Clinical and Experimental Health Sciences

Effects of Online Nutrition Training Program About Mediterranean Diet on Anthropometric Measurements and Diet Quality in Overweight and Obese Adolescent Girls

Seray Kabaran, Tuğçe Memiş

Eastern Mediterranean University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Famagusta, Turkish Republic of North Cyprus.

Correspondence Author: Seray Kabaran
E-mail: seray.kabaran@emu.edu.tr
Received: 14.01.2022 **Accepted:** 07.11.2022

ABSTRACT

Objective: This study was conducted to evaluate the effect of an online nutrition training program about the Mediterranean diet for 8 weeks in overweight and obese female high school students on anthropometric measurements and diet quality.

Methods: A total of 86 students between the ages of 14-18 years were included in the study, and they were divided into two groups as nutrition training (n=44) and control groups (n=42). The Mediterranean Diet Quality Index (KIDMED) scores were calculated and anthropometric measurements of groups were taken by the dietician at the beginning and at the end of the study.

Results: The KIDMED score of the nutrition training group was 4.59±2.40 at the beginning, later on it increased to 7.43±2.57 after the program (p= .001). After the program, it was determined that the difference between the KIDMED scores of the nutrition training and control groups were statistically significant (p= .034), however the decrease in body weight (p= .09), BMI (p= .64), and waist circumference (p= .06) were similar between groups.

Conclusion: As a result of the study, it can be said that online nutrition training program about the Mediterranean diet for 8 weeks may affect the diet quality positively of overweight and obese female adolescents, but long-term programs should be planned to determine the effects on anthropometric measurements.

Keywords: Adolescent, anthropometry, diet, mediterranean diet, obesity

1. INTRODUCTION

Adolescent obesity is a major public health problem that is becoming more frequent in both emerging and industrialized countries, and it is linked to genetic, environmental, psychological, socioeconomic, and cultural variables. It has been stated that the prevalence of obesity in school age and adolescence has increased approximately 4.5 times in the last 40 years (1). In the 2016 report of the World Health Organization (WHO), 18% of children and adolescents aged 5-19 years were reported to be overweight and obese (2). According to the results of Turkey Nutrition and Health Survey-2017 (TBSA-2017), 34.0% of adolescents between the ages of 15-18 years in Turkey are overweight, 27.8% are obese and 3.7% are morbidly obese (3). While 18.6 percent of children and adolescents aged 9-18 living in the Turkish Republic of Northern Cyprus (TRNC) are overweight, 16.2% are obese (4).

Overweight and obese adolescents are at the risk of various health problems, including insulin resistance, hyperinsulinemia, type 2 diabetes, hypertension, hyperlipidemia, asthma, sleep apnea, chronic hypoxemia, orthopedic problems, depression and anxiety (1). Adolescent obesity is also associated with the child school absenteeism and reduced quality of life (5).

In order to minimize and control adolescent obesity, international and local policies and programs have been created and implemented all around the world. On the other hand, school-based intervention programs are frequently preferred to control obesity in adolescents (6-9).

Schools are ideal places to provide nutrition training for children and adolescents and also evaluate their nutritional status (10-12). In the period from pre-school to high school, comprehensive and regular nutrition training given by dietitians in schools is very important to improve nutritional status, academic performance and public health (8). In addition, nutrition training programs can help adolescents gain awareness and become more conscious individuals by providing the skills, social support and environmental reinforcement they need to adopt healthy eating behaviors (13).

DOI: 10.33808/clinexphealthsci.1056470

The goal of school-based nutrition training programs is to promote intake of vegetables, fruits, legumes, and whole grain foods while decreasing consumption of items rich in energy, saturated fat, and salt (8,14). These diet related suggestions are largely based on the Mediterranean diet (MD). The MD is widely considered as one of the healthiest diet models. With increased adherence to the MD, it is possible to protect and improve health against obesity and other chronic diseases (15,16).

In a cross-sectional study, 1643 adolescents aged 11-16 years were included and it was determined that the risk of being overweight and obese decreased by 30% with increasing adherence to the MD (17). In a recent study, it was emphasized that 8-week nutrition training about the MD given to adolescents aged 11-16 years, increases the level of nutrition knowledge and therefore that may be effective in preventing future health problems (18).

Today, in order to provide behavioral change, nutrition training using digital technologies comes to the forefront (19). In order to create a permanent behavioural change in adolescents, it is recommended that nutritional intervention programs to be made using innovative multimedia technology tools (20). Due to the intense use of computers and the internet both at school and outside of school (21), it is suggested that online nutrition training can be beneficial in increasing the level of nutrition knowledge, especially in overweight and obese adolescents (22).

This study was conducted to evaluate the effect of an online nutrition training program about the MD adaptation on anthropometric measurements and diet quality for 8 weeks in overweight and obese female high school students.

2. METHODS

2.1. Study Population and Desing

This case-control study was conducted between December 2019 and May 2020. The study included a total of 86 adolescent females aged 14-18 years who were overweight or obese (≥ 85th percentile) according to the WHO's Body Mass Index (BMI) percentile for age and gender (23), and who did not have any chronic health concerns other than obesity. Because of the higher frequency of food addiction, stress, and depression among obese adolescent girls, it was projected that this group would have a greater need for nutrition training (24).

