ADHERENCE TO MEDITERRANEAN DIET AMONG ADOLESCENTS ATTENDING PUBLIC SCHOOLS IN NORTH LEBANON

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Abstract

The Mediterranean diet (MD) is a model of a healthy diet and healthy lifestyle. Adherence to the MD has been correlated with a reduction in many metabolic disorders including cancers. The factors associated with adolescents' adherence to the MD in North Lebanon using the KIDMED index have never been explored. The objective of this study was to examine the factors associated with the Mediterranean diet (MD) adherence among a sample of Lebanese adolescents. A cross-sectional survey was conducted in the city of Tripoli, North Lebanon. A total of 298 students, aged 11-18 years, were randomly selected from public schools in the area. All participants completed a questionnaire on the Mediterranean diet (KIDMED index), physical activity (physical activity questionnaires for older children [PAQ-C] and adolescents [PAQ-A]), health-related quality of life (KIDSCREEN-27 index), and sociodemographic characteristics (age, gender, grade level, and parents' educational status). The questionnaire was followed by anthropometric measurements. Adherence to the MD was good among only 13.4% of the adolescents. The prevalence rate of overweight and obesity was elevated reaching 36.9% of the students. Lower adherence to the MD was significantly correlated with skipping meals (P=0.004) and consuming fewer meals with the family (P

1. INTRODUCTION

The term Mediterranean diet has been generally used to depict the conventional eating behaviors of individuals living in Crete, South Italy, and other Mediterranean countries during the 1960s. Abundant plant products such as fruits (primarily as typical daily desserts), vegetables, bread, other types of cereals, beans, nuts, and seeds characterize the diet. It also involves olive oil as the main source of fat, moderate quantities of dairy products (mainly cheese and yogurt), low to moderate intake of fish and poultry, and low-quantity of red meat and wine. The Mediterranean dietary pattern is distinguished from other dietary patterns by its abundance in monounsaturated fatty acids, fibers and antioxidants such as vitamins E and C, resveratrol, polyphenols, selenium, and glutathione, and its balanced ratio of (n-6): (n3) fatty acids (Mendez et al., 2006). Following the Mediterranean diet (MD) has resulted in a reduction in the risk of cardiovascular diseases and an increase in life expectancy (Bonaccio, Iacoviello, De Gaetano, & Moli-Sani, 2012). While it is not apparent which component of the MD is associated with the most significant health advantages, a synergistic effect of these elements is more inclined to provide a nutritional pattern that decreases health hazards.

In recent decades, most Mediterranean countries have shifted from this dietary model towards a high-energy diet that is affluent in saturated fats and poor in micronutrients. This diet has often substituted traditional dishes, particularly among children and adolescents (Córdoba-Caro, Luego, & García, 2012; Aounallah-Skhiri, Traissac, El Ati, 2011). However, an increase in the obesity rates has emerged from this nutritional transition among most Mediterranean and industrialized countries as well (Lobstein, Baur, & Uauy, 2004). Lebanese teenagers were also affected by this phenomenon.

This was the culmination of the nutritional transition that the Lebanese population encountered, defined by a westernized lifestyle and food practices (Nasreddine et al., 2012). Among Greek adolescents, lower adherence to the Mediterranean diet was associated with greater body mass index and waist circumference (Mazaraki et al., 2011).

A group of Spanish researchers created an index (KIDMED index) in order to evaluate youth (2–24 y) compliance with the Mediterranean diet (Serra-Majem et al., 2004). A review of the current available literature indicates that there is insufficient data on the factors associated with adolescents' adherence to the MD in North Lebanon. Therefore, the purpose of this research was to assess the level of MD adherence in a group of Lebanese adolescents in relation to their lifestyles as well as social and family environments and to compare the sample dietary practices with similar studies.

2. METHODS

2.1. Study Design and Participants

This was a cross-sectional study conducted in January and March 2019. The study included students aged 11-18 years enrolled in public schools in Tripoli for the academic year 2018-2019. Tripoli is the largest city in Northern Lebanon and the second-largest city in the country. It lies on the Mediterranean coast 65 km north-northeast of Beirut. Its population is approximately estimated to 310 980 inhabitants (around 7,3 % of the total population of the Lebanon). It has the strongest demographic concentration in Lebanon (7 086 inhabitants / Km ²). The schools in Tripoli are divided into public (108), private (38) and semi-private (26) (UN- Habitat Lebanon, 2016).

