Original article

Adherence to the Mediterranean Diet Among Nutrition and Dietetics Students

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Abstract. *Objective:* This study aimed to determine adherence to the Mediterranean diet among Nutrition and Dietetics students. *Methods:* A cross sectional survey was conducted with the voluntary participation of students. 127 nutrition and dietetic students studying at Near East University. The thematic analysis had used to conduct the data by the SPSS version 18.0. "Mediterranean diet score-MDS" was used to determine to the adherence to Mediterranean diet. 3-day food record and 45-item food frequency questionnaire were used. In addition, the survey questioned dietary habits, lifestyle habits and anthropometric measurements. *Results:* Adherence to Mediterranean diet was poor in 31% and moderate in 69% of the students. Adherence of the students to Mediterranean diet decreased towards their final year at the university (p= 0.001). Most of the students were minimal active. Male students were found more active than females (p=0.011). Female students had higher fat percentage (p=0.000), while males had higher waist circumstance (p=0.000). Female students were found to have increased body fat percentage as they continued the education (p=0.015). There was not found any significant correlation between physical activity, anthropometric measurements and adherence to the Mediterranean Diet. In addition, students had higher bread (80.2%) and pasta (34.10%) consumption whereas lower vegetables (38.6%), fruits (34.6%) and fish (42.5%) consumption. *Conclusion:* The findings indicate that the eating and lifestyle habits of the students, even those studying nutrition, should be improved.

Keywords: mediterranean diet, mediterranean diet score, eating habits, university students

Introduction

The Mediterranean diet (MD) is a dietary pattern that includes the healthiest eating habits and accepted as an indicator of a healthy lifestyle among the countries around the Mediterranean area (1-4). In 2010, it had been recognized by UNESCO (United Nations Educational, Scientific and Cultural Organization) as an Intangible Cultural Heritage of Humanity (3). Characteristically, this dietary model involves a high consumption of whole grains, legumes, nuts and seeds, fruits and vegetables, olive oil and fish whereas a low intake of poultry, red meat and meat products and moderate consumption of red wine preferably during meals (1,3).

It has been reported that the traditional MD protects against myocardial infarction, platelet aggregation, neuro-degenerative diseases, some tumors (e.g. breast, colorectal and prostate), diabetes and other diseases associated with oxidative stress and inflammation (1,3,5). In addition, several epidemiological studies have shown that the MD may exert benefits by lowering rates of chronic disease morbidity, mortality and increasing life expectancy (6,7).

Start of the university education is a major life event in transition to adulthood (8). Young individuals

beginning their university education away from home are separated from their families and they are exposed to different people/cultures in a new environment and start making their choices freely. These lifestyle changes also influence their eating behaviors (9). Generally, university students have a poor diet and low nutritional adequacy (10). However, adoption of healthy eating habits are very important to reduce the overall risk for chronic diseases and, it has been reported that the MD fully complies with healthy eating patterns (11). On the other hand, data on the nutritional habits of students who receive nutrition education are insufficient. Thus, determination of eating patterns of university students and appropriately addressing non-adherence to a healthy diet through adequate solutions are crucial to promote a healthy lifestyle.

The aim of the present study was to investigate adherence to the MD among Nutrition and Dietetics students. In addition, the secondary aim of the study is to evaluate the influence of nutrition knowledge of Nutrition and Dietetics students on eating habits

Material and Methods

Study design

A cross sectional survey was conducted with the voluntary participation of students studying at the Department of Nutrition and Dietetics at Near East University in Nicosia-North Cyprus during the academic year 2014-2015. All participants were informed about the study through a consent form in accordance to the Declaration of Helsinki which was signed on a voluntary basis. The study protocol was approved by the Ethics and Review Committee for Scientific Research of the Near East University (YDU/2014/24-141).

Study Participants

The number of all students enrolled in the department was 174 and all students have been reached. 6 students were excluded from study due to chronic diseases and absenteeism. 41 students did not complete the data requested from them during the study. The study was completed with 127 students to provide 72.99% return and 95% confidence interval.

Data Collection

General demographics and relevant information on all students were obtained via the face to face interview.

Food Consumption Assessment

Nutritional status was determined using the "3-day food record" method. "Food intake records" were kept by the students on a 24-hour basis for a total of three days including two weekdays and one weekend day. The students were educated by the study investigator on how to keep food records. At the end of the day after food records were kept, students were personally interviewed and their food intake records were reviewed and any missing data was completed. Also, the serving size was determined using a "Food Picture Catalogue" and food replica models (12). Energy and nutrient values of all food and beverages consumed were estimated using the BEBIS (Nutrition Information System Software Package), a nutrition software package specifically developed for Turkey. Additionally, a 45-item food frequency questionnaire was applied which consists of the components of the MD.

