Assessment of the knowledge and application of the Mediterranean diet among students of dietetics

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A- Conception and study design; **B -** Collection of data; **C -** Data analysis; **D -** Writing the paper;
E- Review article; **F** - Approval of the final version of the article; **G** - Other (please specify)
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ABSTRACT
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Purpose: To assess the knowledge of young adults (students of dietetics) of the health benefits of the Mediterranean diet (MedDiet) and the practical application of the principles of this diet.

Materials and methods: The study was performed on 97 women, students of dietetics. Research on general information about the respondents and knowledge about the MedDiet was carried out using a questionnaire with 29 questions. To assess the nutritional value of the diet, a 3-day nutritional diary and computer programme Diet 5.0 were used. Adherence to the MedDiet was appraised according to the 9-point scale of aMED (alternate Mediterranean Diet Score).

Results: The most students responded that they have high knowledge of the MedDiet, but do not use the MedDiet recommendations in their daily nutrition. Better adherence to MedDiet was significantly associated with the lower waist circumference of the women, higher intake of mono- and polyunsaturated fatty acids, omega-3 fatty acids, fiber, vitamin C, folate, vitamin B1, vitamin E and magnesium, and the knowledge of participants of the diet and nutritional value of foods.

Conclusions: The adherence to the MedDiet is significantly associated with the participants' knowledge about the diet, the higher nutritional value of the daily diet and lower waist circumference.

Keywords: Mediterranean diet, adherence, students of dietetics
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INTRODUCTION

In recent years, nutritional epidemiology is mainly focused on food patterns rather than on individual foods or nutrients. Dietary patterns combine different food habits in the population, the quantity and frequency of consumption, the interactions between different food groups and their effects on the risk of noncommunicable disease [1]. The Mediterranean dietary pattern has been linked to many beneficial health effects. The traditional Mediterranean diet (MedDiet) is characterized by the use of olive oil as main culinary fat, high intake of vegetables, fruits, legumes, nuts and cereals, moderate intake of fish, poultry and red wine, and low intake of red meat, sweets and high fat dairy products [2]. Some studies indicated, that higher adherence to the MedDiet is positive associated with better health-related quality of life [3,4]. The protective effect of the MedDiet on chronic diseases, such as cardiovascular diseases [5], diabetes [6] and cancer [7] is related to the bioactive ingredients contained in Mediterranean food (vitamins, minerals, polyphenols, mono- and polyunsaturated fatty acids). The multicenter trial in Spain, involving older high-risk persons without cardiovascular disease showed, that an energy-unrestricted MedDiet supplemented with either extra-virgin olive oil or nuts has a better effect on the incidence of major cardiovascular events over a period of 5 years than a low-fat diet [8]. Recent intervention study have shown statistically-significant improvements in axon-mediated microvascular vasodilation and endothelial-mediated nitric oxide synthesis in the younger group of patients after 4 week application of MedDiet [9].

Students of dietetics should give evidence of proper nutrition by their own example. Therefore, the aim of the work was to assess the knowledge of young adults (students of dietetics) of the health benefits of the MedDiet and the practical application of the principles of this diet.

MATERIALS AND METHODS

Study group

Subjects were students of dietetics in Medical University of Bialystok, recruited from a list of available students in academic year 2017-2018. Among the total sample of 187 students of dietetics, 90 participants did not meet the inclusion criteria (men, incomplete questionnaires, failure to return questionnaire and nutritional diary). Finally, the study was performed on 97 women, students of dietetics.

The participants provided written informed consent, and the study protocol was approved by the Bioethics Committee of the Medical University of Bialystok (number R-I-002/163/2017).

Nutritional knowledge and dietary assessment

Research on general information about the respondents and knowledge about the MedDiet was carried out using a questionnaire with 29 questions. To assess the nutritional value of the diet, a 3-day nutritional diary and computer programme Diet 5.0 were used. Food portion sizes were estimated using an album with photographs of the most consumed food products established by National Food and Nutrition Institute, Warsaw, Poland.

