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Effects of School-Based Nutrition Education Intervention in Preschool Children and Their Teachers: An Experimental Study

Okulda Verilen Temel Beslenme Eğitiminin Okul Öncesi Çocuklar ve Öğretmenleri Üzerindeki Etkileri: Bir Deneysel Çalışma

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ABSTRACT Objective: This study aimed to examine the effects of healthy nutrition education on eating habits and anthropometric measurements of preschool children and the nutritional knowledge levels of their teachers. **Material and Methods:** Sixty preschool children educated in a kindergarten in Ankara and 6 teachers were included in this follow-up and single-center study. Researchers applied separate questionnaires including "Food Preference Image" for children and "Nutrition Knowledge Level Scale for Adults" for their teachers. Comprehensive healthy nutrition education that had different contents was given to children and teachers. Measurements of pre-education, follow-up 1 (immediate post-intervention), and follow-up 2 (one-month post-intervention) were compared with the Paired Samples t-test, Friedman test, Wilcoxon signed ranks test, and McNemar test. **Results:** The percentile of body weight and height by age of children increased (Z: -3.297; -2.524 respectively, p<0.05) in follow-up 2 compared to pre-education. Eating behaviors, food consumption, and food preferences of children improved (p<0.05). Mean scores of Nutrition Knowledge Level Scale for Adults of teachers were higher at follow-up 1 and follow-up 2 than pre-education (F=64.809; degree of freedom=2; p<0.05). **Conclusion:** Although the healthy nutrition education presented in this study was short-term, preschool children started to eat healthier, and the nutrition attitudes of teachers improved. Comprehensive studies with longer follow-up intervals should be conducted with large samples and more centers to ensure that these effects are due to nutrition education and to measure the effectiveness of the intervention.

Keywords: Preschool; school teachers; nutritional status

ÖZET Amaç: Bu çalışmada, sağlıklı beslenme eğitiminin okul öncesi çocukların beslenme alışkanlıkları ve antropometrik ölçümleri ile öğretmenlerinin beslenme bilgi düzeyleri üzerine etkilerini incelemek amaçlanmıştır. **Gereç ve Yöntemler:** Bu takipli ve tek merkezli çalışmaya, Ankara'daki bir gündüz bakım evinde eğitim gören 60 okul öncesi çocuk ve altı öğretmen dâhil edilmiştir. Araştırmacılar, çocuklar için "Besin Tercih Görseli" ve öğretmenler için "Yetişkinler için Beslenme Bilgi Düzeyi Ölçeği"ni içeren ayrı anketler uygulamışlardır. Çocuklara ve öğretmenlere farklı içeriklere sahip kapsamlı sağlıklı beslenme eğitimi verilmiştir. Eğitim öncesi, müdahaleden hemen sonra (takip 1) ve müdahaleden 1 ay sonraki (takip 2) ölçümler, Paired Samples t-test, Friedman test, Wilcoxon signed ranks test ve McNemar testleri ile kıyaslanmıştır. **Bulgular:** Eğitim öncesine kıyasla takip 2'de çocukların yaşa göre vücut ağırlığı ve boy uzunluğu persentilleri artmıştır (sırasıyla Z: -3,297; -2,524; p<0,05). Çocukların yeme davranışları, besin tüketimleri ve besin tercihleri gelişme göstermiştir (p<0,05). Öğretmenlerin takip 1 ve takip 2'deki ortalama Yetişkinler için Beslenme Bilgi Düzeyi Ölçeği puanları, eğitim öncesine kıyasla daha yüksektir (F=64,809; serbestlik derecesi=2; p<0,05). **Sonuç:** Bu çalışmada verilen sağlıklı beslenme eğitimi kısa süreli olmasına rağmen okul öncesi çocuklar daha sağlıklı beslenmeye başlamış ve öğretmenlerin beslenmeye ilişkin tutumları gelişmiştir. Bu etkilerin beslenme eğitiminden kaynaklandığından emin olmak ve müdahalenin etkinliğini ölçmek için geniş örneklem ve daha fazla merkez ile izlem aralığı uzun kapsamlı çalışmalar yapılmalıdır.