Mediterranean Diet Score

The Mediterranean Diet Score (MDS) index developed by Panagiotakos, Pitsavos, and Stefanadis was used to determine adherence of the students to the MD (13). MDS consist 11 components which include the consumption of the non-refined cereals, potatoes, fruits, vegetables, legumes, fish, red meat and products, poultry, full fat dairy products, olive oil, and alcoholic beverages (13). Each component was rated 0-5 point according to consumption of the component to the recommendation in the Mediterranean diet pyramid. The MDS was categorized as good (36-55 points), moderate (21-35 points) and poor (0-20 points) (13).

Anthropometric Measurements

Height of the participants was measured using a stadiometer. During the measurement, care was taken to ensure that the head, shoulders, hips and heels touch the stadiometer backboard and the head is in the Frankfurt plane (14). Body weight and fat percentage using the "Tanita Mc 180 Multi Frequency Bioimpedance Analysis" and waist circumference using a rigid measuring tape (14). During waist circumference measurement the students were asked to cross the arms and place the hands opposite shoulders. The measurement from the point between the iliac crest and the rib cage (14). BMI (body mass index) data of the students were calculated as the ratio of weight (kg) to height square (m^2) and evaluated in four class; <18.5 kg/m^2 underweight, 18.5-24.9 kg/m^2 normal weight, 25.0-29.9 kg/m^2 pre-obesity, and ≥30kg/m^2 obesity accordance with the BMI classification of the WHO for adults (15).

Physical Activity Assessment

The physical activity level of the students was assessed using the International Physical Activity Questionnaire short form-IPAQ). Each physical activity reported minutes per week and calculated by a MET energy expenditure for determined each activity category and scored in accordance to the IPAQ scoring protocol (16,17).

Statistical Analyses

The statistical analyses of the study data were conducted using the SPSS version 18.0. The mean (μ), standard deviation (S), median and min-max values were provided for continuous variables. Since the mean values could be affected by the random distribution in the case of non-homogenous distribution, median values were taken into consideration. Categorical data were expressed as percentage (%). The non-parametric analysis method was used for the significance tests of continuous variables, taking into account the number of individuals and distribution. Thus, Mann-Whitney U test was used to compare two independent groups and Kruskal-Wallis analysis of variance to compare more than two groups. Pairwise comparisons were performed using the Mann-Whitney U test when Kruskall-Wallis analysis of variance showed significance. For testing the significance of categorical variables, chi-square tests (Pearson, Fisher or Likelihood ratio) were used as appropriate. Pearson's correlation analysis was used to analyze possible relationships between the study variables.

Results

In this study, 22% of the students were male and 78% were female. While BMI values were mostly within normal BMI range for both female and male students, BMI values were significantly higher in male students than in female students (p=0.001). The body fat percentage of the female students was significantly higher in comparison to male students (p=0.000) but male students showed larger waist circumference values (p=0.000). Although the body fat percentage and waist circumference were not affected by the education year of the students (p=0.527 and 0.797, respectively), female students were found to have increased body fat percentage with no change in the waist circumference as they continued their education (p=0.105 and 0.049, respectively). Among the students, 72.2% reported that they never smoked, 5.6% were former smokers and 22.2% were current smokers. The majority of nutrition and dietetics students (72.0%) reported no alcohol consumption (p=0.014). Overall, it was found that 31% of the students had low and 69% had moderate MD scores, with no students with high MD scores. Gender-based assessment of MD scores demonstrated that 32.1% of the male students had low and 67.9% had moderate MD scores and the corresponding percentages for female students were 30.6% and 69.4%, respectively. No statistically significant difference was observed in the distribution of the MDS with respect to gender (p=0.859). Most of the students were found to have a minimal level of physical activity. However, male students mostly engaged in improving their health through physical activity but female students were minimally active (p=0.011, Table 1).

