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Araştırma Makalesi / Research Article

Adölesanlarda Beslenme Eğitiminin Akdeniz Diyeti Kalite İndeksi (KIDMED) Üzerine Etkisi

Nutrition Education's Impact on Mediterranean Diet Quality Index (KIDMED) Among Adolescents

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ÖZ

Bu çalışma, teori temelli beslenme eğitiminin adölesanların Akdeniz diyetine uyumuna etkisini incelemek amacıyla gerçekleştirilmiştir. Çalışmaya Balıkesir'deki bir ortaokulda öğrenim görmekte olan, 11 ila 14 yaş aralığındaki (ortalama yaş 12.5 yıl) 40 gönüllü adölesan katılmıştır. Çalışma 19 Şubat 2020 ile 22 Mayıs 2020 tarihleri arasında gerçekleştirilmiştir. Katılımcıların Akdeniz diyetine olan uyumlarını değerlendirmek için Akdeniz Diyeti Kalite İndeksi (KIDMED) kullanılmıştır. Araştırmada uygulanan müdahale, teori temelli bir beslenme eğitimi şeklinde planlanmış ve bir kez uygulanmıştır. Türkiye Beslenme Rehberi 2015 esas alınarak hazırlanmıştır olan beslenme eğitimi müdahalenin temelinde sosyal bilişsel kuram yer almaktadır. Eğitim bilgisayar üzerinden sunum şeklinde verilmiştir. Müdahale sonrasında katılımcıların KIDMED skorlarında anlamlı bir artış saptanmıştır ($p<0.05$). Müdahale, katılımcıların kahvaltı yapma alışkanlığı üzerinde anlamlı değişiklik sağlamayı başarmıştır ($p<0.05$). Sonuç olarak yapılan çalışma teori temelli beslenme eğitimi müdahalesinin adölesanların Akdeniz diyetine olan uyumlarının arttırılmasında etkili olduğunu ortaya koymuştur. Dolayısıyla zaman ve mali açıdan avantajlı olan bu yöntem, adölesan popülasyonun sağlığını koruma ve geliştirmede bir alternatif olarak kullanılabilir. İleride uygulanacak beslenme eğitimi müdahalelerinin sıklığının arttırılması, kapsamının genişletilmesi ya da sürece sağlık çalışanlarının ve ebeveynlerin dahil edilmesi ile bu etkinin artacağı düşünülmektedir.
Anahtar Kelimeler: Adölesan, Beslenme Eğitimi Müdahalesi, KIDMED.

ABSTRACT

This study was conducted to evaluate the effect of a theory-based nutrition education on adolescents' Mediterranean diet (MeD) adherence. Study was conducted with 40 voluntary adolescents aged between 11 to 14 years (mean age 12.5 years) in a middle school in Balıkesir, Turkey. Mediterranean Diet Quality Index (KIDMED) was used to evaluate adolescent's MeD adherence. The intervention implemented in the study was planned as a theory-based nutrition education and was implemented once. The nutrition education program was prepared based on Turkey Nutrition Guidelines 2015. Social Cognitive Theory was the theoretical framework of the intervention. The intervention has been given via a computer-based presentation assistance. There was an increase in KIDMED scores after intervention which was statistically significant ($p<0.05$). The intervention achieved a significant improvement in the regular breakfast habits ($p<0.05$). As a result, the study revealed that theory-based nutrition education intervention was effective in increasing adolescents' adherance to the MeD. Therefore, this method, which is advantageous in terms of time and finance, can be used as an alternative to protect and improve the health of the adolescent population. It is thought that this effect will be strengthened by increasing the frequency of future nutrition education interventions, expanding their scope, or involving health professionals and parents in the process.
Keywords: Adolescence, KIDMED, Nutrition Education Intervention.

1. Introduction

The Mediterranean diet (MeD) can be defined as increased consumption of plant originated foods including nuts, vegetables, unrefined natural cereals and fruits, moderate-to-high intakes of seafood and fish, minimized consumption of red meat and high-fat dairy products and plenty of olive oil consumption as main source of daily fat (1).