Anahtar Kelimeler: Okul öncesi; okul öğretmenleri; beslenme durumu

Nutrition is one of the most important factors affecting the growth and development of preschool children.[1] The early childhood period is a crucial time for the establishment of dietary habits that will shape the next years of life.[2] Many eating habits form in childhood, and the healthy ones that are acquired in early childhood contribute to similar habits later in life and have potential impacts on adult health.[3,4]

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Poor eating behaviors are responsible for lots of diseases worldwide.[5] Since fruit and vegetable consumption is associated with a reduced risk of non-communicable diseases such as cardiovascular diseases, interventions during this period are considered a critical strategy to reduce the disease burden in the future.[2] However, there is scientific proof that preschool and school-age children do not have healthy dietary habits. A proper diet actually means variety and moderation in diet. The child can choose certain foods because it is tasty or as "just" that has the menu.[6] Although intervention studies aimed at determining strategies to improve children's eating behaviors are still limited, it is thought that providing continuous, appropriate, and nutrition education sessions to preschool children is very likely beneficial.[7] Therefore, instead of insisting on or forcing preschool children to consume some foods that they do not eat like vegetables, presenting nutrition education plays a key role in enhancing their attitudes towards nutrition and increasing their healthy food choices. Especially it is very important that school-based nutrition education interventions for promoting fruit and vegetable intake in preschool children. As a result of studies with school children, it was found that nutrition education interventions increased the desire and intention, nutrition attitudes, and skills of school-age children to consume vegetables and fruit.[8,9]

Research indicates that nutrition education interventions might have a positive effect on eating behaviors among school-aged children and teenagers.[10-13] However, a few nutrition intervention studies among preschool children have been conducted.[2] The current study aimed to report on the effects of nutrition education intervention for preschool children and their teachers. The hypothesis of the study was that healthy nutrition education improves the eating habits, food preferences of the children, and the knowledge and attitudes related to nutrition of teachers.

MATERIAL AND METHODS

PARTICIPANTS AND STUDY PROCEDURES

The study was conducted in a full-time kindergarten in Ankara. Six female teachers working in this kindergarten and 60 children aged 3-6 participated in the study with the permission of their families. The inclusion criteria for the study were volunteering and healthy communication. This study was conducted in accordance with the principles of the Declaration of Helsinki. The data were collected between January-March 2020 with the "face-to-face interview technique".

In order to examine the effects of healthy nutrition education on nutritional habits of preschool children and the nutritional knowledge level of teachers, two questionnaires were created as a result of the literature research.[2,3,8,10,11] The questionnaires included information about the dietary habits of children and teachers. "Food Preference Image" was included in the children's questionnaire, and the "Nutrition Knowledge Level Scale for Adults (NKLSA)" was included in the teachers' questionnaire.

Anthropometric measurements of children [body weight, body height, mid-middle arm circumference (MUAC)] were measured by the researchers. Body height and body weight were measured with a SECA stadiometer (Seca Corporation, Chino, California) and a digital scale while standing, with both feet together and the head in the Frankfurt line. MUAC was measured by bending the left arm at 90 degrees to the body, finding the mid-point between the tip of the shoulder and the elbow, and marking with a pen the mid-upper arm point, respectively.[14] When evaluating these measurements, World Health Organization (WHO) Anthro (version 3.2.2 software) percentile values were used. The percentile was classified as "too low" (<3 p); "low" (3-15 p); "normal" (15-85 p); "high" (85-97 p); and "too high" (>97 p).[15] The body weight and height of parents and teachers were recorded according to their declaration. Based on these statements, body mass index (BMI) [(body weight, kg)/(body height, m^2)] were calculated and assessed according to WHO criteria, those with a BMI of <18.5 kg/m^2 (underweight), 18.5-24.9 kg/m^2 (normal), 25.0-29,9 kg/m^2 (overweight), and 30-39,9 kg/m^2 (obese).[16]

Food Preference Image: Ten unhealthy foods that children often want to consume were determined and their healthy alternatives were visualized. These

