



RESEARCH ARTICLE

Behavioral Factors Associated with Adherence to the Mediterranean Diet in Young University Students - A Cross-Sectional Study

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Abstract

Objective: To investigate healthy behaviors associated with adherence to the Mediterranean diet in young adults. Methods: Behavioral factors were assessed using a self-completed questionnaire in 193 students enrolled in one public and one private university in Cyprus. A health habit score ranging from 0 to 5 was devised based on information on: Breakfast consumption, eating fried food, eating away from home, exercise and smoking. Adherence to the Mediterranean diet was evaluated using the validated KIDMED index.

Results: Adherence to the Mediterranean diet was found to be average for the majority of young adults, with 21.8% being classified as low adherers, and 26.9% as high adherers. A higher health habit score was associated with higher adherence to the Mediterranean diet (0.614 higher average adherence (95% CI: 1.07 to 1.55) for one unit change in health habit score). About 63% of students reported consuming breakfast on a regular basis, while half consumed three or fewer meals per day. The main person responsible for preparing meals at home were the parents (63.7%). A little over half of study participants (55.4%) reported currently exercising, with only half of them feeling happy with their body weight. Tobacco use was relatively high among students (24%).

Conclusion: A higher adherence to the Mediterranean diet was associated with a healthier overall behavioral pattern, including regular breakfast consumption, exercise, positive body image, higher meal frequency and water consumption, lower fried food consumption and lower consumption of meals away from home. Enhancing such positive health behaviors is likely to have an independent and lasting effect on later adulthood behaviors and health.

Introduction

The Mediterranean diet is a dietary pattern based on the traditional diet found around the Mediterranean basin, and is considered one of the healthiest diets worldwide, with the body of evidence from both epidemiological and experimental studies continuing to grow [1-3]. It therefore represents a pattern recommended both for primary and secondary prevention of major chronic diseases [4].

Traditional Mediterranean dietary models are characterized by abundant plant foods such as fruit, vegetables, bread and cereals, pulses, nuts and seeds. Olive oil is the principal source of fat, with dairy products (especially cheese and yogurt), and fish and poultry consumed in low to moderate amounts. Eggs are consumed a few times per week and red meat is used in low amounts, while alcohol -mostly wine- is consumed in low to moderate amounts, normally with meals. An active lifestyle is an additional component of the Mediterranean diet [5].

The protective role of the Mediterranean diet against the occurrence of several diseases is well known. Focusing in just the last five years, findings from several studies suggest that the Mediterranean diet could prove beneficial in a number of diseases associated with chronic inflammation such as atherosclerosis [6], the metabolic syndrome [7], diabetes [3,8] and obesity [9]; but also cancer [10], pulmonary diseases [11] and cognition disorders [12]. It is worth noting that the Mediterranean diet consists of a holistic dietary

approach which includes a combination of foods and nutrients and not just a single dietary component [13].

However in spite of the recognition of the health benefits of the Mediterranean diet, there has been a gradual abandonment of this dietary pattern in recent years, especially in countries traditionally associated with the Mediterranean diet and among younger people [14-18].

Given the fact that emerging adulthood (typically defined as 18-25 years of age), is an important transitional period from adolescence to adulthood, during which long-term health behavior patterns are formed, it is especially important that healthy dietary patterns are established then, thus reducing the risk for many adult onset chronic diseases [19].

Nonetheless, data on behavioral factors associated with adherence to the Mediterranean diet, especially in young adults, are lacking. Previous studies conducted on adolescents reported that lack of physical activity and high level of screen time were inversely related to adherence to the Mediterranean diet [20-22]. A relatively recent study conducted on Spanish university students indicated a positive correlation between number of meals consumed daily and diet quality [18].

The objective of this study was to investigate behavioral factors associated with adherence to the Mediterranean diet in Cypriot young adults attending college, as this is a crucial period for establishing dietary patterns.

Materials and Methods

A total of 193 young adults aged 18-25 years were recruited in the study between October 2014 and December 2014 through convenience sampling. During these months a study researcher visited two university campuses, one public (Cyprus University of Technology, Limassol) and one private (University of Central Lancashire in Cyprus, Larnaca) and asked the students attending a course to self-complete an anonymous dietary-behavioral habits questionnaire. Completion of the questionnaire was considered informed consent.

Adherence to the Mediterranean diet was evaluated by the KIDMED index (Mediterranean Diet Quality Index for children and adolescents), a validated and widely used index [23]. It includes 16 questions based on the principles of the Mediterranean diet, with those denoting a positive aspect with respect to the Mediterranean diet being assigned a value of +1, and those with a negative aspect a value of -1. A total score \leq 3 suggests a very low diet quality, a score between 4 and 7 suggests a diet that needs improvement with regards to the Mediterranean patterns and a score \geq 8 reflects an optimal adherence to the Mediterranean diet.