Adherence to the MedDiet was appraised according to the 9-point scale of aMED (alternate Mediterranean Diet Score) created by Trichopoulou et al. [10]. A value of 0 or 1 was assigned to each of nine indicated components: vegetables without potatoes, pulses, fruit, nuts, whole meal cereal products, fish, red meat, alcohol, monounsaturated to saturated fatty acids ratio. One point was awarded, when consumption of vegetables, pulses, fruit, nuts, whole meal cereal products and fish, and monounsaturated fatty acids/saturated fatty acids ratio were at or above the median, whereas consumption of red meat below the median. For ethanol, a value of 1 was assigned when alcohol intake was 5-25 g/day (women). The total Mediterranean-diet score ranged from 0 (minimal adherence to the traditional Mediterranean diet) to 9 (maximal adherence) [11].

Nutritional status was measured by BMI (body mass index) and waist circumference. A BMI was calculated as body mass in kilograms divided by squared height in meters. A BMI 18.5-24.9 kg/m^2 was defined as normal body mass, a BMI under 18.5 kg/m^2 was classified as underweight, a BMI 25.0-29.9 kg/m^2 as overweight, and BMI over 30.0 kg/m^2 as obesity. The waist circumference was classified as elevated for women, when was ≥80 cm [12].

Statistical analysis

The data analysis was performed using a Statistica 13.1 software (StatSoft, Inc.).

Continuous variables were presented as means and standard deviations (SD) and categorical variables as counts and percentages.

Categorical variables were compared with the χ2 test.

Normality of continuous data distribution was verified with the Shapiro-Wilk test.

The one-way analysis of variance (ANOVA) followed by the Tukey's post‑hoc test was used for normally distributed variables.

The values of $p < 0.05$ were considered to be statistically significant.

RESULTS

Baseline characteristics of the participants was presented in Table 1. The mean age of women was 21.9 ± 3.2. It was found that normal body mass (BMI=18.5-24.9 kg/m^2) was characterized for 71% participants, whereas 15% had underweight, 12% overweight, and 2% obesity. The recommended waist circumference (<80 cm) was shown in 78% women. Better adherence to MedDiet was significantly associated (p=0.012) with the lower waist circumference of the women (Table 2). No significant correlation has been demonstrated for BMI.

In Table 3 was presented the adherence to a Mediterranean diet according to the mean daily energy and nutrients intake. It was shown, that better adherence to MedDiet was significantly associated with higher intake of mono- (p=0.014) and polyunsaturated fatty acids (p=0.011), omega-3 fatty acids (p=0.009), fiber (p=0.011), vitamin C (p=0.012), folate (p=0.015), vitamin B$_1$ (p=0.04), vitamin E (p=0.008) and magnesium (p=0.012).

Among participants, 88% responded, that they have high dietary knowledge of the MedDiet, but only 31% practically use the principles of the MedDiet in their daily nutrition.

The adherence to a MedDiet and self-reported knowledge and applications of the MedDiet were shown in Table 4. It was found, better adherence to MedDiet was associated with the better knowledge of participants of the diet and nutritional value of foods and applications of main principles of MedDiet.

Table 1. Characteristics of the study women

	Age (years)	High (cm)	Weigh (kg)	WC (cm)	BMI (kg/m^2)
mean ± SD (range)	21.9 ± 3.2 (18-25)	165.6 ± 5.7 (153-179)	57.5 ± 8 (40-80)	68.4 ± 9.6 (56-92)	20.9 ± 2.7 (15.4-31.6)

WC – waist circumference, BMI – body mass index, SD – standard deviation

Table 2. Adherence to a Mediterranean diet according to BMI and WC (mean ± SD)

	MedDiet score of 0-3 (n = 25)	MedDiet score of 4-5 (n = 35)	MedDiet score of 6-9 (n = 37)	*p*
BMI (kg/m^2)	21.2 ± 2.4	19.9 ± 2.7	21.5 ± 3.5	0.602
WC (cm)	76.8 ± 9.8	68.7 ± 8.7	65.5 ± 7.5	**0.012**

n – number, WC – waist circumference, BMI – body mass index, SD – standard deviation