The MD scores of students were shown in Table 2. The MD score of students was 23.09±5.49. The female students' MD score was higher than male students, although it was not significant (p=0.076). The adherence to the MD gradually decreased towards the final year of the university (p=0.000). Students' MD scores increased from the first year to the second year,

Table 1. General characteristics of the students (mean±SD)

	Female (99)	Male (28)	Total (126)	p
Population (%)	78	22	100	
Age (years)	22.18±2.48	23.86±3.21	22.55±2.74	
BMI (kg/m^2)	21.92±3.11	24.83±3.95	22.56±3.51	0.001
<18,5	11.2	0.0	8.7	
18,5-24,9	72.4	60.7	69.8	
25,0-29,9	15.3	32.1	19.0	
≥30,0	1.0	7.1	2.4	
Body fat (%)	24.55±5.88	18.43±6.64	23.19±6.55	0.000
Waist circumference (cm)	72.21±7.69	86.39±9.32	75.49±10.05	0.000
Smoking Status				
Never smoked	80.6	42.9	72.2	
Former smoker	5.1	7.1	5.6	0.000
Current smoker	14.3	50.0	22.2	
Number of cigarettes smoked per day				
1-4	35.7	7.1	21.4	
5-9	21.4	21.4	21.4	0.26
10-19	28.6	57.1	42.9	
≥20	14.3	14.3	14.3	
Alcohol Consumption				
Yes	22.7	46.4	28.0	
No	77.3	53.6	72.0	0.01
No.of alcolohic drinks per week				
M: <1-14, F: <1-7	85.0	80.0	83.3	
M: <14-21, F: <7-14	15.0	10.0	13.3	
M: <21-28, F: <14-21	0.0	0.0	0.0	
M: <28-35, F: <21-28	0.0	10.0	3.3	
Adherence to MD (%)				
Poor	30.6	32.1	31.0	
Moderate	69.4	67.9	69.0	0.85
High	0.0	0.0	0.0	
mean±SD	23.58±5.56	21.64±5.07	23.09±5.49	0.07
Level of physical activity (%)				
Sedentary	34.7	12.0	28.9	
Low	43.1	36.0	41.2	0.011
Highly active	22.2	52.0	29.9	

Table 2. Average Mediterranean diet scores of the study sample

	1st Year	2nd Year	3rd Year	4th Year
Female	25.80±5.18	25.90±4.28	22.73±4.04	20.47±4.93
Male	23.55±6.65	25.00±4.24	18.80±3.48	22.28±3.49
Total	25.34±5.51[a,c,d]	25.75±4.09[a,e,g]	21.75±4.23[a,c,e]	20.90±4.64[a,d,g]
p	0.28	0.79	0.009	0.37

[a]: Represents the difference between years in the university irrespective of gender (p=0.000); [b:] Represents the difference between 1st and 2nd year (p=0.850); [c:] Represents the difference between 1st and 3rd year (p=0.002); [d:] Represents the difference between 1st t and 4th year (p=0.001); [e:] Represents the difference between 2nd and 3rd year (p=0.010); [f:] Represents the difference between 3rd and 4th year (p=0.421); [g:] Represents the difference between 2nd and 4th year (p=0.005)

but not significant (p=0.850). On the other hand, the MD score significantly decreased in the third year when compared with the first (p=0.002) and second year (p=0.010). Female students were found to adhere to the MD in comparison to their male counterparts in the third year (p=0.009). In the final year, the MD score of students decreased versus the third year. However, it was not statistically significant (p=0.421). Moreover, the MD score in the final year was found lower than the first (p=0.001) and second (p=0.005) year.

Table 3 shows the distribution (%) of the MDS by the year in the university. Overall, it was found that 31% of the students had low and 69% had moderate MD scores, with no students with high MD scores. No statistically significant difference was observed in the distribution of the MDS with respect to the year in the university (p=0.065).

80.2% of students consumed bread every day and 34.10% of students consumed pasta and rice 3-4 times a week. On the other hand, students (44.10%) mostly consumed potatoes and legumes (41.70%) 1-2 times a week. Vegetables (38.60%) and fruits (34.60%) were consumed 3-4 times a week by the students. Students generally consumed red meat and meat products (41.70%) and poultry and egg (38.10%) 1-2 times a week. However, fish consumption (42.50%) was found less than 1 times a week. Whole-fat dairy products consumption showed varieties. 22% of students didn't consume whole-fat dairy products whereas 19.40% of students consumed whole-fat dairy products every day. On the other hand, 11.30% of students consumed whole-fat dairy products 5-6 times a week while 16.10% consumed 3-4 times a week, 16.10% consumed 1-2 times a week and 15.30% consumed less than 1 time a week. Olive oil was used every day by most students (31.50%). 72% of students didn't consume alcoholic beverages in a week (Figure).