Moreover a 'health habit' score was created based on information derived from five important behavioral

characteristics that were included in the relevant questionnaire (breakfast consumption, eating fried food, eating away from home, current exercise and smoking) ranging from 0 to 5, with questions denoting a positive behavior being assigned a value of +1 and those with a negative behavior being assigned a value of 0. Specific questions used were: "Do you skip breakfast?" (yes/no); "Do you currently smoke?" (yes/no); "Do you currently exercise?" (yes/no); "How often do you consume meals away from home?" (daily, 4-6 times/week, 1-3 times/week, 1-3 times/month, a few times/year or never); "How often do you consume fried food?" (daily, 4-6 times/week, 1-3 times/week, 1-3 times/month, a few times/year or never). An additional question on body image was included in the questionnaire ("Do you feel happy with your body weight? yes/no"), to be able to look at the possible association between a positive body perception and a healthier diet as reported with the KIDMED Index.

Weight and height were also measured with the use of a portable scale and stadiometer at the standing position without shoes by the same study researcher, who was blinded to the subjects replies. Body mass index (BMI) was calculated as $\text{weight}/\text{height}^2$ (Kg/m^2) and used for the assessment of overweight and obesity among young adults according to the International Obesity Task Force (IOTF) age and sex-specific BMI cut offs [24].

Data Handling and Statistical Analysis

Continuous variables are presented as mean \pm SD, whereas categorical variables are presented as frequencies. The normality of continuous variables was tested by the observation of curves and the Kolmogorov-Smirnov test. Differences between categorical variables were tested with the chi-square test and a t-test or ANOVA were applied to evaluate differences in mean values of continuous variables. A p value of less than 0.05 was considered statistically significant. Data were analyzed using the SPSS vs.19 statistical package and Microsoft Excel.

Results

Demographic characteristics of the participants

Study participants had a mean age of 20.56 (\pm 1.85) years, with 87 (45.1%) of them being male. Regarding men the mean height was 176.66 (\pm 6.25) cm, the mean weight was 78.18 (\pm 12.37) Kg and the mean BMI was 25.05 (\pm 3.68) Kg/m^2 , while for women the corresponding values were 162.82 (\pm 6.86) cm, 57.98 (\pm 9.75) Kg and 21.89 (\pm 3.65) Kg/m^2 respectively and differed significantly from men ($p < 0.001$ for all). The majority of participants came from the regions of Larnaca (38.9%) and Limassol (33.7%) reflecting the location of campuses surveyed. Demographic characteristics of the study participants are presented in Table 1.

Table 1: Baseline characteristics of study participants.

Variables	All	Males	Females	P value for difference between sexes
	193	87 (45.1%)	106 (54.9%)	
Age (yr)	20.56 ± 1.85	21.20 ± 1.59	20.05 ± 1.89	< 0.001
Height (cm)	169.06 ± 9.53	176.66 ± 6.25	162.82 ± 6.86	< 0.001
Weight (Kg)	67.09 ± 14.90	78.18 ± 12.37	57.98 ± 9.75	< 0.001
BMI (Kg/m ²)	23.31 ± 3.98	25.05 ± 3.68	21.89 ± 3.65	< 0.001
BMI categories				
≤ 18.5 (Kg/m ²)	6.2%	2.3%	9.4%	< 0.001*
18.5-25 (Kg/m ²)	64.8%	51.7%	75.5%	
25-30 (Kg/m ²)	24.9%	41.4%	11.3%	
> 30 (Kg/m ²)	4.1%	4.6%	3.8%	
Type of education				
Public university	94 (48.7%)	44 (50.6%)	50 (47.2%)	0.638
Private university	99 (51.3%)	43 (49.4%)	56 (52.8%)	
Currently Employed				
Yes	47 (24.6)	27 (31.4%)	20 (19%)	0.049
No	144 (75.4%)	59 (68.6%)	85 (81%)	
Region of main residence				
Nicosia	34 (17.6%)	20 (23%)	14 (13.2%)	0.121*
Larnaca	75 (38.9%)	34 (39.1%)	41 (38.7%)	
Limassol	65 (33.7%)	22 (25.3%)	43 (40.6%)	
Paphos	4 (2.1%)	2 (2.3%)	2 (1.9%)	
Famagusta	15 (7.8%)	9 (10.3%)	6 (5.7%)	

Data are presented as mean ± SD and categorical variables as percentages in parentheses.

*Shows p value for trend.

Behavioral characteristics

Breakfast consumption: The majority of participants (63.2%) reported consuming breakfast on a regular basis. However about a third of those reported eating commercially baked goods or pastries (30.6%) for breakfast, a widely used practice in Cyprus and other Mediterranean countries such as Greece and Italy and which may not represent the healthiest choice for breakfast.