Initially, the girls were evaluated with a questionnaire on age, nutritional habits, and adherence to the MD. Overweight and obese adolescent girls were analyzed in terms of age, anthropometric measures, energy, macronutrients, fiber intake, and mean KIDMED score. They were randomly separated into two groups, with no statistically significant difference between the groups (Table I). A simple randomization method was used in this study.

It was calculated that 86 cases, 43 in each group, would be needed for the study, assuming that the pretest-posttest data would be tested using the Wilcoxon signed-rank test, with an error probability of 0.05 and a statistical power of 80%. In the study, 44 participants were included in both groups but 2 people in the control group were excluded from the study because they could not be reached at the end of the study. The study was completed with 44 adolescents in the nutrition training group and 42 adolescents in the control group.

The purpose, plan, and reasons for the research were explained to the individuals and they were invited to participate in the study voluntarily. Written informed consent was obtained from the parents of all students included in the study. This study was deemed ethically appropriate by the Eastern Mediterranean University (EMU) Scientific Research and Publication Ethics Committee with the decision dated 8.11.2019 and numbered 2019/25-05. Since the study was carried out in a state high school in Famagusta District, official permission was also obtained from the General Secondary Training Department of the Ministry of National Training and Culture of the Turkish Republic of Northern Cyprus.

The dietitian provided nutrition instruction for the MD compliance to the nutrition training group for 45 minutes once a week for a total of 8 weeks. The control group was given general nutrition training for 1 hour, only once face to face, by the dietitian.

The nutrition training group received a nutritional via online nutritional information training for 8 weeks. Training content is divided by weeks and that is the MD and its importance (week 1), grains (week 2), vegetables and fruits (week 3), olive oil (week 4), fish (week 5), chicken, red meat, egg (6th week), milk and dairy products (7th week), legumes and nuts (8th week) respectively. A WhatsApp group has been created and the dietitian narrated a video and question-and-answer training were supplied to the nutrition training group via this group. Additionally, varied brief messages about the MD were distributed routinely over the WhatsApp group to reinforce the information, three days a week. In this eight-week study, the anthropometric measurements and adherence to the MD of both groups before and after the study were taken and evaluated by the dietitian. In addition, the amount of variation between the body weight loss and other anthropometric measurements of the individuals at the end of 8 weeks was also calculated.

2.2. Anthropometric Measurements

The body weight of the individuals was taken with a standard digital scale while they wear thin clothes and without shoes. The height measurement of the individuals was taken with a non – flexible tape measure on the fronkfort plane with paying attention to the fact that their feet were united. Waist circumference was measured from the midpoint between the lower rib bone and the cristailiac with a non-flexible tape measure parallel to the ground. The measurement of hip circumference was also measured by standing on the side of the person and measuring from the highest point of the hip

(25). In addition, individuals' BMI value, waist/hip ratio and waist/height ratio were calculated.

2.3. Energy and Nutrient Intake

Foods consumed by individuals for 3 consecutive days (2 weekdays, 1 weekend) were questioned by 24-hour food consumption recording method. Energy, macronutrient and fiber intake were calculated with the Nutrition Information System (BEBIS 8.2) program.

2.4. Mediterranean Diet Quality Index (KIDMED)

The Mediterranean Diet Quality Index (KIDMED) was used to evaluate adherence to the MD and diet quality. This index is a simple tool developed and widely used to evaluate the nutritional habits and nutritional status of children and adolescents (26,27). Also, diet quality in children and adolescents can be measured using the KIDMED index (27). KIDMED consists of 16 yes-no questions; For the 6th, 12th, 14th and 16th questions, yes answers are scored as – 1 point, while yes answers for other questions are scored as +1 point. As a result, the total score ranges from – 4 to 12. In the present study, adherence to the MD was classified into three levels based on KIDMED scores: score 8-12, optimal adherence to the MD; score 4-7, average adherence to the MD; and score ≤3, very poor adherence to the MD (26).

2.5. Statistical Analyses

The data of the research were analysed using the Statistical Package for the Social Sciences (SPSS) 20.0 program. In descriptive statistics, frequency and percentagewere used for categorical variables, and mean, standard deviation (SD) lower and upper values were used for numerical variables. The normality of numerical variables to normal distribution was evaluated using Kolmogorov-Smirnov and Shapiro-Wilk tests. Pearson Chi-Square test was used to compare categorical variables between groups. To compare the numerical variables, the control group and the nutrition training group were compared before and after the training, the dependent samples t-test (Paired samples t-test) and the independent samples t-test (Student t-test) was used for the comparisons between the groups. Hypotheses were tested at 5% significance level.

3. RESULTS

This research was conducted with a total of 86 overweight and obese female high school students aged 14-18 years, 44 in the nutrition training group and 42 in the control group. Age, energy, macronutrient and fibre intake, anthropometric measurements and KIDMED scores of the adolescents included in the nutrition training group and the control group were similar (Table 1).