Table 3. Adherence to the Mediterranean Diet among the students (%)

	1st Year	2nd Year	3rd Year	4th Year
Poor	22.7	8.3	37.5	43.3
Moderate	77.3	91.7	62.5	56.7
High	0.0	0.0	0.0	0.0
p	0.06			

Considering the relations between anthropometric measurements and adherence to the MD, BMI (r=0.027, p=0.790), waist circumference (r=0.064, p=0.544), and the body fat percentage (r=0.098, p=0.333) showed positive weak correlation with the MD score in female students. However, these correlations were not statistically significant. Among male students, there were negative weak correlation between BMI (r=-0.089, p=0.651), waist circumference (r=-0.157, p=0.426), and the body fat percentage (r=-0.091, p=0.645) and the MD score, but the association was not significant (Table 6). Physical activity levels and the MDS were positively correlated (weak) and non-significant association among females (r=0.138, p=0.247) and male (r=0.112, p=0.593) students (Table 4).

Discussion

Equipped with specialized knowledge on nutrition, students of Nutrition and Dietetics departments of universities play an active role in promoting well-being and health, improving the quality of life and minimizing disease risks by preventing diet-related chronic diseases in the community. Several studies exist in the literature that reported low adherence to the MD among young adults (18,19). The findings of the current study showed that the majority of Nutrition and Dietetics students adhere moderately to the MD (69.0%). There was no statistically significant difference between the score range of male and female students (p=0.859). Similar to our results, the majority

Table 4. Relations Among Anthropometric Measurements and the Mediterranean Diet Scores in the Students

			BMI	Waist circumference	Fat (%)	Physical Activity
MDS	Female	r	0.027	0.064	0.098	0.138
		p	0.79	0.54	0.33	0.24
			Male r -0.089 -0.154		-0.091	0.112
		p	0.65	0.42	0.64	0.59
	Total	r	-0.58	-0.103	0.111	-0.111
		p	0.52	0.26	0.21	0.27

of the nursing students taking nutrition course moderately adhere to the MD (20). Different study results showed that university students were far from the Mediterranean eating habits and reported a moderate level of adherence to the MD (19,21). Also, it was reported that students regarded themselves as healthier with increased adherence to the MD (19,21). In general, it can be said that having a university education even with nutrition and health field does not necessarily confer a positive impact on the nutrition habits of young adults.

The average MDS was 23.09±5.49 of the students. The average score was 23.58±5.56 for female students and, 21.64±5.07 for males, although it was not significant (p=0.076). It was only found significant MD score between females and, male students in the third year (p=0.009). It may be said that female students made better food choices than males in the third year. The ATTICA study reported an average MDS of 26±7.55 as well as moderate overall adherence to the MD among young adults. Additionally, females were found to achieve greater adherence to the MD than males (p<0.001). The ATTICA study showed that adherence to the MD decreased with advancing age among adults (p<0.001) (22). In contrast to our findings, one study on adherence of university students to the Mediterranean diet previously reported higher MDS following provision of nutrition education (p<0.0001) (23). Although the MDS was found moderate for all the university years, the score decreased towards the final year, unexpectedly. At first year, students had moderate adherence to MD and this adherence increased at second year, but not significantly. Most of students have lived with their parents so they have regular dietary habits when they started at university and increased nutrition knowledge of students because of nutrition education at second year. On the other hand, the MD score decreased at third year and this decreasing continued at final year. It may be explained with increasing academic stress. It may lead to decrease adherence to the MD dietary pattern among the students. Moreover, this may have resulted from the difficulties the students experience in accessing food and financial problems. In turn, this negatively affects diet quality of the students and poor food quality can be a risk factor for chronic diseases associated with diet. Therefore, it is crucial to help young individuals adopt a healthy lifestyle through healthy eating habits.

Bread, pasta, rice, fruits, and vegetable consumption was 3-4 times a week. On the other hand, potatoes and legumes consumption was 1-2 times a week, fish consumption was less than 1 time a week. Whole fat dairy products consumption varied. Olive oil was consumed every day while alcoholic beverages were not consumed (Figure 1). Although bread, pasta, and rice consumption are recommended every per main meal preferably whole grain in the current MD pyramid, students consumed these foods less.[3,24] Vegetable and fruit consumption are important promoting health and, recommended consuming every main meal according to the MD (3,24,25).