Table 3. Adherence to a Mediterranean diet and mean daily energy and nutrients intake

nutrients	MedDiet score of 0-3 (n = 25)	MedDiet score of 4-5 (n = 35)	MedDiet score of 6-9 (n = 37)	*p*
Energy (kcal)	1651.2 (1319.9-1982.5)	1585.9 (1201.7-1970.1)	1619.3 (1292.3-1946.3)	0.768
Proteins (g)	76.5 (52.7-100.3)	76.3 (48.2-104.3)	81.4 (57.3-105.5)	0.458
Fat (g)	56.7 (40.6-72.7)	50.9 (27.5-74.2)	61.1 (43.7-78.5)	0.344
SFA (g)	21.2 (12.1-30.3)	15.7 (8.5-22.9)	17.5 (9.9-25.1)	0.133
MUFA (g)	12.8 (6.0-19.6)	14.1 (6.7-21.5)	18.5 (9.7-27.2)	**0.014**
PUFA (g)	5.2 (1.9-8.5)	8.0 (3.3-12.7)	9.8 (3.1-16.4)	**0.011**
omega-3 (mg)	0.7 (0.1-1.6)	1.4 (0.3-2.6)	2.5 (0.5-5.3)	**0.009**
omega-6 (mg)	13.1 (3.7-59.9)	5.8 (2.1-9.6)	5.9 (1.7-10.2)	0.344
Carbohydrates (g)	182.8 (113.2-252.4)	200.6 (145.5-255.6)	194.2 (137.7-250.6)	0.535
Sugar (g)	45.0 (12.5-77.6)	44.8 (23.3-66.3)	47.7 (24.4-71.0)	0.699
Fiber (g)	14.0 (8.7-19.4)	18.2 (11.6-24.8)	24.2 (14.7-33.7)	**0.011**
Vitamin C (mg)	84.5 (20.8-148.2)	117.2 (28.5-205.9)	163.1 (55.9-270.2)	**0.012**
Folate (µg)	197.9 (98.4-297.5)	231.7 (111.9-351.4)	318.7 (186.5-450.8)	**0.015**

Vitamin B$_{12}$ (µg)	2.5 (1.1-4.0)	1.8 (0.9-2.7)	3.8 (0.3-7.2)	0.054
Vitamin B$_1$ (mg)	0.9 (0.4-1.3)	0.8 (0.5-1.1)	1.1 (0.7-1.6)	**0.04**
Vitamin B$_2$ (mg)	1.3 (0.6-2.1)	1.2 (0.8-1.7)	1.5 (0.9-1.9)	0.312
Vitamin B$_6$ (mg)	1.4 (0.8-1.9)	2.1 (1.3-5.3)	1.7 (0.9-2.5)	0.489
Vitamin E (mg)	5.5 (1.8-9.2)	7.9 (3.2-12.7)	11.5 (0.7-23.2)	**0.008**
Vitamin A(ug)	1580.9 (75.1-5551.4)	727.9 (173.3-1282.4)	1385.8 (521.9-2249.6)	0.830
Magnesium (mg)	201.8 (138.9-264.8)	237.5 (131.1-343.9)	298.3 (186.1-410.5)	**0.012**
Iron (mg)	7.9 (4.6-11.2)	7.9 (5.3-10.6)	9.4 (6.4-12.4)	0.077

n – number, SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids

Table 4. Adherence to a Mediterranean diet and self-reported knowledge and applications of the MedDiet

		MedDiet score of 0-3 (n=25)	MedDiet score of 4-5 (n=35)	MedDiet score of 6-9 (n=37)	*p*
Do you usually read the nutrition labelling of packaged foods?	Yes	26%	29%	44%	**0.035**
What are your main reasons for choosing food products?	Price	67%	0%	33%	**0.031**
	Nutritional value	18%	30%	52%	
	Taste	43%	29%	29%	
	Other	0%	75%	25%	
Do you have dietary knowledge of the MedDiet?	Yes	26%	28%	46%	**0.028**
Do you know the health benefits of the MedDiet?	Yes	25%	29%	46%	**0.022**
Do you use the principles of the MedDiet in your daily diet?	Yes	17%	22%	61%	**0.036**
Do you use olive oil as main culinary fat?	Yes	30%	45%	62%	**0.035**
Do you consume ≥2 vegetable servings per day? (1 serving : 200 g)	Yes	45%	52%	80%	**0.041**
Do you consume ≥3 fruit units (including natural fruit juices) per day?	Yes	39%	51%	65%	**0.038**
Do you prefer red wine for your main meal ?	Yes	15%	17%	16%	0.454
Do you consume ≥3 servings of fish per week? (1 serving : 100-150 g)	Yes	25%	30%	27%	0.335
Do you consume ≥3 servings of nuts per week (1 serving: 30 g)	Yes	52%	63%	71%	**0.031**
Do you consume ≥3 servings of legumes per week (1 serving: 150 g)	Yes	28%	35%	31%	0.246
Do you prefer chicken, turkey or rabbit meat instead of veal, pork, hamburger or sausage?	Yes	41%	58%	74%	**0.012**
Do you prefer commercial sweets and sugar-sweetened beverages?	Yes	39%	23%	7%	**0.011**
Do your physical activity is at least 30 minutes per day?	Yes	46%	55%	67%	**0.038**