Meal patterns: About half (47.2%) of young adults consumed three or fewer meals per day while the rest consume more than four meals per day. The main person responsible for preparing meals at home were the parents (63.7%), with only 29% of young adults preparing food by themselves. The majority of young adults (45.6%) consume meals away from home 1-3 times per week.

With regards to fried foods, half of study participants (50.3%) reported consuming fried food 1-3 times per week, with another 29% consuming such foods only 1-3 times per month. Most of them however use little extra salt at the table (44.6%).

As expected, given body size, men drank more water

than women, with 40% of men consuming ≥ 8 glasses of water vs. 24% of women (p = 0.017).

Exercise: A little over half of study participants (55.4%) reported currently exercising, with men exercising significantly more than women (69% vs. 44.3%, p = 0.001). Noticeably, about a fifth of men surveyed (21.8%) reported taking protein supplements compared with only 4.7% of women (p < 0.001), and about 20% of study participants took vitamins/minerals supplements (p = 0.3 for men vs. women).

Smoking: Tobacco use (currently smoking) was relatively high among this group of young Cypriots (24%) and especially among males, with 31% of them reporting current smoking, vs. 18.1% of young females (p = 0.037). Among smokers, the average number of cigarettes/day was 11.39 (± 7.14).

Body image: Only half of young adults feel happy with their body weight, with males being overall happier than females (62.1% vs. 41.5%, p = 0.004). However, out of those who feel unhappy with their body weight only 23.2% were currently on a diet and 43.2% exercised. Students with a positive body image had a higher health habit score vs. students who had a negative image (2.98 and vs. 2.41, p = 0.004).

Table 2: Behavioral characteristics.

	Total (%)	Males (%)	Females (%)	p
No breakfast	36.8	36.8	36.8	0.999
Currently Exercising	55.4	69	44.3	0.001
Taking Protein Supplements	12.4	21.8	4.7	0.000
Taking Vitamins/minerals supplements	21.8	18.4	24.5	0.304
Currently Smoking	24	31	18.1	0.037
Meal preparation by:				
Self	29	29.9	28.3	0.813
Parents	63.7	63.2	64.2	
Grandparents	5.7	4.6	6.6	
Other	1.6	2.3	0.9	
Meals per day				
≤ 3	47.2	41.4	51.9	0.146
≥ 4	52.8	58.6	48.1	
Meals away from home				
Daily	9.8	8	11.3	0.949
4-6 times/week	13	13.8	12.3	
1-3 times/week	45.6	47.1	44.3	
1-3 times/month	24.4	24.1	24.5	
Few times/year or never	7.3	6.9	7.5	
Fried food consumption				
Daily	0.5	1.1	0	0.311
4-6 times/week	5.2	6.9	3.8	
1-3 times/week	50.3	55.2	40.2	
1-3 times/month	29	24.1	33	
Few times/year or never	15	12.6	17	
Extra salt at the table				
Much	16.1	14.9	17	0.716
Little	44.6	42.5	46.2	
Not at all	39.4	42.5	36.8	
Water consumption				
≤ 3 glasses	17.1	5.8	26.4	0.017
4-7	51.8	54.7	50	
> 8	30.6	39.5	23.6	

Students that consumed breakfast and exercised reported feeling happy with their body weight more often, compared to students that skipped breakfast ($p = 0.035$) and did not exercise ($p = 0.001$), while there were no statistically significant differences with regards to smoking ($p = 0.239$), eating fried food ($p = 0.531$) and eating away from home ($p = 0.221$), for both males and females.

Behavioral characteristics are presented in detail in [Table 2](#).

Mediterranean diet: Adherence to the Mediterranean diet as assessed by KIDMED index was found to be average (4-7) for the majority (51.3%) of young adults surveyed, with 21.8% being classified as low adherers to the Mediterranean diet, and 26.9% as high. The median KIDMED score was 6.00 (IQR: 4 to 8).

Students who skip breakfast and smoke had a lower KIDMED index value compared to students who consume breakfast and do not currently smoke (3.46 vs. 6.98; $p = 0.000$ and 4.61 vs. 6.0; $p = 0.005$).

Students who feel happy with their body weight had a higher KIDMED index compared to those who didn't (6.3 vs. 5.05, $p = 0.003$).

Health habit score: Having a higher health habit score, which included combined information on breakfast consumption, eating fried food, eating away from home, exercise and smoking, was significantly associated with higher adherence to the Mediterranean diet (p for trend < 0.001), with a one unit increase in the health score being associated with a 0.614 (95% CI: 1.07 to 1.55) (38%; 95% CI: 51.7% to 60.8%) increase in the KIDMED index.

Discussion

We report an average adherence to the Mediterranean diet among university students in Cyprus, in accordance with previous studies conducted in children and adolescents [14,25]. As expected participants with a higher health habit score also had a higher adherence to the Mediterranean diet, indicating that improvements in overall health behaviors also affect diet in a holistic approach.