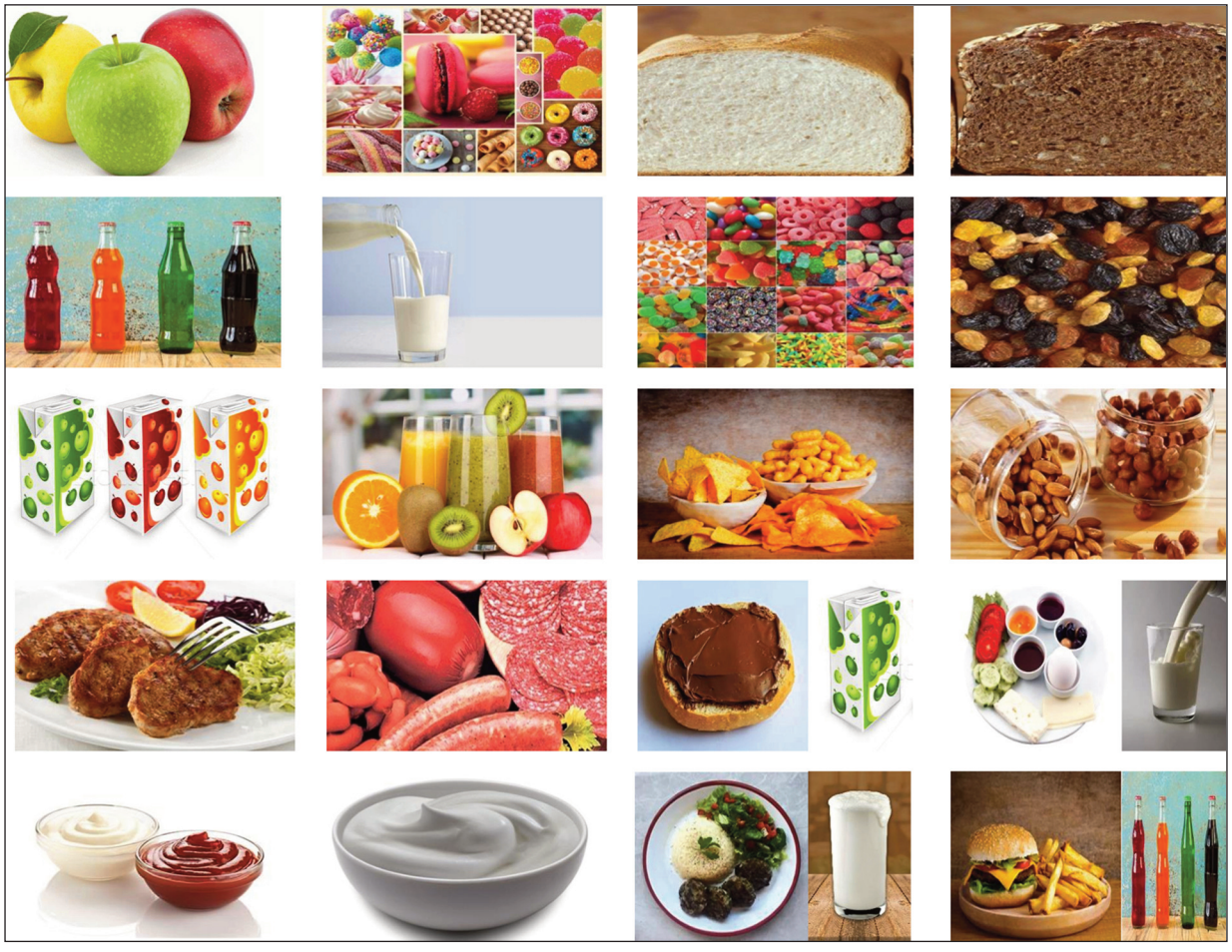

FIGURE 1: Food preference image for preschool children.

images were shown to the children, and they were asked which one they would prefer if they consumed these. It has been noted that the options are the same size in the image. The children were not guided by the researchers while making their choices. The food preference image for preschool children is in Figure 1.

NKLSA: This scale aims to determine the level of nutrition knowledge of adults. NKLSA consists of two parts as 20+1 items NKLSA-basic nutrition and 12+1 items NKLSA-food preference. The Cronbach alpha values for both parts were determined as 0.72 and 0.70, separately. After confirmation of the author, the first part was used in this study. The maximum score to be taken from the scale is 80. The knowledge level of the participants with the basic nutrition score of less than 45 is evaluated as "poor", the knowledge level of those with a score of 45-55 is considered as "moderate", those with a score of 56-65 as "good", and the knowledge level of those with a score above 65 is considered as "excellent" after dividing into percentiles taken from the scale. Participants evaluated the last item of NKLSA (What is the degree of relationship between nutrition and health? Evaluate.) with a visual analog scale grading from 0 to 10. It has been reported to be a valid and reliable scale developed by Batmaz.[17] Necessary permission has been obtained from the author.

ETHICAL CONSIDERATION

Before starting the study, detailed information about the study was given to the children, their parents, teachers, and kindergarten management, and the personnel and parental written and verbal consent were obtained. The study was executed with the Ethics Committee Approvals received from Ankara University Rectorate Ethical Committee (date: January 13, 2020; no: 56786525-050.04.04/2352).