It is believed that impairment in MeD adherence, in parallel to adopting a Western dietary pattern in the Mediterranean Countries, might be responsible for the increasing incidence of chronic diseases since childhood (2).

Higher adherence to MeD has numerous beneficial effects on cognitive health (3–5), cardiovascular diseases (CVDs) (6–8), various cancers (9–11), obesity (12–14) and musculoskeletal health (15–17). Developing healthy eating habits at early ages has significant positive potency on healthy growth & development and those habits tends to be transferred to later periods of life (18,19).

Mediterranean Diet Quality Index (KIDMED) comprises the main principles of the MeD and accepted as a rapid and valid tool in terms of MeD adherence evaluation (20). A case study from Turkey showed that there is a significant association between participants nutritional knowledge and their adherence to the MeD (21). Several nutrition education programs are previously used for an improvement in nutrition knowledge and a modification on dietary patterns of children's and adolescents' (22–25).

Nutritional knowledge of an individual is directly related with his/her nutritional choices (22). Providing right nutritional knowledge and introducing decent nutritional habits to children while they are young are quite important for their future nutritional preferences (26). A 8 month healthy school transformation program conducted with 628 adolescents also shown that nutrition knowledge is an important predictor of the healthy eating behavior (27). Studies also supports that eating patterns and habits developed during adolescence and childhood tends to track into adulthood (28,29). It is possible to find other school based nutritional education interventions in literature which improved children's nutrition knowledge or behavior (23-25). Dean et al.'s meta-analysis from 2015 which compiled data from 49 studies (38001 children in total from 13 different countries) about school based healthy eating intervention, shown that enhanced curriculum approaches (Exclusive nutrition education applications beyond existing curriculum delivered by teachers.) are more dominantly used

in this particular matter. According to this meta-analysis, enhanced curriculum strategies have minimal influence on total energy and sugar consumption reduction but results emphasize that enhanced curriculum intervention strategies are capable of improving children's nutritional knowledge and fruits and vegetable consumption preferences (30).

We aimed to evaluate the effects of theory-based nutrition education on adolescent's MeD adherence.

2. Materials and Methods

2.1. Participants

Ethical approval (date and number: 06.11.2019, 1115) obtained from Yeditepe University Clinical Research Ethical Committee. Additional permissions were taken from Ministry of National Education and students and their parents were informed about the study and only voluntary students included for the study after a written informed consent form. The study was carried out in a voluntary middle school located in Balıkesir, Turkey. Minimum sample size was calculated via sample size calculation formula for known population by using power analysis statistical software package version 3.1 (SAS Institute, Cary, NC, Calculated using USA). According to this calculation, it was calculated that 39 participants should be included in the study, with a 95% confidence interval, alpha 0.05 and 80% power, and an effect size of 1.9 was predicted. 40 of 46 registered students volunteered to attend the study, which was higher than the minimum sample size. None of the volunteers had a medical condition which requires a specialized nutrition program.

2.2. Data Collection

Data was collected between 18th of February 2020 to 22nd of May 2020. Maternal education, sex, physical activity, age and sedentary behaviors were questioned with a self-administered questionnaire; academic performance was evaluated based on participant's grade point average (GPA). Participant's body weight was measured with a portable, 0.1kg sensible scale; height was measured with a non-flexible measuring tape while participants lean against the wall, their feet next to each other and their hand in frontal plane. AnthroPlus© software was used to calculate and classify participant's percentiles according to their age in accordance with WHO.

At the first visit, voluntary consent forms were given to the school's administration and school transmitted them to the parents. At the second visit, participants with the written informed consent form answered the socio-demographical form and KIDMED questionnaire, then anthropometric measurements were performed and they attended to the nutrition education designed for this study. Final visit designed to be carried out 3 weeks after the second visit but due to isolation protocols

(COVID-19), online surveys was created and send out to the participants via school administration. All information from 1st and 2nd visits obtained via face-to-face interviews during class hours when both the researcher and teachers were present at the classroom.