About one third of college students in the study did not consume breakfast on a regular basis. This is in agreement with previous reports, albeit in non-Mediterranean countries, that many young adults have the habit of skipping breakfast; with values ranging between 33% in Australian university students [26] and 57% in American young adults [27], indicating a possible relationship between a heavy study load and skipping breakfast. In another study of adolescents and young adults in Sao Paulo, those who ate breakfast were shown to have a significantly higher mean calcium, vitamin D and dairy products intake than those who did not [28].

In the present study about half of young adults reported currently exercising. A recent study conducted in Spain with a large sample size reported that whereas the majority of children (72.2%) and adolescents (56.4%) reached their recommended physical activity levels, only a 40% of young adults managed to do so. Most active were students in primary schools, with university students being the least active [29]. We report a higher percentage of college students exercising and in line with other studies [30,31], young men in our study population were more active than young women. This could be explained by cultural norms and trends in Cyprus, where joining a gym on a regular basis has increased in popularity among young adults, especially men.

About a fifth of the young adults surveyed used vitamins/minerals supplements, with one fifth of males also taking protein supplements (another popular trend among young ages in Cyprus). Lieberman, et al. [32] indicated that 42% of college students used multivitamins/multimineral and 17% protein/amino acids. College students appear more likely to use dietary supplements than the general population in order to promote general health, provide them with more energy, increase muscle strength and enhance performance [32] and this appears to be true in Cypriot students too. While the intake of vitamin supplements in recommended doses may not pose a risk, protein supplements may pose a real risk. Excess dietary protein can adversely affect bone through urinary calcium loss [33] and high protein diets can accelerate renal disease progression [34,35]. On the other hand, there is no evidence to suggest that supplements are required for optimal muscle growth or strength gain and even strength-trained athletes should consume protein consistent with general population

guidelines, or 12% to 15% of energy from protein [36]. Protein supplementation in this young population deserves further attention.

Smoking prevalence among young adults and especially among young males in our study was high but in agreement with previous reports from Cypriot school children [37]. Studies suggest that more young males than females smoke cigarettes [38,39] with even further implications, as Atalay, et al. [40] have shown that nicotine dependence may be a factor that affects physical activity among young people.

With regards to body image, about half of young adults reported not being happy with their body weight, with females being unhappy at a higher percentage than males (58.5% vs. 37.9%, $p = 0.004$). Factors associated with body image included breakfast consumption and exercise.

A birth cohort study in 4100 subjects aged between 22 and 23 years in Brazil showed that the prevalence of body dissatisfaction reached 64%, with 42% of the subjects reporting feeling larger and 22% reported feeling smaller than the desired body size [41]. It would seem that body dissatisfaction is pervasive among young adults and as perhaps expected, is a particular issue for young women, with more women than men desiring a body shape slimmer than their current one [31,42]. While body dissatisfaction may start even before adolescence, longitudinal studies have shown that body dissatisfaction increases between middle and high school and increases even further during the transition to young adulthood [43], making this an important period for future perceptions and self-confidence.

Limitations of this study include the fact that only two universities were surveyed and this was a convenience sampling, therefore the study population may not be representative of the Cypriot college student population and as such our results should be extrapolated with caution. In addition, data obtained in this survey were based on a self-completed questionnaire and therefore the possibility of bias cannot be excluded. Further information on frequency of exercise could not be used as it was missing from the majority of responders (63%), thus not allowing us to further probe into the possible relationship between frequency of physical activity and diet. Finally, as in any cross-sectional study, no causal relationships can be drawn.

However, as data is lacking on the topic it is expected that our results can help shed some light on the possible relationship between positive behaviors and adherence to a healthy diet pattern and guide possible intervention promoting a holistically healthy lifestyle in youth. As young adulthood is a critical life stage with similar trends and norms among youth, some of our results could be applicable to young adults in other countries, especially Mediterranean countries that share common

cultural and diet characteristics.

Conclusion

We report an association between behavioral factors and adherence to the Mediterranean diet; specifically, a higher adherence to the Mediterranean diet was associated with regular breakfast consumption, exercise, positive body image, a higher meal frequency, higher water consumption, lower fried food consumption and lower consumption of meals away from home.

Based on these findings, tailored-made public health strategies and methods targeting the young adult population would be warranted, focusing on interventions to shape holistic health behavior patterns in order to increase adherence to the Mediterranean diet, with positive effects carried into later adulthood.

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The authors declare that they have no competing interests.

Author's Contributions

EH carried out all data collection, analyzed the data and drafted the manuscript. GB and VG conceived the study and participated in the design and coordination of the study and helped draft the manuscript. AGP participated in data analysis, drafted and critically revised the manuscript. All authors read and approved the final version of the manuscript.

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