CONTENTS OF NUTRITION EDUCATION INTERVENTIONS

Two separate healthy nutrition educations were prepared for children and teachers by the researchers. Healthy nutrition education was given to children and teachers in two sessions. The first part of the education lasted 25 minutes for the children and 20 minutes for the teachers. After a one-week break, the second part of the education sessions that lasted the 15-minute was given. Nutrition education sessions and data collection were carried out in a suitable room in the kindergarten.

Pre-education (baseline-before the education) survey, follow-up 1 (right after the end of the education) survey, and follow-up 2 (one-month post-intervention) survey were applied. The pre-education and follow-up 2 results were compared to detect the change in dietary habits, food preferences of children and nutritional knowledge, and attitudes of teachers.

Colorful slides, a simple game, and a question-and-answer teaching technique were used in the education prepared for children. Sentences were used to express healthy nutrition to children, such as "Eating healthy is eating healthy meals, such as the meals our mother made at home, and the meals we are at school. Junk food that we buy from outside, hidden in packages is unhealthy. If we eat healthily, we will not get sick quickly, if we get sick, we will recover quickly. If we eat healthily, we become stronger and stronger, we do not get tired quickly while playing games, we get taller and bigger, we have a strong memory, and we learn quickly. Fruits and vegetables were introduced, separated by color, and children were asked about their favorite fruits and vegetables. Then they were asked which foods are unhealthy. Expressions are used such as "If we consume unhealthy foods, our intestines do not work well, our stomachs get upset and can't function well, our heart gets tired quickly, our teeth rot and hurt quickly. If we eat too much sugar and chocolate, our teeth will rot and become sad. If we drink too many carbonated beverages, our stomach will be upset. If we eat too many salty things, our kidneys will be damaged and upset. While making salami and sausage, bad substances are added to it, so we should not eat them in order to grow healthy. The question was asked and answers were collected from the children "Well, now we have learned, what do we do to grow up healthy?" The education was reinforced with expressions such as "We do breakfast every morning. We always eat an egg for breakfast. We drink two glasses of milk a day. We eat lots of vegetables and fruit. We do not separate one from the others." The education ended with this game that was animated by children. "There was a little boy. He loved to eat. But he had a very difficult time choosing what he ate. He couldn't decide which was better. Now that we've learned all of them today, how about we help her decide which one is healthier? Which should he choose when there is oily popcorn sold there when he goes to the movies and fat-free popcorn that his mother makes at home? When the weather is very hot, she decides to eat ice cream, should she eat ice cream with milk? When he's very hungry and has a hot dog and cheese sandwich, which one would be healthier to eat? His mother prepared a hamburger for him at home. Should he add ketchup and mayonnaise to the hamburger or not? She wanted to eat something sweet, should she eat a sugar cookie or a nice apple? The little boy saw his mother put oil in the food. I wonder if this oil should be butter or olive oil?"

Healthy nutrition education for teachers included the definition of adequate and balanced nutrition, the importance of healthy nutrition, the nutrients, and their functions, the introduction of food groups, the amounts that should be consumed daily, and nutritional recommendations. Visual presentation was used as educational material. Slide contents usually consisted of large-sized images.

STATISTICAL ANALYSIS

The statistical analysis was performed with SPSS for Windows release 15.0.1 (November 2006) (SPSS Inc., Chicago, IL). Descriptive statistics (mean, standard deviation, minimum-maximum) were calculated for all study participants. In order to compare measurements of pre-education, follow-up 1, and follow-up 2, repeated measures analysis of variance test was used for normally distributed dependent variables. Friedman test was used for non-normally distributed variables. When pre-education and follow-up 2 were compared, Wilcoxon signed ranks test was used since

variables were un-normally distributed. The McNemar test was performed to compare categorical variables. The level of significance was set in all analyses as $p<0.05$.

RESULTS

CHARACTERISTICS OF THE PRESCHOOL CHILDREN AND TEACHERS

A total of 60 children, 25 (41.7%) girls and 35 boys (38.3%) with a mean age of 4.3±0.82 (3-6) years, participated in the study. The mean age of the mothers and fathers of the children was 33.2±4.47 (25-44) and 35.4±4.63 (27-45) years, respectively. 56.7% of the mothers, 83.3% of the fathers were graduated, 68.3% of the mothers and all the fathers were working. The mean BMI of the mothers and fathers was within the normal range (24.8±2.42; 25.6±1.58 kg/m^2, respectively).