In the old MD pyramid potatoes consumption recommended maximum of 3 servings per week, while this recommendation was updated every main meal according to sustainable pyramid (3,24). In the current study, students consumed potatoes by the sustainable pyramid. Legumes are recommended consuming every day according to sustainable pyramid whereas old pyramid recommended ≥2 servings per week (3,24). Nutrition and dietetics students consumed legumes in accordance old pyramid recommendations. Minimum 2 servings fish consumption per week recommended according to the MD (3,24). However, students' fish consumption does not meet these recommendations. On the other hand, olive oil is the main fat in the MD and is recommended consumption every main meal (3,24). Although the students did not consume it at every main meal, they consumed olive oil every day in the current study. Low fat dairy products are recommended in the MD as a 2 servings per week (3,24). In this study, very few of the students consume milk and its derivatives by this recommendation. Moreover, the scale we used to determine the adherence to the MD questions full-fat dairy products (13). So, only full-fat dairy products consumption was questioned in the current study.

The main aberration from adherence to the MD is low consumption of vegetable and fish. Meseguer et al. (21) showed that, low intake of vegetables and fruits and high intake of dairy products and red meat were reported the main cause of deviation from adherence to the MD among university students. Benito et al.

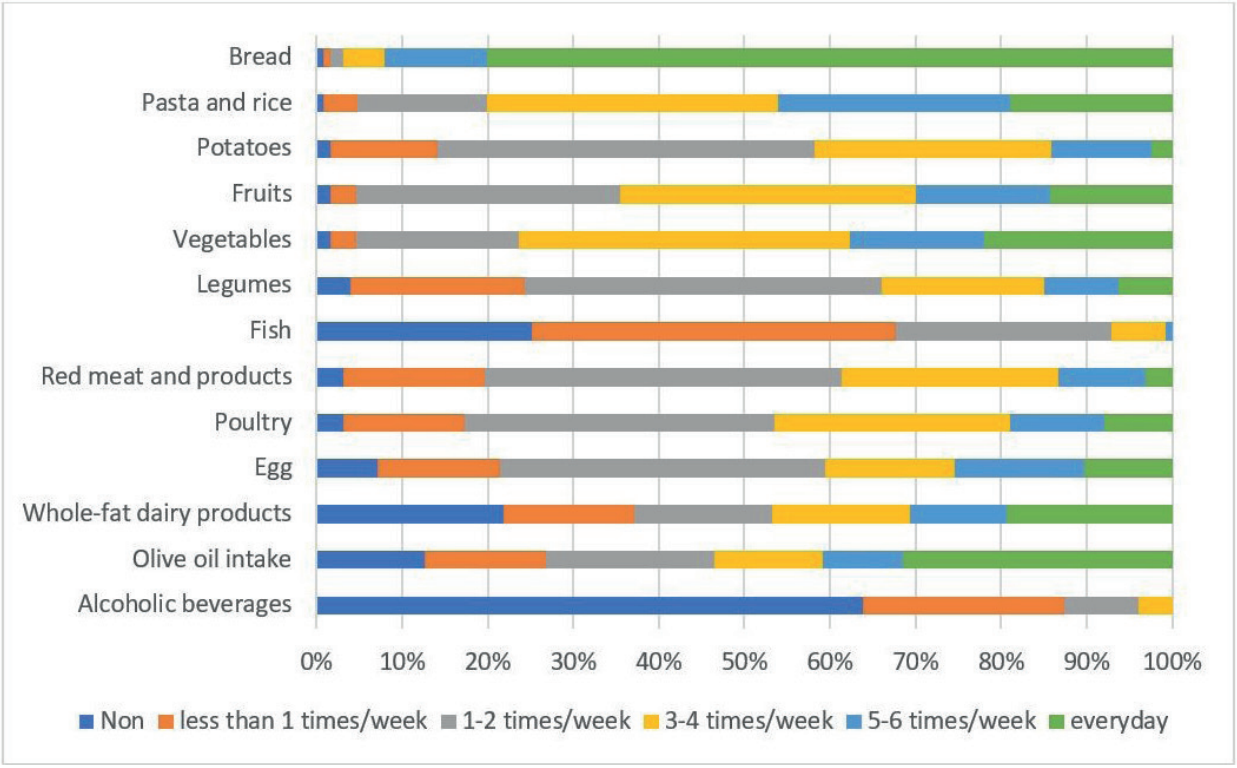

Figure 1. Average weekly consumption frequencies of food and beverages by the students.