n- number

DISCUSSION

In the present work, we evaluated the knowledge of young adults (students of dietetics) of the MedDiet and the practical application of the principles of this diet. It was found, that better adherence to the MedDiet is significantly associated with the participants' knowledge about the diet, the higher nutritional value of the daily diet and better nutritional status, measured by waist circumference.

Recent studies [13,14] support, that a better adherence to MedDiet may play an important role in decreasing the incidence of obesity and metabolic syndrome. In this study better adherence to MedDiet was significantly associated with the lower waist circumference of the women. The Mediterranean dietary pattern is typically based on whole or minimally processed foods, such as fruits, vegetables, legumes, nuts, whole grain cereals, extra virgin olive oil, fish and poultry, but is poor in food predisposing to obesity (fast food, commercial sweets, sugar-sweetened beverages, refined grain products). Foods typical for MedDiet contains many valuable nutrients, such as polyphenols, vitamins, minerals, fiber, and mono-and polyunsaturated fatty acids [15]. In this study better adherence to MedDiet was positively associated with a higher diet quality.

Nutrition labelling can obtain information about the nutritional value of packaged foods and has potential utility to promote healthier eating choices [16]. In the present study better adherence to a MedDiet was characterized for participants who usually read the nutrition labelling of packaged foods and for which the choice of foods was linked to their nutritional value.

In this study, the most students responded that they have high knowledge of the MedDiet, but do not use the MedDiet recommendations in their daily nutrition. To assessment the participants' knowledge about the MedDiet were applied questions based on nutritional recommendations for health promotion (Mediterranean diet pyramid and a 14-item MedDiet assessment tool) [15,17].

Better adherence to the MedDiet was associated with the self-reported knowledge and applications of the diet, and physical activity recommended in MedDiet. The knowledge of people about food and nutrition plays an important role for improving lifestyle and preventing noncommunicable diseases [18].

Medical students should give evidence of proper nutrition by their own example. However, some studies indicate, that medical students show inadequate application of their academic knowledge about healthy living to their own lives [19] or their knowledge about healthy eating and the MedDiet is poor [20].

CONCLUSIONS

The adherence to the MedDiet is significantly associated with the participants' knowledge about the diet, the higher nutritional value of the daily diet and lower waist circumference.

Conflicts of interest
The authors declare that they have no conflict of interest.

REFERENCES

1. Mertens E, Markey O, Geleijnse JM, Givens DI, Lovegrove JA. Dietary patterns in relation to cardiovascular disease incidence and risk markers in a middle-aged British male population: Data from the Caerphilly Prospective Study. Nutrients 2017 Jan;9(1),pii: E75.
2. Carlos S, De La Fuente-Arrillaga C, Bes-Rastrollo M, Razquin C, Rico-Campà A, Martínez-González MA, Ruiz-Canela M. Mediterranean Diet and health outcomes in the SUN Cohort. Nutrients 2018 Mar;10(4),pii: E439.
3. Henríquez Sánchez P, Ruano C, de Irala J, Ruiz-Canela M, Martínez-González MA, Sánchez-Villegas A. Adherence to the Mediterranean diet and quality of life in the SUN Project. Eur J Clin Nutr 2012 Mar; 66(3):360-8.
4. Pérez-Tasigchana RF, León-Muñoz LM, López-García E, Banegas JR, Rodríguez-Artalejo F, Guallar-Castillón P. Mediterranean diet and health-related quality of life in two cohorts of community-dwelling older adults. PLoS One 2016 Mar;11(3):e0151596.
5. Shikany JM, Safford MM, Bryan J, Newby PK, Richman JS, Durant RW, Brown TM, Judd SE. Dietary Patterns and Mediterranean Diet Score and Hazard of Recurrent Coronary Heart Disease Events and All-Cause Mortality in the REGARDS Study. J Am Heart Assoc. 2018 Jul; 7(14), pii:e008078.
6. Grosso G, Stepaniak U, Micek A, Kozela M, Stefler D, Bobak M, Pajak A. Dietary polyphenol intake and risk of type 2 diabetes in the Polish arm of the Health, Alcohol and Psychosocial factors in Eastern Europe (HAPIEE) study. Br J Nutr 2017 Jul;118(1): 60-8.
7. Bravi F, Spei ME, Polesel J, Di Maso M, Montella M, Ferraroni M, Serraino D, Libra M, Negri E, La Vecchia C, Turati F. Mediterranean

Diet and Bladder Cancer Risk in Italy. Nutrients 2018 Aug;10(8), pii: E1061.