The mean age of the teachers was 25.7±10.01 (20-46) years, and their professional experience was 3.4±3.50 (1-10) years. 2 of them were under graduated, 4 of them were graduated. Five of them had taken any education related to nutrition before this study. The mean BMI of the teachers was 22.6±4.0 (16.9-26.9) kg/m^2 (Table 1).

TABLE 1: Characteristics of preschool children, parents and teachers.

Characteristics	n (%)
Girls/boys	25/35 (41.7/38.3)
Age (years) $\bar{X}$±SD (minimum-maximum)	4.3±0.82 (3-6)
Age of mothers (years) $\bar{X}$±SD (minimum-maximum)	33.2±4.47 (25-44)
Age of fathers (years) $\bar{X}$±SD (minimum-maximum)	35.4±4.63 (27-45)
Education status of mothers	
Under graduated	26 (43.3)
Graduated	34 (56.7)
Education status of fathers	
Under graduated	10 (16.7)
Graduated	50 (83.3)
Working status of mothers	
Yes	41 (68.3)
No	19 (31.7)
Working status of fathers	
Yes	60 (100.0)
No	-
BMI of mothers $\bar{X}$±SD (minimum-maximum)	24.8±2.42 (19.1-30.3)
BMI of fathers $\bar{X}$±SD (minimum-maximum)	25.6±1.58 (22.6-30.7)
Age of teachers (years) $\bar{X}$±SD (minimum-maximum)	25.7±10.01 (20-46)
Professional experience of teachers (years) $\bar{X}$±SD (minimum-maximum)	3.4±3.50 (1-10)
Education status of teachers	
Under graduated	2 (33.3)
Graduated	4 (66.7)
Taking nutrition education before the study	
Yes	
No	
BMI of teachers $\bar{X}$±SD (minimum-maximum)	22.6±4.0 (16.9-26.9)

SD: Standard deviation; BMI: Body mass index.

ANTHROPOMETRIC MEASURES OF PRESCHOOL CHILDREN

The anthropometric measurements before and after the nutrition education are given in Table 2. In the follow-up 2, height and weight by age increased compared to the pre-education (Z: -2.524; -3.297 respectively; $p<0.05$). The MUAC did not change (Z: 0.000; $p>0.05$).

THE EFFECT OF NUTRITION EDUCATION ON PRESCHOOL CHILDREN

The number of children having 3 main meals a day increased from 80% to 96.7% after nutrition education. Similarly, the rate of those who have 2 main meals in the kindergarten increased (from 85% to 98.3%). The number of children who have 3 snacks a day increased after nutrition education (85% of them). The rate of breakfast skipping decreased after education (from 15% to 1.7%; Table 3).

After nutrition education, while the rates of consumption of essential foods (dairy products, meat, chicken, fish, legumes, bread and cereals, vegetables, and fruits) increased, the rate of consumption of junk food decreased (children who consume ≥5 times a week, from 50% to 6.7%) (Table 3).

When the food preferences of the children at pre-education, follow-up 1, and follow-up 2 were compared, it was determined that the other food preferences, except for bread preferences ($p>0.05$), changed healthy food preferences ($p<0.05$). There was no statistical difference between follow-up 1 and follow-up 2 results ($p>0.05$) (Table 4).

It was determined that the mean scores of the nutritional knowledge and nutrition-health relationship

TABLE 2: Anthropometric measures of preschool children after nutrition education.

Percentile	Pre-education Median (IQR)	Follow-up 2 Median (IQR)	Z	p value
Height for age	80.15 (31.50)	80.15 (31.50)	-2.524	<0.05*
Weight for age	82.00 (30.08)	83.55 (30.67)	-3.297	<0.05*
MUAC	83.60 (20.70)	83.60 (20.70)	0.000	>0.05

*Wilcoxon signed-ranks test; IQR: Interquartile range;
MUAC: Mid-middle arm circumference.

tests of teachers were higher at follow-up 1 and follow-up 2 compared to the pre-education results ($p<0.05$). While the nutritional knowledge level of 2 teachers was good before the nutrition education, the number of good and very good teachers increased after the education (Table 4).