KIDMED index, which has also been validated among Turkish adolescents (31, 32) was used in the evaluation of adherence to the MeD. Index was built on the major principles of Mediterranean dietary pattern plus that factors could impair the dietary pattern and included 16 yes/no questions in which an adherence score ranged between 0 to 12. Scores ≥ 8 are excepted as optimal adherence; 4-7 excepted as an average adherence (needed to be improved); and ≤ 3 excepted as a very low adherence (20).

Participants' sedentary behavior and physical activity were evaluated based on Turkey Physical Activity Guideline 2014 (33). According to the guideline; screen time is a term used for activities done in front of a screen, such as watching TV, working on a computer, or playing video games. Participants who have a screen time > 2 hours/day were considered to have overly excessive sedentary behavior; 1 to 2 hours/day as excessive sedentary behavior; and <1 hour/day as normal. Participants were divided in to 4 groups regarding their daily physical activity. 1st group was assigned for participants who does not perform any kind of physical activity and 2nd group was assigned for participants who perform less than 60 minutes moderate to vigorous physical activity and both 1st and 2nd groups were considered to have an inadequate physical activity level. Participants who perform 60 minutes moderate to vigorous physical activity has been located into 3rd group and considered to have an adequate physical activity level. 4th group included participants who perform more than 60 minutes moderate to vigorous physical activity daily and considered to have an adequate physical activity level which generates additional health benefits (33).

2.3. Nutrition Education Intervention

Nutrition education intervention was designed as a theory-based program which focuses on the KIDMED index's questions. Definitions of macronutrients, micronutrients and food groups, information about their sources, their effect on individual health, portion sizes and recommended quantities for each food group was explained to the participants. Turkey Nutrition Guidelines 2015 (34) was used as a primary source in constitution of the intervention implemented via a computer-based presentation assistance (Microsoft, PowerPoint®) with an approximate 60 minutes of duration and consisted of related images rather than long and elusive sentences.

2.4. Statistical Analysis

Participants' demographic characteristics are shown as means with standard deviations or percentages. Independent-samples t test was used in determination of differences between sexes for continuous variables. Paired samples t test was used to evaluate the effect of the intervention on MeD adherence score (KIDMED score). Partial correlations were used to analyze the relationship between KIDEMED scores and school success after controlling body mass index (BMI), age and screen time. The McNemar test was used to assess the effect of the intervention regarding to the answers given to each question before and after the intervention. One Way ANOVA was used to determine the relationship between KIDMED score & physical activity and KIDMED score &body weight status. A p-value less than 0.05 considered to be statistically significant.

3. Results

Amongst the study population, 52.5% of them were boys and 47.5% were girls. Thirty-seven (92.5%) of the participants' mothers were primary school graduate. High school and university graduate maternal education status was 2.5% and 5% respectively. 5% of the participants were unsuccessful, 40% of them were successful, 22.5% of them were rewarded with certificate of achievement and 32.5% of them rewarded with certificate of higher achievement according to their academic success.

Eighteen participants (45%) stated that they do not perform any moderate to vigorous physical activity. 25% of the study population had inadequate physical activity whereas 10% of them had adequate physical activity and 20% of them had above adequate physical activity. Regarding screen time only one participant (2.5%) fitted the requirements, 15% of the participants had excessive screen time and 82.5% of them had highly excessive screen time. 5 participants (12.5%) were obese, 7 (17.5%) were overweight, 23 (57.5%) were at normal body weight, 3 (7.5%) were thin and 2 (5%) were severely thin. Table 1 represents demographic characteristics of the study population.