2.2. Sampling Procedure

Based on a previously published study (Sahingoz, & Sanlier, N. (2011), a total sample size of 298 students distributed over the three categories of the score allowed for the detection of a 15% decrease in KIDMED with a 5% significance level and an 80% study power. Records provided from the Ministry of Education were used to compile a sampling frame of all schools in the City of Tripoli. Schools were randomly selected based on the stratified cluster sampling method. The strata were complementary and secondary classes. Clusters were defined as the schools within each stratum, from which two schools were randomly selected. In total, our sample was composed of four schools. The end units were all the students within the selected schools aged between 11 and 18 and agreeing to participate. Consent of students' parents was obtained. Students suffering from physical disabilities or were absent on the days of the data collection were excluded from the study.

2.3. Data Collection

The study used a multicomponent questionnaire completed through a face-to-face interview. The questionnaires were completed during school hours in the classrooms in the presence of a teacher. Each questionnaire consisted of different sections which evaluated adherence to the MD, sociodemographic characteristics, physical activity, and HRQoL among the participants. The average length of the questionnaire was 25-30 minutes. The questionnaire was piloted in advance and filled by dietitians who received previous training to standardize the data collection procedures.

2.4. Measures

2.4.1. Adherence to the Mediterranean diet

Adherence to the MD among participants was assessed using the KIDMED index. The index consists of 16 yes-or-no questions with a total score ranging from -4 to 12. The KIDMED index combined the Mediterranean diet guidelines for adults as well as the general dietary guidelines for children (such as skipping breakfast) in a single index (Serra-Majem et al., 2004). Questions with a negative connotation (skipping breakfast, going to a fast food restaurant more than once a week, eating pastries or baked goods for breakfast, eating sweets or candies several times a day) were given a value of -1, while the rest were given a score of +1. The total score is classified into three categories: ≤3, poor diet quality; 4–7, an average level of adherence; and ≥ 8–12, good adherence (Kontogianni et al., 2008). This section also included questions about the number of meals consumed daily and with the family as well as how frequent meals were skipped.

2.4.2. Sociodemographic characteristics

The sociodemographic characteristics of the students were comprised of: age, gender, grade level, and parent's educational status (primary, complementary, secondary, or university).

2.4.3. Quality of life

The quality of life of the participants was evaluated by the KIDSCREEN-27 index and the level of physical activity. The KIDSCREEN-27 was used to assess the HRQoL of the participants. This tool includes 27 questions which cover five dimensions of well-being: *physical well-being* (5 items), *psychological well-being* (7 items), *parent relations and autonomy* (7 items), *social support and peers* (4 items), and *school environment* (4 items). The HRQoL is an internationally validated questionnaire. The instrument demonstrated an excellent cross-cultural comparative validity. The final score is the sum of all item responses. Higher scores are associated with a better quality of life (Ravens-Sieberer et al., 2008).

The level of physical activity was evaluated using the physical activity questionnaires for children (PAC-C) and adolescents (PAC-A). These questionnaires assessed the activity level of participants below the age of fourteen, at the age of fourteen, and above respectively (Kowalski, Crocker, & Faulkner, 1997).

2.4.5. Anthropometric measurements

Weight, height, and waist circumference (WC) were measured for each student in duplicate using standardized techniques (WHO). Height was assessed in a standing position without shoes to the nearest 0.1 cm using a stadiometer. Feet were put together with buttocks, heels, scapulae, and back of the head against the vertical board of the stadiometer during maximal expiration. Participants were weighed with light indoor clothing using an electronic digital calibrated scale to the nearest 0.1 kg. WC was measured in a standing position with non-stretchable flexible tape to the nearest 0.1 cm. Body mass index (BMI) was calculated using the following formula: weight (kg)/ height (m^2).