THE EFFECT OF NUTRITION EDUCATION ON TEACHERS OF PRESCHOOL CHILDREN

In Table 5, the changes in the nutrition attitudes of teachers were determine. Attitudes of teachers related to sources of nutrition information, self-nutritional knowledge assessment, and eating with the children enhanced in follow-up 2.

DISCUSSION

This study was carried out in one kindergarten located in Ankara and measured the effect of healthy nutrition education given to 60 preschool children and 6 teachers on nutrition-related parameters. The content of the nutrition education and the questionnaires for both children and teachers before and after the education was created as a result of the literature review.[2,3,8,10,11] Hence, it is stated that nutrition education for preschool children should be positive, fun, interactive, and engaging. The education should focus on teaching children the relationship between food and health, and helping children start to develop sound attitudes and acquire knowledge about food, nutrition, and health.[18] In this study, attention was paid to these criteria, especially in the education given to children.

There is proof in the literature on nutrition education has a positive effect on especially vegetable and fruit consumption.[8,9] In a study, after 12 hands-on nutrition education lessons were given to 3-5 years old children, analyses showed that the change over time in consumption of the three vegetable samples varied by intervention status with greater change oc-

TABLE 3: Eating habits and food consumption of preschool children after nutrition education.

	Pre-education (n/%)	Follow-up 2 (n/%)
Main meals/day		
2	12 (20.0)	2 (3.3)
3	48 (80.0)	58 (96.7)
Skipped main meals		
Breakfast	9 (15.0)	1 (1.7)
Dinner	3 (5.0)	1 (1.7)
Snacks/day		
2	21 (35.0)	71 (11.7)
3	37 (61.7)	51 (85.0)
4	2 (3.3)	2 (3.3)
Main meals in kindergarten/day		
1	9 (15.0)	1 (1.7)
2	51 (85.0)	59 (98.3)
Skipped main meals in kindergarten		
Breakfast	9 (15.0)	1 (1.7)
Snacks in kindergarten/day		
1	15 (25.0)	5 (8.3)
2	45 (75.0)	55 (91.7)
Dairy products		
1-4 times a week	50 (83.3)	60 (100.0)
Rarely-never	10 (16.7)	-
Meat, chicken, fish		
1-4 times a week	52 (86.7)	60 (100.0)
Rarely-never	8 (13.3)	-
Eggs		
1-4 times a week	38 (63.3)	60 (100.0)
Rarely-never	22 (36.7)	-
Legumes		
1-4 times a week	23 (38.3)	38 (63.3)
Rarely-never	37 (61.7)	22 (36.7)
Bread and cereal		
≥5 times a week	33	53 (88.3)
1-4 times a week	27	7 (11.7)
Vegetables		
≥5 times a week	-	1 (1.7)
1-4 times a week	33 (55.0)	55 (91.6)
Rarely-never	27 (45.0)	4 (6.7)
Fruits		
1-4 times a week	50 (83.3)	59 (98.3)
Rarely-never	10 (16.7)	1 (1.7)
Junk food		
≥5 times a week	30 (50.0)	4 (6.7)
1-4 times a week	27 (45.0)	46 (76.6)
Rarely-never	3 (5.0)	10 (16.7)

TABLE 4: Food preference of preschool children and nutritional knowledge scores of the teachers after nutrition education.