(26) reported that high consumption of red meat and meat products and small amounts of fruits in young adult males. It was reported that a very small percentage of adults actually consumed the recommended amount of vegetables, fruits and legumes (27). In a study in which the students were given education on diet, decreased intake of red meat and meat products among males and increased intake of fruits among females were shown following education (23). The ATTICA study showed that the participants consumed large amounts of red meat and sweet foods ($p<0.05$) and small amounts of fish, poultry, dairy products, vegetables and cereals ($p<0.05$) (28). Previous studies reported low intake of olive oil, vegetables, fruits, wine, legumes, fish and nuts and high intake of red meat and meat products, animal fats and sugar-sweetened beverages among young Spanish adults, whereas among Turkish adults, males were reported to consume greater amounts of meat and meat products, eggs, legumes and nuts, milk and dairy products, bread, cereals, alcohol-free beverages and alcoholic beverages and smaller amounts of vegetables and fruits compared to females (18,29). In contrast to our findings, Trichopoulou et al. (30) reported that adult Greek males consumed greater amounts of vegetables, fruits, legumes, milk and meat products, cereals, red meat and meat products, fish, poultry, olive oil, fish and eggs in comparison to adult Greek females. They also looked at the relation between foods and the MDS and an association with the score was only observed for potatoes. In general, it can be said that young adults living in different regions of the world generally tend to consume larger quantities of animal products such as red meat and poultry and smaller quantities of vegetables, fruits and legumes. International health bodies state that excessive intake of fats, saturated fats and sodium from foods such as red meat and poultry is associated with an increased risk of chronic conditions such as cardiovascular diseases, obesity, diabetes, cancer and metabolic syndrome, whereas intake of food and nutrients including vegetables, fruits, fish, whole grains, fibers and adequate calcium (≥500mg/day) lowers the risk of

chronic conditions.[31-33] Thus, young adults are needed to be encouraged to adopt a healthy dietary pattern in order to prevent development of chronic diseases.

The data from the study showed a positive weak correlation between anthropometric measurements and MD score in female students, however, it was not significant association whereas negative weak correlation and the non-significant association was found in males. Other studies also reported no association between BMI and adherence to the MD (34,35). Nevertheless, there are some studies reporting reduced BMI values with greater adherence to the MD (13,18,23). The EPIC study found that BMI was not significantly associated with the MDS in males and females (36). Contradictory findings exist in the literature on the relation between the adherence to the MD and anthropometric measurements. This may be explained by the fact that in addition to the diet, other factors such as physical activity and chronic conditions might have an impact on the anthropometric measurements including body weight, BMI, body fat percentage and waist circumference. On the other hand, our findings showed a positive weak correlation but the non-significant association between physical activity and MD score both in females and male students. Trichopoulou has also reported a positive correlation between physical activity and the MDS (30). However, other studies reported no influence of the physical activity level on the adherence to the MD (18,37). Our results are consistent with those reported in the literature.

Studies show that male students are physically more active than female students (38,39). Also, bigorexia or muscular dysmorphia which is a current global trend that mostly affects males might have caused male students give more importance to physical activity (40). Being physically active is an integral component of both the MD and healthy lifestyle (3). Regular physical activity can improve the quality of life through immediate and long-term health benefits (41). Being physically inactive affects public health all over the world and has been associated with increased risk of several conditions including cardiovascular disease, diabetes mellitus, cancer, hypertension, depression, type II diabetes, metabolic syndrome and overall mortality (42). Therefore, supportive strategies should be developed to help young adults adopt a lifestyle that includes regular physical activity.

The fact that the study population is nutrition and dietetics students constitute the strength of this study. Dieticians have a critical role in nutrition-focused health care and prevent nutrition-related chronic diseases in all age groups (43). For this reason, it is important to know the nutrition and lifestyle habits of nutrition and dietetics students.

On the other hand, determining study limitations is important for designing more comprehensive studies. Firstly, the study has cross-sectional design. Therefore, cause and effect relationship could not be investigated. Secondly, as participation in the study was voluntary, the study was conducted with a small sample (n=127). Thirdly, it would be more beneficial to determine the adherence of the students to MD starting from the first year and to evaluate their adherence periodically until the graduation year.

Conclusion

Although MDS of Nutrition and Dietetics students reduced towards their final year, students show moderate adherence to the MD in this study. Dietitians are nutrition experts who have a key role in guiding healthy food choices in the community. Thus, Nutrition and Dietetics students should be encouraged to adopt healthy dietary habits during their years at the university. Further studies are needed to interpret results in the context of changing and evolving lifestyles and community-based strategies should be implemented to help individuals adopt a healthy dietary pattern. Data from the study may provide a wider perspective on eating patterns among university students and be used as a guide for future studies.

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