Table 1. *Comparison of age, energy, macronutrient intakes, anthropometric measurements and KIDMED scores of adolescents*

Energy and Nutrients	Control Group (n=42)		Nutrition Training Group (n=44)		p
	$\bar{X}$ ± ss	min-max	$\bar{X}$ ± ss	min-max	
Age +	16.28 ± 0.21	15-18	16.37 ± 0.32	14-18	0.88
Macronutrient intake +					
Energy (Kcal)	1560.09 ± 452.33	1028.43-2255.50	1748.48 ± 302.73	1171.75-2170.32	0.08
Protein (%)	20.33 ± 2.57	16.03-21.22	19.13 ± 3.10	14.01-27.05	0.07
Protein (g)	79.28 ± 12.90	41.20-119.65	83.59 ± 14.07	41.21-124.06	0.09
Fat (%)	35.47 ± 5.61	20.03-47.88	38.87 ± 6.02	21.02-46.32	0.06
Fat (g)	60.66 ± 16.11	23.87-117.99	75.39 ± 18.4	27.59-111.19	0.06
CHO (%)	44.13 ± 6.58	37.11-63.01	41.98 ± 6.58	35.69-60.88	0.06
CHO (g)	172.10 ± 16.16	95.09-330.72	178.18 ± 20.96	101.29-325. 20	0.08
Fiber (g)	16.15 ± 3.39	8.89-25.76	16.41 ± 2.52	10.20-23.21	0.16
Anthropometric measurements +					
Height (cm)	161.81 ± 7.04	150.0-178.0	161.48 ± 6.69	150.0-184.0	0.84
Body Weight (kg)	74.96 ± 9.91	58.0-103.5	74.69 ± 9.60	60.0-109.5	0.83
BMI (kg/m²)	28.53 ± 2.71	24.4-35.4	28.56 ± 2.90	23.0-37.7	0.82
Waist circumference (cm)	82.06 ± 8.86	64.0-98.0	82.54 ± 9.10	67.0-106.0	0.99
Hip circumference (cm)	99.25 ± 10.10	81.0-122.5	101.68 ± 10.38	83.0-126.0	0.32
Waist/Hip ratio	0.82 ± 0.07	0.65-0.94	0.80 ± 0.07	0.64-0.98	0.22
Waist/Height ratio	0.50 ± 0.05	0.41-0.62	0.51 ± 0.06	0.43-0.70	0.59
KIDMED +					
Overall score	5.15 ± 2.45	0-9	4.59 ± 2.40	0-10	0.22
BMI percentile classification by age, n (%) *					
Overweight (85-95th percentile)	15 (35.7)		25 (55.5)		0.06
Obese (>95th percentile)	27 (64.3)		20 (44.5)		

$\bar{x}$: Mean, sd: Standard deviation

+ Independent sample t-test was used for comparison between groups.

**Pearson Chi-square test was used for comparisons between groups*

When the adherence to the MD was evaluated, 26.2% and 19.0% of the adolescents included in the control group showed poor and optimal adherence to the MD before the training. While 11.9% and 28.6% of them achieved poor and optimal adherence to the MD after the training, respectively. In the nutrition training group, 31.8% and 11.4% of the adolescents showed poor and optimal adherence to the MD before nutrition training; 20.4% and 43.2% of them achieved poor and optimal adherence to the MD after training respectively (Table 2).

There was no statistically significant difference in the anthropometric measurements of the adolescents included in both groups after the training compared to the values before the training (p> .05). In addition, the anthropometric measurements of the adolescents included in the nutrition training group and the control group after the training were similar (p> .05). In addition, the KIDMED score of the nutrition training group was 4.59±2.40 before the training and 7.43±2.57 after the training. The KIDMED score of the control group was 5.15 ± 2.45 before the training and 6.26±2.15 after the training. There was a statistically significant difference in the KIDMED scores of both groups obtained before and after the training (p= .001). In addition, after the training, the difference between the pre – and post-training KIDMED scores of the adolescents in both groups was found to be statistically significant (p= .026) (Table 3).

The decrease in body weight (p= .09), BMI (p= .064) and waist circumference (p= .06) of the adolescents included in both groups after the training was found to be statistically similar. In addition, the increase in the KIDMED scores of the adolescents included in the nutrition training group after the training was found to be higher than the control group (p= .034) (Table 4).