	Pre-education (n/%)	Follow-up 1(n/%)	Follow-up 2(n/%)	p value
Apples	31 (51.7)[a]	54 (90.0)[b]	56 (93.3)[b]	<0.05*
Candy	29 (48.3)	6 (10.0)	4 (6.7)	
Carbonated beverage	27 (45.0)[a]	2 (3.3)[b]	6 (10.0)[b]	<0.05*
Milk	33 (55.0)	58 (96.7)	54 (90.0)	
Fruit juices	16 (26.7)[a]	5 (8.3)[b]	4 (6.7)[b]	<0.05*
Freshly squeezed juices	44 (73.3)	55 (91.7)	56 (93.3)	
Meatballs	30 (50.0)[a]	47 (78.3)[b]	54 (90.0)[b]	<0.05*
Salami, sausage	30 (50.0)	13 (21.7)	6 (10.0)	
Ketchup, mayonnaise	32 (53.3)[a]	12 (20.0)[b]	6 (10.0)[b]	<0.05*
Turkish yogurt	28 (46.7)	48 (80.0)	54 (90.0)	
White bread	51 (85.0)	51 (85.0)	49 (81.7)	>0.05
Brown bread	9 (15.0)	9 (15.0)	11 (18.3)	
Jelly bean	41 (68.3)[a]	12 (20.0)[b]	22 (36.7)[b]	<0.05*
Dried grapes	19 (31.7)	48 (80.0)	38 (63.3)	
Crisps	35 (58.3)[a]	9 (15.0)[b]	12 (20.0)[b]	<0.05*
Nuts	25 (41.7)	51 (85.0)	48 (80.0)	
Bread with chocolate, fruit juice	47 (78.3)[a]	21 (35.0)[b]	12 (20.0)[b]	<0.05*
Egg, cheese, olive, jam, tomato, cucumber, milk	13 (21.7)	39 (65.0)	48 (80.0)	
Meatballs, rice, salad, ayran	32 (53.3)[a]	55 (91.7)[b]	56 (93.3)[b]	<0.05*
French fries, hamburger, a carbonated beverage	28 (46.7)	5 (8.3)	4 (6.7)	
The Score of Nutrition Knowledge Level Scale for Adults of Teachers	52.7±6.19[a]	68.2±4.88[b]	67.17±4.02[b]	<0.05**
$\bar{X}$±SD (minimum-maximum)	(44-60)	(61-75)	(63-73)	
F		64.809		
df		2		
Nutrition-health relationship				
Median (IQR)	7.50 (1.50)[a]	8.00 (1.25)[b]	8.00 (1.25)[b]	<0.05****
Chi-square		8.000		
df		2		
Score categorization (n/%)				
Poor	1 (16.7)	-	-	***
Moderate	3 (50.0)	-	-	
Good	2 (33.3)	1 (16.7)	3 (50.0)	
Excellent	-	5 (83.3)	3 (50.0)	

[ab]Statistically significant difference between scores; *McNemar test; **Repeated measures analysis of variance test; ***Values were not performed; ****Friedman test;
SD: Standard deviation; df: Degree of freedom; IQR: Interquartile range.

curring among children within the intervention group.[19] In another study, 2 years-long school-based nutrition and health education were conducted for 2,066 children in China and were compared to the control group. Significant interactions between groups and time were observed in nutrition knowledge, the frequency of eating breakfast, and dietary intake, including meat, eggs, milk, and vegetables, but not in nutritional status.[20] In a study involving 2,227 children and guardians conducted by Asakura et al., a school-based nutrition education program was supplied with a 45-minute lecture in 14 public primary schools in Japan, and was shown that children's nutrition knowledge level was significantly increased following the intervention.[21] In this study, the number of children who ate vegetables and fruit 1-4 times a week increased. In addition, when the effect of healthy nutrition education on the dietary habits of children was investigated, the rate of consumption of three main meals and snacks a day and the consumption of main foods (dairy products, eggs, etc.) increased, while the rate of consumption of junk food

TABLE 5: Nutritional attitudes of the teachers after nutrition education.

	Pre-education (n/%)	Follow-up 2 (n/%)
Source of information related to nutrition		
Nutritionist	2 (33.3)	4 (66.7)
Others*	4 (66.7)	2 (33.3)
Self-definition of nutritional knowledge level		
Moderate	4 (66.7)	1 (16.7)
Good	2 (33.3)	5 (83.3)
Self-definition of adequate and balanced nutritional status		
No	2 (33.3)	-
Yes	4 (66.7)	6 (100.0)
Pickiness in food		
Yes	1 (16.7)	1 (16.7)
No	-	1 (16.7)
Sometimes	5 (83.3)	4 (66.7)
Eating with the children at the kindergarten		
Yes	4 (66.7)	5 (83.3)
No	2 (33.3)	1 (16.7)

*Other: TV, newspaper, magazine, social media, other health employees.

and the frequency of skipping meals decreased (Table 3). Positive changes also occurred in nutritional attitudes. For example, the rate of those who preferred apples to candy, milk to carbonated beverages, and Turkish yogurt to mayonnaise increased after the education. Similar developments were observed in teachers as well. Nutrition knowledge score increased compared to pre-education. The level of finding a relationship between nutrition and health similarly increased (Table 4).