The level of obesity was then estimated based on the Center for Disease Control and Prevention age-and gender-specific growth charts. A value greater than the 85th percentile reflects overweight or obesity (Department of Health and Human Services). Central adiposity was defined according to WHtR waist-to-height ratio. A value of 0.5 or greater was used to detect children with elevated WHtR (McCarthy & Ashwell, 2006).

2.5. Statistical Analysis

The collected data were analyzed using descriptive statistics for calculating the means and standard deviations of continuous variables and the frequencies and percentages of categorical variables. ANOVA test for the comparison of three means and chi square test were used to significantly identify the factors associated with adherence to Mediterranean diet among Lebanese adolescents. Multiple linear regression analysis using a stepwise technique was applied to identify the factors associated with adherence to the Mediterranean diet among Lebanese adolescents in a multivariate approach, where variables included in the equation were presented with their corresponding coefficients and p-values. Data were analyzed by using the Statistical Package for the Social Sciences (SPSS/PC version 22.0) software. All tests were two tailed, and a p-value <0.05 was considered statistically significant.

3. RESULTS

Table 1 represents the characteristics of the participants. The sample consisted of 298 students (56.4% boys and 43.6% girls). The average age of the participants was 14.55 (±2.13) years old. Students were randomly distributed between complementary (55.4%) and secondary classes (44.6%). The educational levels of both parents were high among this sample. Only 13.4% of adolescents showed optimal adherence to the MD suggesting that an improvement is needed in the diet quality of Lebanese adolescents. The results of this study showed that the overall prevalence rate of generalized overweight/obesity (according to BMI-for-age) was 36.9%, and those of central obesity (evaluated by WHtR) was 35.9%. Moreover, Lebanese students had a higher tendency of skipping meals (79.2%) and consuming few meals with their families.

Table 2 represents the factors associated with adherence to the MD among Lebanese adolescents. Adherence to the MD was good in 13.4%, average in 57%, and poor in 29.6% of the sample. Younger participants tend to report a higher MD score. Additionally, an optimal diet quality was positively associated with consuming more meals with the family (p=0.001) and being more physically active according to the PAQ score (p=0.005). Similarly, students who enjoyed a better quality of life according to the KIDSCREEN total score and its subscales (physical, psychological well-being, and school environment) scored significantly higher on the KIDMED. In contrast, skipping meals more frequently was significantly correlated with a lower KIDMED score (p<0.001).

When all significant determinants were taken into account, the variables that remained positively associated with a higher KIDMED score were consuming more meals with the family (p<0.001) and engaging in a higher level of physical activity (p=0.005), while skipping meals tends to be negatively correlated with KIDMED score (p=0.004) (Table 3).

Table 1: Characteristics of the adolescents by sociodemographic, adherence to MD, HRQoL, physical activity, and anthropometric measurements (n=298)

	Total (n=298)
Age	14.55 ± 2.13
Gender	
Male	168 (56.4%)
Female	130 (43.6%)
Grade	
Complementary	165 (55.4%)
Secondary	133 (44.6%)
Father's education level	
Primary/Complementary	131 (43.9%)
Secondary/University	167 (56.1%)
Mother's education level	
Primary/Complementary	99 (33.2%)
Secondary/University	199 (66.8%)
Weight	59.79 (± 16.07)
Height	161.66 (± 11.26)
PAQ total score	
	2.49 (± 0.79)
KIDMED score	
Low (≤ 3)	88 (29.5%)
Medium (4 -7)	170 (57.0%)
High (≥ 8)	40 (13.4%)
KIDSCREEN-27	
KIDSCREEN-27 total score	45.51 (± 5.84)
Physical wellbeing	44.98 (± 8.15)
Psychological wellbeing	37.45 (± 4.40)
Parents & autonomy	48.24 (± 9.02)
Social support & peers	48.38 (± 11.96)
School environment	48.52 (± 11.34)
BMI-for-age	
Underweight($<5^{th}$ percentile)	14 (4.7%)
Normal weight (5th- 84th percentile)	174 (58.4%)
Overweight(85th-94th percentile)	61 (20.5%)
Obese ($\geq 95^{th}$ percentile)	49 (16.4%)
Waist circumference (cm)	
Mean (SD)	77.65 (± 12.47)
Waist to height ratio (WHtR)	
Normal	191 (64.1%)
High	107 (35.9%)
Skipping meals	
Never	62 (20.8%)
Sometimes	213 (71.5%)
Always	23 (7.7%)
Number of meals (day)	
Mean (SD)	3.15 (± 1.00)
Number of meals with family(day)	
Mean (SD)	2.05 (± 0.86)

PAQ, Physical Activity Questionnaire; BMI, Body Mass Index.