Table 2. *Comparison of KIDMED score distributions of both groups before and after training*

		Control Group				Nutrition Training Group			
		BT (n=42)		AT (n=42)		BT (n=44)		AT (n=44)	
		n	%	n	%	n	%	n	%
KIDMED score	Low adherence	11	26.2	5	11.9	14	31.8	9	20.4
	Medium adherence	23	54.8	25	59.5	25	56.8	16	36.4
	Optimal diet quality	8	19.0	12	28.6	5	11.4	19	43.2
	p_1	0.06							
	p_2	**0.039***							
	p_3	**0.011***							
	p_4	**0.024***							

BT:before training, AT:after training
p1: difference between nutrition training and control groups BT
p2:control group BT-AT difference
p3: nutrition training group BT-AT difference
p4: difference between nutrition training and control groups AT
Pearson Chi-square test was used for comparisons between all groups.
** p < 0.05*

Table 3. *Evaluation of anthropometric measurements and KIDMED scores of adolescents included in both groups*

	Control Group n=42			Nutrition Training Group n=44			
	BT	AT	p_1	BT	AT	p_2	p_3
	± ss	$\bar{x}$ ± ss		$\bar{x}$ ± ss	$\bar{x}$ ± ss		
Anthropometric measurements							
Height (cm)	161.81 ± 7.04	161.94 ± 7.05	0.99	161.48 ± 6.69	161.49 ± 6.70	0,99	0.84
Body Weight (kg)	74.96 ± 9.91	73.59 ± 10.57	0.47	74.69 ± 9.60	73.19 ± 9.87	0.59	0.90
BMI (kg/m²)	28.53 ± 2.71	28.02 ± 2.91	0.39	28.56 ± 2.90	28.04 ± 2.85	0.53	0.75
Waist circumference (cm)	82.06 ± 8.86	81.52 ± 8.98	0.69	82.54 ± 9.10	81.63 ± 9.37	0.63	0.95
Hip circumference (cm)	99.25 ± 10.10	98.83 ± 10.45	0.80	101.68 ± 10.38	100.91 ± 10.50	0.74	0.38
Waist/Hip ratio	0.82 ± 0.07	0.82 ± 0.07	0.68	0.80 ± 0.07	0.80 ± 0.07	0.82	0.30
Waist/Height ratio	0.50 ± 0.05	0.51 ± 0.07	0.73	0.51 ± 0.06	0.50 ± 0.05	0.41	0.98
KIDMED							
Overall score	5.15 ± 2.45	6.26 ± 2.15	**0,001***	4.59 ± 2.40	7.43 ± 2.57	**0,001***	**0,026***

BT:before training, AT:after training, x̄: Mean, sd: Standard deviation
p1:control group BT-AT difference
p2:nutrition training group BT-AT difference
p3: difference between nutrition training and control group AT
p1-p2: Independent sample t-test was used for comparison between groups.
p3: Independent sample t-test was used for comparison between groups.
** p < 0.05*

Table 4. *Comparison of KIDMED, body weight, BMI and waist circumference differences of adolescents included in both groups after training*

	Control Group (n=42)		Nutrition Training Group (n=44)		p
	$\bar{x}$ ± ss	min-max	$\bar{x}$ ± ss	min-max	
KIDMED	1.11 ± 1.52	-1 – 6	2.84 ± 1.63	-2 – 7	**0.034***
Body Weight (kg)	-1.36 ± 1.24	-8 – 0	-1.50 ± 1.36	-6 – 0	0.09
BMI (kg/m²)	-0.51 ± 1.29	-3.5 – 0	-0.52 ± 1.19	-3.3 – 0	0.64
Waist circumference (cm)	-0.54 ± 1.03	-5 – 0	-0.91 ± 1.45	-6 – 0	0.06

Independent sample t-test was used for comparison between groups.
$\bar{x}$: Mean, sd: Standard deviation
** $p < 0.05$*

4. DISCUSSION

Nutrition training about the MD, which is given to adolescents regularly, increases the level of nutrition knowledge, thus it can be effective in reducing the risk of future health problems (15-18). In this study, it was determined that the nutrition training about the MD, which was given online regularly for 8 weeks to overweight and obese adolescent girls, improved diet quality compared to the general nutrition training given face-to-fact. However it had no effect on anthropometric measurements.

In another study, it was shown that in adolescents aged 10-14 years, the quality of diet measured with KIDMED was low, and the level of nutritional knowledge was associated with eating habits (28). The diet quality of children and adolescents aged 6-16 years in Italy was evaluated by KIDMED, showing that 16.7% had low, 63.7% moderate and 19.6% optimal diet quality (29). In a study that conducted with 1231 adolescents aged 12-17 years, it was determined that 30% of the adolescents had high and 15.7% of them had low MD quality. It was determined that 32.0% of the boys and 25.2% of the girls had a high MD quality (30). In a study conducted in Turkey, it was determined that 17.9% of adolescents aged 10-14 years had adhered to low, 59.2% had moderate, and 22.9% optimal diet quality. On the other hand, 18.4% of the girls found to have low, 56.8% moderate, 24.9% optimal diet quality (28). Recently conducted studies in Turkey with adolescents have been found that adolescents show Mediterranean diet at a low-moderate level (31,32). Consistent with these studies 26.2% of the adolescents included in the control group had low, 19.0% optimal diet quality, and 31.8% adolescents included in the nutrition training group had low, 11.4% optimal diet quality in this study (Table 2).

In a cross-sectional study conducted with 520 children aged 8-17 years, it was shown that children with normal body weight were more likely to adapt to the MD than those who were overweight and sedentary (33). Accordingly, while high body weight and BMI may negatively affect the quality of the MD (33), the diet quality measured by KIDMED in adolescents may also vary according to regional and cultural eating habits (34).