Table 1. Demographic characteristics of the participants

	Frequency (n)	**Percentage (%)**
Sex		
Male	19	47.5
Female	21	52.5
Total	40	100.0
Maternal Education		
Primary School Graduate	37	92.5
High School Graduate	1	2.5

University Graduate	2	5.0
Total	40	100.0
Academic Success		
Unsuccessful	2	5.0
Successful	16	40.0
Certificate of Achievement	9	22.5
Certificate of High Achievement	13	32.5
Total	40	100.0
Physical Activity		
None	18	45.0
Inadequate	10	25.0
Adequate	4	10.0
Above Adequate	8	20.0
Total	40	100.0
Screen Time		
Normal (<1hr/day)	1	2.5
Excessive (1-2hr/day)	6	15.0
Highly Excessive (>2hr/day)	33	82.5
Total	40	100.0
Z-Score		
Obese	5	12.5
Overweight	7	17.5
Normal	23	57.5
Thin	3	7.5
Severe Thin	2	5.0
Total	40	100.0

Regarding KIDMED scores, participants in adequate physical activity and above adequate physical activity groups were combined and evaluated as one group to create more evenly distributed analyze. No statistically significant difference found between groups as determined by one-way ANOVA (p=0.068), Table 2. Groups for obese & overweight participants and thin & severe thin participants combined and evaluated as one group to create more evenly distributed analyze. No statistically significant difference found between groups as determined by one-way ANOVA (p = 0.405), Table 3.

Table 2. Descriptive statistics of KIDMED score according to physical activity

	n	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
None	18	5,17	2,31	4,02	6,31	1,00	9,00
Inadequate	10	5,6	1,84	4,28	6,91	4,00	9,00
Adequate&Above Adequate	12	7	1,86	5,82	8,18	3,00	9,00
Total	40	5,83	2,17	5,13	6,52	1,00	9,00

Table 3. Descriptive statistics of KIDMED score according to body weight status

	n	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Obese & Overweight	12	5,58	1,93	4,36	6,80	3,00	9,00
Normal	23	6,17	2,06	5,28	7,06	3,00	9,00
Thin & Severe Thin	5	4,8	3,19	0,83	8,77	1,00	9,00
Total	40	5,82	2,17	5,13	6,52	1,00	9,00

A correlation analyze was performed to determine the relationship between participant's KIDMED score and school success after controlling for age, BMI and screen time. As stated at the Table 4, there was a negative partial correlation between KIDMED score (5.82 ± 2.17) and school success (73.19 ± 15.46) after adjusting for age (12.5 ± 1.1 years); BMI (19.29 ± 4.7 kg/m²); and screentime (290 ± 165 minutes) which was not statistically significant (p = 0.219).

Table 4. Relationship between participant's KIDMED score and school success after controlling for age, BMI and screen time.

Control Variables			School success	KIDMED score
Age & Screen time & BMI	School success	Correlation	1,000	-,207
		Significance	.	,219
		df	0	35
	KIDMED score	Correlation	-,207	1,000
		Significance	,219	.
		df	35	0

Any answer, which will lead a positive health outcome, considered an affirmative answer. For 11 questions in total frequencies of affirmative answers increased after the intervention. Those questions (Q) were aimed to investigate different eating habits such as having a breakfast (Q1) which increased from 57.5% to 80%; avoiding consumption of commercially baked products at breakfast (Q4) which increased from 22.5% to 35%. Consumption of 2 glasses of milk/yogurt or 40 grams of cheese daily (Q7) increased from 60% to 70%. Consumption of a second fruit daily (Q8) increased from 57.5% to 70%; consumption of cooked or fresh vegetables more than once daily (Q9) increased from 40% to 42.5%. Regular consumption of fish (Q10) increased from 37.5% to 42.5%. Avoidance from fast-food consumption more than once a week (Q11) increased from 85% to 92.5%. Consumption of legumes and pulses more than once weekly (Q13) increased from 70% to 75%. Regular consumption of rice or pasta (Q14) increased from 40% to 55%. Avoidance from sweet and dessert consumption more than once daily (Q15) increased from 15% to 22.5%. Lastly, olive oil consumption (Q16) increased from 97.5% to 100%. Intervention did not affect the frequency of grain & cereal products consumption at breakfast (Q3) and consumption of fruits or freshly squeezed fruit juices daily (Q5). Frequencies for affirmative responds to remaining 3 questions decreased after intervention. Those questions were milk and milk product consumption at breakfast (Q2) which decreased from 80% to 75%; consumption of cooked or fresh vegetables once a day (Q6) decreased from 80% to 75%; and regular consumption of nuts (Q12) decreased from 60% to 55%.