Table 2: Factors associated with adherence to Mediterranean diet among Lebanese adolescents (n=298) (bivariate analysis)

	KIDMED Score Low ≤ 3		KIDMED score Medium 4 – 7		KIDMED score High ≥ 8		P-value
n (%)	88	29.60%	170	57.00%	40	13.40%	
Age							
Mean (SD)	15.22	2.04	14.37	2.13	13.88	2.00	0.001
Gender							
Male	45	26.80%	102	60.70%	21	12.50%	0.344
Female	43	33.10%	68	52.30%	19	14.60%	
Number of meals (day)							
Mean (SD)	3.02	0.99	3.16	0.98	3.38	1.08	0.176
Number of meals with family(day)							
Mean (SD)	1.80	0.83	2.11	0.85	2.38	0.84	0.001
Grade							
Complementary	43	26.10%	96	58.20%	26	15.80%	0.213
Secondary	45	33.80%	74	55.60%	14	10.50%	
Father's education level							
Primary/Complementary	33	25.50	78	59.20	20	15.30	0.051
Secondary/University	57	34.30	86	51.20	24	14.50	
Mother's education level							
Primary/Complementary	33	33.0	55	55.35	11	11.65	0.123
Secondary/University	60	29.82	114	57.53	25	12.65	
PAQ total score							
Mean (SD)	2.27	0.73	2.56	0.78	2.68	0.84	0.005
KIDSCREEN-27							
KIDSCREEN-27 total score	43.92	5.95	46.06	5.60	46.70	6.01	0.007
Physical wellbeing	43.25	8.20	45.30	7.89	47.39	8.53	0.021
Psychological wellbeing	36.48	4.87	37.98	3.96	37.38	4.81	0.034
Parents & autonomy	46.49	9.33	48.77	8.93	49.84	8.35	0.076
Social support & peers	47.41	12.26	48.77	12.29	48.85	9.75	0.664
School environment	45.94	11.65	49.50	10.74	50.02	12.47	0.038
BMI-for-age							
Underweight (<5th percentile)	2	14.30%	9	64.30%	3	21.40%	0.355
Normal weight (5th-84th percentile)	45	26.00%	105	60.70%	23	13.30%	
Overweight (85th-94th percentile)	22	36.10%	33	54.10%	6	9.80%	
Obese (≥95th percentile)	18	36.70%	23	46.90%	8	16.30%	
Waist circumference (cm)							
Mean (SD)	79.77	11.48	76.79	13.02	76.64	11.85	0.163
Waist to height ratio (WHtR)							
Normal (<0.5)	50	26.20%	115	60.20%	26	13.60%	0.226
High (≥0.5)	38	35.50%	55	51.40%	14	13.10%	
Skipping meals							
Never	10	16.10%	34	54.80%	18	29.00%	<0.0001
Sometimes	65	30.50%	127	59.60%	21	9.90%	
Always	13	56.52%	9	39.13%	1	4.35%	

Table 3: Factors associated with KIDMED score as dependent variable using stepwise multiple regression (n=298)

	Coefficients	t	P-value	F (ANNOVA)	P-value	R²
(Constant)	3.646	4.173	.000			
Number of meals with family	.713	4.030	.000	14.512	<0.001	0.129
Skipping meals	-.852	-2.913	.004			
PAQ total	.536	2.857	.005			
Excluded variables						
Age		-1.350	0.178			
KIDSCREEN total score		1.711	0.088			
KIDSCREEN (physical wellbeing)		1.409	0.160			
KIDSCREEN (psychological wellbeing)		1.088	0.278			
KIDSCREEN (school environment)		1.602	0.110			

4. DISCUSSION

Studies examining adherence to the MD among young people are scarce. The current study reported nutritional data from 298 adolescents attending public schools in Tripoli, the capital of North Lebanon governorate, and evaluated the factors associated with their adherence to the MD. The level of adherence to the MD was generally low. Indeed, only 13.4% of the adolescents reported having good adherence to the traditional dietary pattern. According to multivariate logistic regression analysis, poor adherence to the MD was significantly associated with skipping meals and consuming fewer meals with the family, while engaging in a high level of physical activity was correlated with a better adherence to the MD.