Preschool centers where many young children regularly attend childcare are ideal places for encouraging children to eat healthily.[22] In a study that evaluated the effectiveness of behavioral intervention in 3-6 years preschool children in kindergartens, the results showed that consumption of Western fast food, sweetened beverages, and fried food was decreased.[4] Another study conducted with Norwegian 3-5 years preschool children showed that the long-term effects on child vegetable intake were not significant.[23] On the other hand, in our study, it was found that the rate of children who rarely or never eat fruit and vegetables decreased. A behavioral-based, 3 months lasted and participated elementary school children in 4th and 5th-grade randomized control trial showed that the consumption of fish increased. It was stated that this is related to the increase in knowledge and attitude toward consuming fish by children.[13]

Considering the effect of education on anthropometric measurements, it was determined in our study that the height and weight percentiles for age increased one month after the end of education (follow-up 2). Intervention programs delivered by nutritional experts and class teachers over 10 weeks caused increased weight and height, and decreased BMI of children.[24] On the other hand, in the study of Effendy et al., the intervention effect on height-for-age Z-score (HAZ) could not be shown after 6 months of nutrition education intervention that was given to caregivers of 6-17 months children.[25] In a pilot study conducted in Bekaa, Lebanon with refuge primary school children, findings sign a positive impact of this school-based nutrition intervention on dietary knowledge, attitude, and nutritional status of the children when compared to the control group.[10] In the same study, while there was no significant difference in other anthropometric measurements between the nutrition intervention group and the control group, the HAZ of the intervention group is higher.[10] In our study, results of follow-up 1 and follow-up 2 showed that the mean height and weight percentiles by age increased compared to baseline.

Kindergarten teachers play a crucial role in providing preschool children with nutrition education. According to a cross-sectional survey in China, 54.2% of kindergarten teachers had basic nutrition-related knowledge; 9.9% of them were satisfied with their knowledge of childhood nutrition. 38.7% of them had taken nutrition knowledge courses or training about childhood nutrition.[26] In a study, similar to our study, with 200 teachers who work in 40 private kindergartens, it was detected that 16.5% of the teachers had sufficient, 70.0% of them had moderate and 13.5% of them had insufficient nutrition knowledge level.[27] These findings reveal the necessity of providing nutrition-related education not only to children but also to their teachers regularly and continuously in kindergartens. However, studies dealing with preschool-based nutrition-related education to both

children and teachers are very limited.[28,29] However, these studies are usually related to teacher education which has effects in decreasing the prevalence of over-nutrition and obesity in preschool children. The results of these studies show that the education given to teachers working in kindergartens will play an important role in the nutrition of children and prevent obesity.[30-32]

CONCLUSION

The current findings point to the need to give nutrition education to both preschool children and teachers to improve the nutritional status in kindergarten. To promote healthy eating behaviors of children, and enhance the nutritional-based knowledge and attitudes toward nutrition of teachers, nutrition education should be targeted and repeated at regular sessions and its effectiveness should also be measured frequently. Although the body height and weight percentile values of children showed significant increases one month after the nutrition education, the results of the studies suggesting school-based nutrition education in reducing the prevalence of obesity suggested that this result should be evaluated for a long time.

It is seen that before nutrition education is given, the nutrition knowledge level of the teachers is poor, moderate, or good. However, after education, there are no poor and moderate teachers. Similarly, the levels of finding a relationship between nutrition and health increased. If nutrition education to teachers is provided constantly, it is thought that the results obtained from our study will improve the nutritional status of children in the long term.

Along with children and teachers, it may be more beneficial to involve their parents, the managers, and the cooks of kindergartens in education sessions. Early-aged children may benefit from planning and presenting this nutrition education in kindergartens by volunteer researchers, dietitians, and public health specialists. Thus, healthy eating habits are acquired and future health problems and disease burdens are reduced.

However, there are some limitations of this study. Firstly, the results of this study are preliminary data. The results of this study reflect data on only children and their teachers in one kindergarten. Secondly, the study was carried out in only one institution and with a very small number of participants. In order to draw a more valid conclusion from the findings obtained from the study and to make a contribution to the literature, it should be carried out in a multicenter and with more participants. Lastly, educational interventions that were given by nutritionists to children and teachers are on basic health nutrition, not structured education.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Aylin Bayındır Gümüş, Alev Keser;* ***Design:*** *Aylin Bayındır Gümüş, Alev Keser;* ***Control/Supervision:*** *Alev Keser;* ***Data Collection and/or Processing:*** *Aylin Bayındır Gümüş;* ***Analysis and/or Interpretation:*** *Aylin Bayındır Gümüş, Alev Keser;* ***Literature Review:*** *Aylin Bayındır Gümüş;* ***Writing the Article:*** *Aylin Bayındır Gümüş, Alev Keser;* ***Critical Review:*** *Alev Keser.*

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