It is known that diet quality and the level of knowledge about healthy and proper nutrition in adolescence are quite low. The importance of implementing intervention programs to improve this situation is emphasized (35-38). Improving the level of nutrition knowledge and awareness in obese adolescents positively affects their nutritional behaviors and diet quality (36). Adolescence is an important period in which behavior and attitude development in health is ensured, and nutrition training programs carried out in schools contribute to the acquisition of correct eating habits (8). In the study conducted by Şahingöz et al. (18), it was found that 25.0% of the 11-16-year-old adolescents had low, 56.6% of them moderate and 18.4% of them had optimal KIDMED scores before the training. The training given for 18 hours for 8 weeks increased the KIDMED scores. It was determined that the score decreased from 6.06 ± 2.16 to 5.26±2.65 in the control group, increased from 5.20±2.45 to 11.84±0.52 in the experimental group, and finally, 100% of the experimental group reached the optimal diet quality score (18). In this study, the KIDMED score of the nutrition training group before the training was (4.59±2.40) and (7.43±2.57) after the training ($p< .05$); the KIDMED score of the control group was (5.15±2.45) before the training and (6.26±2.15) after the training ($p< .05$). In addition, the difference between the KIDMED scores of the adolescents included in the nutrition training group and the control group after the training was statistically significant ($p< .05$) (Table 3) besides the increase in the KIDMED scores of the adolescents included in the nutrition training group after the training was higher than the control group ($p< .05$) (Table 4). Similarly, it has been determined that the training given for 18 hours for 8 weeks in 11-16 years old adolescents increased KIDMED scores. For this reason, it is recommended to provide nutrition training from an early age and to increase the level of nutrition knowledge in order to minimize adult health problems (18).

Nutrition training programs given regularly in schools are of great importance in reducing the prevalence of obesity in adolescents (6-9). It is stated that the risk of being overweight and obese at school age decreases with the

increase in adherence to the MD (33). It is emphasized that it is important to improve the quality of diet in order for a significant decrease in BMI value and changes in body composition to occur in adolescents (39). In a recent study found that increasing adolescents MD like food choices led to a significant reduction in glucose and lipid profile. In relation to this, it has been emphasied to maintain a MD diet to increase adolescent health status (40).

As the prevalence of excessive weight gain and related diseases among young people increases, the frequency of developing and applying computer-based programs for nutrition training is also increases. Computer interventions have the potential to provide standardized and effective programs alongside rapid technology (22). It has been shown that internet-mediated obesity prevention programs in young people can provide significant improvement in nutritional behaviors (41,42). There was no statistically significant difference in the anthropometric measurements of the adolescents included in both groups after the training compared to the values before the training (p> .05). In addition, the anthropometric measurements of the adolescents included in the nutrition training group and the control group after the training were similar (p> .05) (Table 3). Likewise, the decrease in body weight, BMI and waist circumference of the adolescents included in both groups after the training was found to be statistically similar (p> .05) (Table 4).

It was determined that after the internet-mediated nutrition training program given to adolescents to prevent obesity, there was an improvement in healthy eating habits. However it had no effect on the decreases of obesity prevelance with an average age of 15.2 years (43). According to the results of different studies, it is stated that there is an improvement in food intake as a result of nutrition training but the effect on BMI is controversial (44,45). As a result of a systematic review of nutrition training programs conducted in schools, it was determined that nutrition training programs had a positive effect on obesity in 8 out of 24 studies including 25896 children, while 16 were ineffective (46). When the meta-analysis of the 11 studies conducted was examined, it was determined that there is no significant difference in BMI values when the nutrition training group and the control group compared as a result of the intervention programs carried out at schools (44).

Supporting components of nutrition training programs applied to adolescents such as curricula, method of application, length, and inclusion of the family in the program differ depending on the programs (44-46). It is emphasized that a significant decrease in BMI can be achieved, especially in programs lasting 1-2 years, however there is no significant difference can be observed between groups in intervention programs lasting less than 6 months (44). In a different study, it is suggested that at least 1 year of follow-up is required for a school-based online obesity prevention program to achieve a significant reduction in BMI (43).

Considering a study with different results from these findings, it is emphasized that the importance of including families in these programs during the implementation of behavior change programs for diet and physical activity in overweight and obese adolescents aged 13-16 years (39). According to a systematic review of randomized controlled trials, when nutrition training for 10-18 year-olds is theoretically based as part of training in schools and is incorporated into training by school staff, in concordance with parents and families as well as it includes changes in school canteens and cafeterias, it may have significant effects on adolescent nutrition (47). Multicomponent lifestyle interventions to adolescents in the school environment may provide a first step in behavior changes and provide grounds for future prevention programs in adolescent (48). In addition, it is also emphasized that it is important to maintain individual nutrition programs in order for a significant change in BMI in obese adolescents (29,49). Also individual programs in adolescents can be effective in reducing BMI and resolving nutrition related issues (49).