Eleven participants changed their breakfast habits towards having a breakfast from skipping breakfast after the intervention. Although frequencies for affirmative responses increased after the intervention for 11 questions, according to the McNemar test that proportional chance was statistically significant for only Q1 ($p=0.022$).

Participants' MeD adherence improved after the intervention. 15% of the participants remained showing poor adherence to Mediterranean dietary pattern. While percentage of the participants with good adherence increased 40% from 27.5%, average adherence decreased from 57.5% to 45%.

There was a 0.93 points increase in KIDMED scores after intervention (95% CI [-1.5, -0,34]). Mean difference between KIDMED scores was statistically significant ($p < 0.05$) (Table 2).

Table 2. KIDMED scores before & after the intervention.

KIDMED scores	n	Mean	SD	Significance*
Before the intervention	40	5.8250	2.17076	*t*=-3.195 p=0.003
After the intervention	40	6.7500	2.53943	

n=Number, SD=Standard deviation.

4. Discussion

Adherence to the MeD pattern has beneficial outputs beyond prevention of diseases and increased academic performance. Studies found that adherence to the MeD is directly associated with better quality of life. Emily Knox and Jose Joaquin Muros' study revealed increased positive scores in 4 parameters of health related quality of life for adolescents with better MeD adherence (35). Likewise, findings of cross-sectional analysis of PREDIMED-Plus Trial shown significantly better scores in 8 parameters of health-related quality of life in adults with higher MeD adherence (36) which further strengthens that dietary habits of youngsters is a highly important issue and requires investments on.

Studies conducted in European countries signalize that university students' diet was distancing from traditional MeD (37-39). One of them, in particular, revealed that only 19.4% of the students in the study group had adherence to the MeD (39). As providing appropriate nutritional information to children in early stages of their life is associated with healthy nutritional preferences (40) school-based nutrition education programs has potential to improve the patterns.

Although our results showed that a theory-based nutrition education achieved statistically significantly behavioral chances in adolescents' breakfast habits, it should be considered that students were on a distance education program instead of their regular school program. As this education approach, that begins later in the morning compared to the face-to-face education at schools, and does not take time during transportation to school, might be effective for having breakfast. Also, because of the study design, it is not possible to predict whether that effect will remain for longer period of time.

Percentage of the adolescents with good MeD adherence increased to 40 from 27.5 but percentages of the adolescents with poor adherence did not change. It can be said that theory based nutritional education is more effective on improving adolescents' adherence from average to good than improving their adherence from poor to average.

While considering that individuals with poor adherence to MeD have greater risk for developing overweight and obesity (14) as well as CVDs (6), upgrading this theory-based education program to support the imperilment group (participants with poor adherence) should be the main focus for further studies.

As expected, intervention achieved to increase affirmative answers given to the 15th question, which evaluates sweet and dessert consumption. For a statistically significant improvement on reducing sweet and dessert consumption, a systematic review and meta-analyses suggested that larger interventions are required beyond theory-based nutrition education programs (30). An intervention study, which used both parental involvement and school curriculum-based nutrition education techniques, achieved significantly decreased unhealthy food (sweets, cookies and ice cream) consumption compared to control group (24). However, Alicia et al. revealed significantly increased dairy consumption compared to the control group after their social cognitive theory-based nutrition education intervention (22). Similarly, we found that percentage of affirmative answers for 7th question (dairy consumption) increased 10% after the intervention.

Although a meta-analysis on teaching approaches to promote healthy eating showed 60% of the interventions with curriculum-based approaches achieved significant increase on vegetable and fruit consumption (30), our intervention achieved increased fruit and vegetable consumption (Q8, Q9 and Q10) even it was not statistically significant.

