. Consumes pasta or rice almost every day (5 or more times per week)	.085 (.620)	-.097; .267	.351	.085 (.654)	-.107; .277	.377
9. Has cereals or grains (bread, etc.) for breakfast	-.170 (.564)	-.336; -.005	.044	-.234 (.598)	-.409; -.059	.010
10. Consumes nuts regularly (at least 2–3 times per week)	-.106 (.561)	-.271; .058	.200	.043 (.509)	-.107; .192	.569
11. Uses olive oil at home	-.085 (.408)	-.205; .035	.160	-.043 (.464)	-.179; .094	.533
*12. Skips breakfast	.064 (.528)	-.091; .219	.411	-.021 (.571)	-.189; .146	.799
13. Has a dairy product for breakfast (yoghurt, milk, etc.)	-.043 (.464)	-.179; .094	.533	-.021 (.531)	-.177; .135	.785
*14. Has commercially baked goods or pastries for breakfast	-.064 (.528)	-.219; .091	.411	-.085 (.583)	-.256; .086	.323
15. Takes two yoghurts and/or some cheese (40 g) daily	-.064 (.639)	-.252; .124	.497	.106 (.634)	-.080; .292	.256
*16. Takes sweets and candy several times every day	-.128 (.647)	-.318; .062	.183	-.021 (.531)	-.177; .135	.785

*Reversed items

**Paired-samples t-test scores

DISCUSSION

This nutrition education study was effective in changing the nutrition knowledge of students in a positive way according to their self-evaluations. However, it was ineffective in improving nutrition literacy and the Mediterranean diet.

This study aims to evaluate the effect of nutrition education intervention, on the Mediterranean diet while examining the effect on nutrition knowledge and nutrition literacy, with this to prevent or reduce the formation of unhealthy eating habits in this period of life where weight gain, which can lead to obesity and related health problems, begins. Nutrition education is frequently used to reduce nutritional problems such as obesity and malnutrition, which are common in adolescents^{19,20}. The first year of high school is a period in which the influence of peers on adolescent decisions, including food, becomes evident²¹. As the time spent outside the home increases, adolescents consume foods that are low in nutrients and high in energy, fat, and sodium more frequently²².

The Mediterranean diet, which includes anti-inflammatory foods, is shown to be protective against obesity-related diseases and can help adolescents live healthy lives early and later²³. Because it is easy to access the foods in the diet and compatible with the diet of countries, the Mediterranean diet is recommended, especially in Mediterranean countries, including Türkiye²⁴. However, with the increase in Western-style nutrition in recent years, significantly young people are gradually distancing themselves from this diet²⁵. The nutrition education intervention in this study was insufficient to improve the students' Mediterranean diet adherence, according to KIDMed, even though a few items changed in the desired direction. Besides, consumption of cereals or grains (bread, etc.) in the breakfast recommended in the Mediterranean diet has changed negatively. Psychosocial theories with motivating and facilitating action determinants are important in adolescent groups. Because this group is under the heavy influence of Western-style diets and has accessibility to highly palatable ultra-processed foods that are engineered to be irresistible and are heavily marketed to youth, it emphasizes that arrangements between individuals and their social environments are significant for this group. To increase adherence to this diet, besides different interventions, increasing the availability and accessibility of healthy foods may also be considered.

Nutrition education increases the nutrition knowledge of adolescents and is more effective when it is long-term²⁶. In a study, nutrition education is given to high school students for two months, examining whether the effectiveness continues after two months. Students' nutrition knowledge increased after the education and at the end of the two months compared to before²⁷. In this 8-week nutrition education study, of those who stated their self-assessment nutrition knowledge level as insufficient/do not know at the beginning, 57.1% stated their post-education level, and 50% stated their follow-up nutrition knowledge level as sufficient. It should be remembered that knowledge is permanent as long as it is repeated and can be forgotten when education is interrupted for a long time. Ensuring the continuity of education sessions, nutrition knowledge can be made permanent. Also, it should be kept in mind that in addition to having nutrition knowledge, it is also important to convert this knowledge into practice. Therefore, it is thought that sometimes ignorance and sometimes the difficulty of transforming knowledge into practice may prevent the development of healthy eating habits.

Nowadays, individuals are exposed to lots of nutrition information through social media and written and visual media and need help extracting reliable information. Choosing suitable sources for nutrition knowledge is essential in developing correct and permanent nutritional habits and contributing to the health of adolescents and adults. Nutrition literacy effectively grows healthy adolescent eating habits, improves nutritional status, and positively changes food-related attitudes and behaviors^{28,29}. In this study, nutrition education had no positive effect on nutrition literacy items. It is stated that adolescents are enthusiastic about food preparation and cooking, but they cannot develop their skills in these areas because they need facilities at home and school³⁰. Methods like food preparation and cooking lessons, which attract the attention and increase the desire to participate of adolescents, as well as the inclusion of the internet and social media, can be more effective in improving the nutrition literacy of adolescents.

This study was based on the theory that the information taught to students using the narrative technique would be adopted by them and used in their daily lives. However, although it was supported by visual content such as presentations and brochures, the teaching technique used was insufficient to reflect the students' knowledge into their behavior. Supporting the nutrition education sessions with interesting visual images and

videos, distributing brochures containing the summary of what was explained in the related education session at the end of each session (thus supporting the recall of what was explained in that week of education session), creating a discussion and brainstorming by doing question-answer activities during the education sessions were the strengths of the intervention. On the other hand, the nutrition education provided in the classroom setting might have been insufficient to attract the attention of all students. One of the weaknesses was that the personality differences between students were not taken into account. There is a possibility that parts that were not understood in the education sessions were not asked due to hesitation or embarrassment. Another weakness was the assumption that students who did not ask questions during the training understood what was explained. All students may not have been reached adequately in a class setting.

The study's primary limitation was that the participants' randomization was not done. A school of the med socioeconomic level was randomly selected for education. Students' distraction and boredom when answering questions was another study limitation. The exclusion of websites, social media, and television, where adolescents frequently obtain nutrition information, and the transmission of nutrition information only through presentations and brochures might have restricted students' benefits from education. The study's advantage was monitoring the long-term effectiveness of the intervention by following up after the education sessions.

CONCLUSIONS

As a result, the nutrition intervention in this study effectively improved adolescents' self-evaluation of nutrition knowledge. However, this study was insufficient to reduce unfavorable dietary habits or improve healthy dietary habits of adolescents in the first year of high school. This nutrition education was ineffective in increasing students' nutrition literacy levels. For future research, when planning dietary interventions to improve adolescents' diet or eating behaviors, it is suggested to consider individual factors related to adolescents, as well as internet and social media fields and the school/home food environment.

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AUTHORS' CONTRIBUTIONS

All authors contributed to the interpretation of results and preparation of the manuscript. GÜ was responsible for the analysis of the data with assistance from AU. All authors critically revised the manuscript and read and approved the final version. All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

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CONFLICTS OF INTEREST

Authors state no conflict of interest.

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