8. Estruch R, Ros E, Salas-Salvadó J, Covas MI, Corella D, Arós F, Gómez-Gracia E, Ruiz-Gutiérrez V, Fiol M, Lapetra J, Lamuela-Raventos RM, Serra-Majem L, Pintó X, Basora J, Muñoz MA, Sorlí JV, Martínez JA, Fitó M, Gea A, Hernán MA, Martínez-González MA; PREDIMED Study Investigators. Primary Prevention of Cardiovascular Disease with a Mediterranean Diet Supplemented with Extra-Virgin Olive Oil or Nuts. N Engl J Med. 2018 Jun;378(25):e34.

9. Liu Y, Milner M, Klonizakis M. Physiological effects of a short-term, lifestyle intervention based on the Mediterranean diet: Comparison between older and younger healthy, sedentary adults. Nutrition 2018 May; 55-56:185-191.

10. Trichopoulou A, Costacou T, Bamia C, Trichopoulos D. Adherence to a Mediterranean diet and survival in a Greek population. N Engl J Med. 2003 Jun; 348(26):2599-608.

11. Cyuńczyk M, Zujko K, Zujko ME. The importance of the Mediterranean diet in cardiovascular disease. Prog Health Sci. 2017; 7(2):105-10.

12. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart JC, James WP, Loria CM, Smith SC Jr; International Diabetes Federation Task Force on Epidemiology and Prevention; Hational Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; International Association for the Study of Obesity. Harmonizing the metabolic syndrome. A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation 2009 Oct;120(16):1640-5.

13. Echeverría G, McGee EE, Urquiaga I, Jiménez P, D'Acuña S, Villarroel L, Velasco N, Leighton F, Rigotti A. Inverse associations between a locally validated Mediterranean diet index, overweight/obesity, and metabolic syndrome in Chilean adults. Nutrients 2017 Aug;9(8), pii: E862.

14. Kanauchi M, Kanauchi K. Development of a Mediterranean diet score adapted to Japan and its relation to obesity risk. Food Nutr Res 2016 Nov;60:32172.

15. D'Alessandro A, De Pergola G. Mediterranean diet pyramid: a proposal for Italian people. Nutrients 2014 Oct;6(10):4302-16.

16. Navarrete-Muñoz EM, Torres-Collado L, Valera-Gran D, Gonzalez-Palacios S, Compañ-Gabucio LM, Hernández-Sánchez S, García-de-la-Hera M. Nutrition labelling use and higher adherence to Mediterranean diet: results from the DiSA-UMH Study. Nutrients 2018 Apr;10(4),pii:E442.

17. Martínez-González MA, García-Arellano A, Toledo E, Salas-Salvadó J, Buil-Cosiales P, Corella D, Covas MI, Schröder H, Arós F, Gómez-Gracia E, Fiol M, Ruiz-Gutiérrez V, Lapetra J, Lamuela-Raventos RM, Serra-Majem L, Pintó X, Muñoz MA, Wärnberg J, Ros E, Estruch R; PREDIMED Study Investigators. A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. PLoS One 2012;7(8):e43134.

18. Vitale M, Racca E, Izzo A, Giacco A, Parente E, Riccardi G, Giacco R. Adherence to the traditional Mediterranean diet in a population of South of Italy: factors involved and proposal of an educational field-based survey tool. Int J Food Sci Nutr. 2018 Jun;1-7.

19. Baydemir C, Ozgur EG, Balci S. Evaluation of adherence to Mediterranean diet in medical students at Kocaeli University, Turkey. J Int Med Res. 2018 Apr;46(4):1585-94.

20. Fiore M, Ledda C, Rapisarda V, Sentina E, Mauceri C, D'Agati P, Oliveri Conti G, Serra-Majem L, Ferrante M. Medical school fails to improve Mediterranean diet adherence among medical students. Eur J Public Health 2015 Dec;25(6):1019-23.