This study revealed the influence of family on Lebanese adolescents' adoption of the Mediterranean dietary pattern. The results of this study agree with other cross-sectional studies. European students residing with their parents consumed more fruits and vegetables compared to those residing outside their family home (El Ansari, Stock, & Mikolajczyk, 2012). When leaving their family home, young Greeks encountered difficulties in maintaining a conventional Mediterranean diet. This has been translated in a decrease in the consumption of fresh fruits, vegetables, oily fish, seafood, pulses, and olive oil while increasing the intake of sugar, alcohol, and fast food (Kremmyda, Papadaki, Hondros, Kapsokefalou, & Scott, 2008; Papadaki, Hondros, Scott, & Kapsokefalou, 2007).

In the present study, skipping meals was associated with poor adherence to the MD. In a prospective study, meal frequency among a group of children was positively associated with a better adherence to the MD (Bawaked et al., 2018). Similar findings were reported among Lebanese adolescents in Mount Lebanon and Beirut, where skipping breakfast in particular was correlated with poor adherence to the Mediterranean diet (Mounayar et al, 2019). Skipping meals is associated with excessive snacking mostly from unhealthy food choices and energy dense foods rather than nutrient dense foods which characterize the MD.

Another finding of this study was PA which was strongly correlated with the adherence to MD. Among Spanish adolescents, engagement in physical activities or, on the contrary, spending more than 4 hours daily on media screen time was the most important predictor of adherence to the MD (Bibiloni Mdel, E et al., 2012). Watching television or playing video games is a sedentary behavior. Sedentary behavior has been correlated with food choice, for example cereals, fruits and vegetables are elements of the diet of active adults and children (Bellisle F, 1999). Children who follow a healthy diet and lifestyle are generally those who might also maintain high levels of physical

activity. Similarly, among Greek and Italian adolescents, low adherence to the MD was associated with low physical activity level (Papadaki, & Mavrikaki, 2015; F. Santomauro et al., 2014).

Understanding the dietary habits of adolescents is crucial in order to plan educational intervention programs designed to improve their eating behaviors and hence their health. Nutritional interventional programs among children aiming to improve their adherence to the Mediterranean diet have been successful in increasing their intake of fruits, vegetables, yogurt and/or cheese, while decreasing skipping breakfast, consumption of bakery products for breakfast, and sweets several times a day (Bibiloni et al., 2017).

5. CONCLUSION

The results of the study will provide guidance in order to plan population-based nutrition intervention programs targeting adolescents. These programs will have long-lasting beneficial effects in adult life. Several studies suggested the potential role of schools in behavior change among adolescents encouraging them in adopting healthier lifestyles and eating habits while preventing obesity (Gortmaker et al., 1999; Li, Yang, Lowry, & Wechsler, 2003). Therefore, educational programs conducted at schools should focus on improving food quality with special emphasis on fat or calorie dense foods. In addition, parents can be targeted by these programs convincing them to make healthier choices when buying and preparing food at home.

The findings of the present study should be seen in light of their strengths and limitations. One of the strengths of this study is that data collection was carried out through interviews which could reduce the bias of self-reported data. On the other hand, one of the limitations is the cross-sectional design which prevents the investigation of causal relationships. Therefore, cohort studies should be carried out to further assess the association between those components in regard to adherence to the MD. At the same time, since private schools were excluded, the results of this study cannot be generalized. The majority of Lebanese private schools include students from medium to high-socioeconomic status who may enjoy a better diet quality compared to students in public schools. Therefore, a follow-up study should be conducted in private schools.

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