5. CONCLUSION

As a result of this study, it can be specified that nutrition training about the MD, which have been given online for 8 weeks to overweight and obese adolescent girls, can positively affect diet quality. However more comprehensive and long-term programs should be planned in order to be effective on anthropometric measurements. Among the limitations of the study may be indicated as this study covers a short-term nutrition training of 8 weeks and that it is not repeated after a certain period of time in order to determine whether the effect of the training continues. For this reason, it is recommended that the online nutrition training given to obese adolescent girls be repeated at regular intervals in order to have a positive effect on body weight. It is also recommended that similar extended studies have to be planned for boys and girls adolescents/children.

***Acknowledgments**: The authors are grateful to the participants for their willingness to participate in this study.*
***Funding:** The author(s) received no financial support for the research.*
***Conflicts of interest:** The authors declare that they have no conflict of interest.*
***Ethics Committee Approval:** This study was approved by the Eastern Mediterranean University (EMU) Scientific Research and Publication Ethics Committee (Date: 8.11.2019; Approval number: 2019/25-05).*
***Peer-review:** Externally peer-reviewed.*
Author Contributions:
Research idea: SK
Design of the study: SK
Acquisition of data for the study: TM
Analysis of data for the study: TM, SK
Interpretation of data for the study: TM, SK
Drafting the manuscript: SK
Revising it critically for important intellectual content: SK
Final approval of the version to be published: SK, TM

REFERENCES

[1] Fisher M. Foreword: Evaluation and management of overweight and obesity in children and adolescents. Curr Probl

Pediatr Adolesc Health Care. 2020;50(9):1-3. DOI: 10.1016/j.cppeds.2020.100872

[2] World Health Organization (WHO). Obesity and overweight. Published [9 June 2021]. Accessed [05 October 2021]. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

[3] Türkiye Beslenme ve Sağlık Araştırması (TBSA) 2017 Beslenme durumu ve alışkanlıklarının değerlendirilmesi sonuç raporu, Halk Sağlığı Genel Müdürlüğü, Sağlık Bakanlığı Published [2019] Accessed [20.12.2020]. https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-hareketli-hayat-db/Yayinlar/kitaplar/TBSA_RAPOR_KITAP_20.08.pdf

[4] Kabaran S, Gezer C. Determination of the Mediterranean diet and the obesity status of children and adolescents in Turkish Republic of Northern Cyprus. Turk J Pediat Dis. 2013;7(1):11-20. DOI: 10.12956/tjpd.2013.1.03 (Turkish)

[5] Gopinath B, Baur LA, Burlutsky G, Mitchell P. Adiposity adversely influences quality of life among adolescents. J Adolesc Health. 2013;52(5):649-653. DOI: 10.1016/j.jadohealth.2012.11.010

[6] Cheng G, Yang F, Xiong F, Zhao L, Zhang L, Wang Y. Comparison of nutrition education policies and programs for children in China and other selected developed countries. Global Health J. 2020;4(3):72-78. DOI: 10.1016/j.glohj.2020.08.002

[7] Hyska J, Burazeri G, Menza V, Dupouy E. Assessing nutritional status and nutrition-related knowledge, attitudes and practices of Albanian schoolchildren to support school food and nutrition policies and programmes. Food Policy. 2020;96:1-10. DOI: 10.1016/j.foodpol.2020.101888

[8] Hayes D, Contento IR, Weekly C. Position of the Academy of Nutrition and Dietetics, society for nutrition education and behavior, and school nutrition association: comprehensive nutrition programs and services in schools. J Acad Nutr Diet. 2018;118(5):913-919. DOI: 10.1016/j.jand.2018.03.005

[9] Srivastav P, Broadbent S, Vaishali K, Nayak B, Bhat V. Prevention of adolescent obesity: The global picture and an indian perspective. Diabetes Metab Syndr. 2020;14(5):1195-1204. DOI: 10.1016/j.dsx.2020.06.039

[10] Yabancı N. School health and nutrition programs. TAF Prev Med Bull. 2011;10(3):361-368. DOI:10.5455/pmb.201.102.15104609 (Turkish)

[11] Briggs M, Safaii S, Beall DL. Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association-Nutrition services: An essential component of comprehensive school health programs. J Am Diet Assoc. 2003;103(4):505-514. DOI: 10.1016/j.jada.2010.08.035

[12] Medin AC, Myhre JB, Diep LM, Andersen LF. Diet quality on days without breakfast or lunch–Identifying targets to improve adolescents' diet. Appetite. 2019;135:123-130. DOI: 10.1016/j.appet.2019.01.001

[13] Evans S, McKenzie J, Shannon B, Wechsler H. Guidelines for school health programs to promote lifelong healthy eating. J Sch Health. 1997;67(1):9-26. DOI: 10.1111/j.1746-1561.1997.tb06289.x

[14] Hayes D, Dodson L. Practice paper of the Academy of Nutrition and Dietetics: comprehensive nutrition programs and services in schools. J Acad Nutr Diet. 2018;118(5):920-931. DOI: 10.1016/j.jand.2018.02.025

[15] Hidalgo-Mora JJ, García-Vigara A, Sánchez-Sánchez ML, García-Pérez MÁ, Tarín J, Cano A. The Mediterranean diet: A historical perspective on food for health. Maturitas. 2020;132:65-69. DOI: 10.1016/j.maturitas.2019.12.002