Using olive oil at home (in food preparation) has the highest affirmative answer rate in both before and after intervention. Such high ratio of olive oil usage is believed to be an effect of the region, on which study was conducted.

Data regarding to evaluate sedentary behavior (screen time) and physical activity are recorded for only comparing with adherence to the MeD. Even the study does not represent all adolescent population because of sampling size and method, it still is a dramatic outcome that only 1 participant (2.5%) found to be spending normal time in front of a screen and 28 participants (70%) had below adequate physical activity according to Turkey Physical Activity Guideline 2014 (33). Thus, further studies are strongly recommended.

Additional strategies were used in intervention studies accompanied to curriculum focused nutrition education. Firstly, In HealtyKick Study, experiential teaching approaches (establishing vegetable gardens at schools) were used and a healthy eating environment was tried to be created via healthier food options in truck shops and special events in addition to theory-based nutrition education (41). In addition, in the Pathways Study, together with enhanced curriculum technique parental involvement techniques were used, within three years nine different family events accomplished in schools.

Low-fat snack pack samples introduced to parents, cooking demonstrations and other healthy lifestyle promoting activities were performed with families (25). A systematic review and meta-analysis pointed out that most of the interventions which showed improved fruit and vegetable consumption used curriculum based approaches coupled with secondary approaches like experiential learning or parental involvement (30). Thus, combined strategies for further interventions to improve adolescents eating habits are recommended.

Parental factors and home environment are important factors for children's eating habits (42,43) and a systematic review on interventions for obesity prevention in children showed that school-based intervention programs' effectiveness can be enhanced by parental evolvement (44). Another review also suggested that parental involvement is more effective when it is used as a direct approach like group education rather than indirect approach like sending informative brochures to houses (45). Although peers also have influence on adolescents eating patterns (46), future studies are still recommended to consider parental involvement techniques since their nutrition knowledge and dietary habits are shown to correlate with their children's adherence to MeD (47).

Nutrition education was performed only for once in this study while recurrent nutrition educations are performed in other intervention studies as much as 64 times (45 minutes each) within 3 years (25) or 10 times (30 minutes each) within 6 months (24). It might be said that a nutrition education for just once may not be effective on generating appropriate nutritional behaviors in all aspects. Duration and frequency of the nutrition education programs seems to be as important as programs' content.

Unfortunately, as Şahingöz et al. mentioned, there are no nutritional programs in Turkish school curriculums (21). Considering that education within specific settings (such as schools, workplaces, and hospitals) are valuable strategies on health promotion and schools provide the most efficient & effective way to reach multiple segments of the population (48) governmental (Ministry of Health & Ministry of Education) regulations and actions for schools should be prioritized on nutrition subject. Literature points out that nutrition education programs in school curriculums should not be vague and general. They should be evaluated regularly to follow the progress and use results from it to encourage and enhance the strategies (49).

5.Conclusion

As a conclusion, theory-based nutrition education intervention has a potential towards increasing MeD adherence of adolescents'. This potential may strengthen with repetition (frequency) of the education, family participation in the education process, health professionals' involvement during preparation and presentation of the education, an enhanced scope and a complementary

approach which will also focus on physical activity. It cannot be expected from either schools or small health organizations to overcome construction of such elaborated intervention by themselves, governmental support seems to be the key point while creating such nutrition education programs.

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Authors' Contribution

Idea/Concept: C. Zeybek, B. Okan Bakır; **Design:** C. Zeybek; **Control/Supervision:** B. Okan Bakır; Kaynaklar: C. Zeybek, B. Okan Bakır; **Materials:** C. Zeybek, B. Okan Bakır; Data **Collection and/or Processing:** C. Zeybek; **Analysis and/or Interpretation:** C. Zeybek, B. Okan Bakır; **Literature Review:** C. Zeybek; **Writing:** C. Zeybek; **Critical Review:** B. Okan Bakır.

Conflict of Interest

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