[16] Sánchez-Sánchez ML, García-Vigara A, Hidalgo-Mora JJ, García-Pérez MÁ, Tarín J, Cano A. Mediterranean diet and health: A systematic review of epidemiological studies and intervention trials. Maturitas. 2020;136:25-37. DOI: 10.1016/j.maturitas.2020.03.008

[17] Mistretta A, Marventano S, Antoci M, Cagnetti A, Giogianni G, Nolfo F, Rametta S, Pecora G,Marranzano M. Mediterranean diet adherence and body composition among Southern Italian adolescents. Obes Res Clin Pract. 2017;11(2):215-226. DOI: 10.1016/j.orcp.2016.05.007

[18] Sahingoz SA, Dogan L. The implementation and evaluation of a nutrition education programme about Mediterranean diet for adolescents. Prog Nutr. 2019;21(2):316-326. DOI: 10.23751/pn.v21i2.7529

[19] Burgermaster M, Wong SS, Bateson W, Qamar Z, McGuirt J, Uribe AM, El-Kour T, Spielmaker A, Stage VC. DigiTech Division: Positioning SNEB to lead the way in digital technology for nutrition education and behavior change. J Nutr Educ Behav. 2019;51(3):265-266. DOI: 10.1016/j.jneb.2019.01.016

[20] Roseman MG, Riddell MC, Haynes JN. A content analysis of kindergarten-12th grade school-based nutrition interventions: Taking advantage of past learning. J Nutr Educ Behav. 2011;43(1):2-18. DOI: 10.1016/j.jneb.2010.07.009

[21] Witt EA, Massman AJ, Jackson LA. Trends in youth's videogame playing, overall computer use, and communication technology use: The impact of self-esteem and the Big Five personality factors. Comput Hum Behav. 2011;27(2):763-769. DOI: 10.1016/j.chb.2010.10.025

[22] Ajie WN, Chapman-Novakofski KM. Impact of computer-mediated, obesity-related nutrition education interventions for adolescents: a systematic review. J Adolesc Health. 2014;54(6):631-645. DOI: 10.1016/j.jadohealth.2013.12.019

[23] World Health Organization (WHO). Growth reference data for 5–19 years. Published [2007]. Accessed [05 October 2020] https://www.who.int/growthref/en/

[24] Vidmar AP, Wee CP, Salvy SJ. Food addiction, executive function and mood in adolescents with obesity seeking treatment. Appetite. 2020;159:1-6. DOI: 10.1016/j.appet.2020.105049

[25] Pekcan G. Determination of Nutritional Status. Baysal A, Aksoy M, Besler T, Bozkurt N, Keçecioğlu S, Mercanlıgil SM, editors. Diyet El Kitabı. Hatiboğlu Yayınevi: Ankara; – 2014.p108-119.

[26] Serra-Majem L, Ribas L, Ngo J, Ortega RM, García A, Pérez-Rodrigo C, Aranceta J. Food, youth and the Mediterranean diet in Spain. Development of KIDMED, Mediterranean Diet Quality Index in children and adolescents. Public Health Nutr. 2004;7(7):931-935. DOI: 10.1079/phn2004556

[27] Idelson PI, Scalfi L, Valerio G. Adherence to the Mediterranean Diet in children and adolescents: A systematic review. Nutr Metab Cardiovasc Dis. 2017;27(4):283-299. DOI: 10.1016/j.numecd.2017.01.002

[28] Sahingoz SA, Sanlier N. Compliance with Mediterranean Diet Quality Index (KIDMED) and nutrition knowledge levels in adolescents. A case study from Turkey. Appetite. 2011;57(1):272-277. DOI: 10.1016/j.appet.2011.05.307

[29] Archero F, Ricotti R, Solito A, Carrera D, Civello F, Di Bella R, BelloneS, Prodam F. Adherence to the Mediterranean diet among school children and adolescents living in northern Italy and unhealthy food behaviors associated to overweight. Nutrients. 2018;10(9):1-13. DOI: 10.3390/nu10091322

[30] Bibiloni MM, Pons A, Tur JA. Compliance with the Mediterranean Diet Quality Index (KIDMED) among Balearic Islands' adolescents and its association with socioeconomic, anthropometric and lifestyle factors. Ann Nutr Metab. 2016;68(1):42-50. DOI: 10.1159/000442302

[31] Aydın G, Yılmaz HO. Evaluation of the nutritional status, compliance with the Mediterranean diet, physical activity levels, and obesity prejudices of adolescents. Progr Nutr. 2021;23(2):1-14. DOI: 10.23751/pn.v23i2.10449

[32] Alim NE, Çalışkan G, Besler ZN. Assessment of adherence to the mediterranean diet and behaviors of fruit and vegetable consumption in adolescents. Value Health. 2022;12(1):152-159. DOI: 10.33631/sabd.1055497

[33] Guillamón AR, López PJC, Cantó EG, Soto JJP, Marcos LT, López PJT. Mediterranean diet, weight status and physical activity in schoolchildren of the Region of Murcia. Clín Investig Arterioscler (English Edition). 2019;31(1):1-7. DOI: 10.1016/j.arteri.2018.09.002

[34] Hollis JL, Collins CE, DeClerck FF, Chai LK, McColl K, Demaio AR. Defining healthy and sustainable diets for infants, children and adolescents. Glob Food Sec. 2020;27:1-47. DOI: 10.1016/j.gfs.2020.100401

[35] Taher AK, Ensaff H, Evans CE. Cross-sectional associations between lunch-type consumed on a school day and British adolescents' overall diet quality. Prev Med Rep. 2020;19:1-8. DOI: 10.1016/j.pmedr.2020.101133

[36] Vanhelst J, Beghin L, Duhamel A, De Henauw S, Ruiz JR, Kafatos A, Androutsos O, Widhalm K, Mauro B, Sjöström M, kersting M, Gottrand F. Do adolescents accurately evaluate their diet quality? The HELENA study. Clin Nutr. 2017;36(6):1669-1673. DOI: 10.1016/j.clnu.2016.10.019

[37] Kundu S, Khan MSI, Bakchi J, Sayeed A, Banna M, Begum M, Hassan M. Sources of nutrition information and nutritional knowledge among school-going adolescents in Bangladesh. Public Health Prac. 2020;1:1-5. DOI 10.1016/j.puhip.2020.100030

[38] Morris SS, Barquera S, Sutrisna A, Izwardy D, Kupka R. Perspective: Interventions to improve the diets of children and adolescents. Glob Food Sec. 2020;27:1-5. DOI: 10.1016/j.gfs.2020.100379

[39] De Miguel-Etayo P, Moreno LA, Santabárbara J, Martín-Matillas M, Azcona-San Julian MC, Del Moral AM, Campoy C, Marcos A, Ma Garagorri J, EVASYON Study Group. Diet quality index as a predictor of treatment efficacy in overweight and obese adolescents: The EVASYON study. Clin Nutr. 2019;38(2):782-790. DOI: 10.1016/j.clnu.2018.02.032

[40] Ceraudo F, Caparello G, Galluccio A, Avolio E, Augimeri G, De Rose D, Vivacqua A, Morelli C, Barone I, Catalano S, Giordano C, Sisci D, Bonofiglio D. Impact of Mediterranean Diet food choices and physical activity on serum metabolic profile in healthy adolescents: Findings from the DIMENU Project. Nutrients. 2022;14(4):1-14. DOI: 10.3390/nu14040881.

[41] Ezendam NP, Brug J, Oenema A. Evaluation of the Web-based computer-tailored FATaintPHAT intervention to promote energy balance among adolescents: Results from a school cluster randomized trial. Arch Pediatr Adolesc Med. 2012;166(3):248-255. DOI: 10.1001/archpediatrics.2011.204

[42] Mauriello LM, Ciavatta MMH, Paiva AL, Sherman KJ, Castle PH, Johnson JL, Prochaska JM. Results of a multi-media multiple behavior obesity prevention program for adolescents. Prev Med. 2010;51(6):451-456. DOI: 10.1016/j.ypmed.2010.08.004

[43] Whittemore R, Jeon S, Grey M. An internet obesity prevention program for adolescents. J Adolesc Health. 2013;52(4):439-447. DOI: 10.1016/j.jadohealth.2012.07.014

[44] Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009;37(5):418-427. DOI: 10.1016/j.amepre.2009.07.012

[45] Kanekar A, Sharma M. Meta-analysis of school-based childhood obesity interventions in the UK and US. Int Q Community Health Educ. 2009;29(3):241-256. DOI: 10.2190/IQ.29.3.d

[46] Flodmark C-E, Marcus C, Britton M. Interventions to prevent obesity in children and adolescents: A systematic literature review. Int J Obes. 2006;30(4):579-589. DOI: 10.1038/sj.ijo.0803290

[47] Meiklejohn S, Ryan L, Palermo C. A systematic review of the impact of multi-strategy nutrition education programs on health and nutrition of adolescents. J Nutr Educ Behav. 2016;48(9):631-646. DOI: 10.1016/j.jneb.2016.07.015

[48] Efthymiou V, Charmandari E, Vlachakis D, Tsitsika A, Pałasz A, Chrousos G, Bacopoulou F. Adolescent self-efficacy for diet and exercise following a school-based multicomponent lifestyle intervention. Nutrients. 2021;14(1):1-14. DOI: 10.3390/nu14010097

[49] Lee SY, Kim J, Oh S, Kim YM, Woo S, Jang HB, Lee HJ, Park SI, Park KH, Lim H. A 24-week intervention based on nutrition care process improves diet quality, body mass index, and motivation in children and adolescents with obesity. Nutr Res. 2020;84:53-62. DOI: 10.1016/j.nutres.2020.09.005

How to cite this article: Kabaran S, Memiş T . Effects of Online Nutrition Training Program About Mediterranean Diet on Anthropometric Measurements and Diet Quality in Overweight and Obese Adolescent Girls. Clin Exp Health Sci 2023; 13: 815-822. DOI: 10.33808/clinexphealthsci.1056470