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Original article

Mothers and Children Adherence to the Mediterranean Diet: Evidence from a Mediterranean Country

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Abstract. The aim of the study was to determine the effect of adherence to the Mediterranean diet of mothers on children's adherence levels. The study was conducted with 140 mothers and preschool children in North Cyprus, which is a Mediterranean country. Adherence of mother's to the Mediterranean diet was measured by Mediterranean Diet Adherence Screener (MEDAS) and children's adherence was determined by Mediterranean Diet Quality Index (KIDMED). In addition, diet diversity levels of children were evaluated with the Diet Diversity Score (DDS) scale. In mothers; 47.1% were found to have high, 37.2% moderate and 15.7% had low adherence to the Mediterranean diet. 78.6% of children showed high adherence to the Mediterranean diet. 10% of children had a high, 81.4% had moderate and 7.7% had low diet diversity. In addition, it was stated that as adherence to the Mediterranean diet of children increased, diet diversity also significantly increased ($p<0.05$). 80% of mothers, who were at least university graduates, had children with higher adherence and diet diversity. Moreover, the results showed that, as the adherence of mothers to the Mediterranean diet increases, adherence to the Mediterranean diet and diet diversity scores of children significantly increased ($p <0.05$). Since the Mediterranean diet is a dietary model in which diet diversity is easily achieved and recommended, it is an effective dietary approach that supports growth and development in childhood, and in the prevention of noncommunicable chronic diseases in adulthood period.

Key words: Mediterranean diet, KIDMED, MEDAS, preschool age

Introduction

According to United Nations International Children's Emergency Fund (UNICEF), every person is accepted as a child until the age of eighteen (1). The first two years of life is defined as 'infancy' whereas, children aged between 2-6 years are 'pre-schoolers', 6-11 years are called 'school-aged' and 11-18 year-olds are regarded as 'adolescents' (2). Pre-school term is an important life period where developmental experiences and skills are acquired. During this term; nutrition has significant effects on health such as growth, development and prevention of adulthood diseases (3,4). Nutritional habits are gained in early stages in life, such as pre-school age, and usually, these habits continue throughout life (5). Nutritional habits of parents, especially mothers can affect the children's food choices. So, evaluation and correction of any poor nutritional habits of parents have an important effect on overall child's nutritional status and health (6).

The Mediterranean diet was first described by Ancel Keys in 1960 and defined as a diet with low saturated fat and high vegetable content which is observed in Greece and Southern Italy (7). It is a tra-

ditional dietary model rich in nutrients, containing vitamins, minerals, dietary fibre, mono- and polyunsaturated fatty acids and phenolic compounds which are also characterized by high fruits and vegetables, whole grains, nuts, olive oil and fish consumption. Energy and nutrient deficiency is quite rare in children who adhere to the Mediterranean diet. Food diversity which is an important component of the Mediterranean diet also has significant effects on health (8). Adherence to this dietary model supports healthy growth and development and prevents diseases in childhood (9).

The aim of the study was to evaluate the effects of mother's adherence to the Mediterranean diet on child's Mediterranean diet adherence score and effects of food diversity.

Materials and Methods

Place and time of the study and sample selection

This study was designed as a cross-sectional study and conducted between September 2018 to January 2019 at Atmosfer Kindergarten. Atmosfer Kindergarten was established in 2011 and an institution approved as a part of Ministry of National Education. Atmosfer Kindergarten was assigned by Ministry of National Education as a response to approval of granted permission of the study (Official letter reference number: 15479/18). All children who were educated at Atmosfer Kindergarten were included in the study. In total, 100 pre-school children and their mothers were participated in the study. Participation was completely voluntary, and overall, 30 mothers and their children were refused to participate. Therefore, 70 mothers and 70 children, in total 140 participants were included in the study.

Data collection

The study was approved by Near East University Health Sciences Ethics Committee (NEU/2018/61-648) and all participants were asked to sign an informed consent form in line with the Declaration of Helsinki. General background information about mothers was collected with a face to face interview with a questionnaire which was edited by researchers. Adherence to the Mediterranean diet was evaluated by 'Mediterranean Diet Adherence Screener (MEDAS)' for mothers and 'Mediterranean Diet Quality Index (KIDMED)' for children. 'Diet Diversity Score (DDS)' was used to determine children's food diversity.

Mediterranean diet adherence screener (MEDAS)

MEDAS was developed by Martinez-Gonzalez et al according to Mediterranean diet principles. There are 14 items in this scale and 12 of them are related with components of Traditional Mediterranean diet and two are related to the Mediterranean type nutrition model. Each item is accepted as one point (10,11). The total score of MEDAS is 14 points and scores ≤6 means 'low', between 7-8 is 'moderate' and ≥9 refers to 'high' adherence to the Mediterranean diet (12). MEDAS was validated in Turkish language by Pehlivanoglu et al. (13).

Mediterranean diet quality index (KIDMED)

KIDMED was developed by Serra-Majem et al to evaluate children's adherence to the Mediterranean diet. KIDMED was previously used by Turkish speaking populations (14,15). There are 12 positive, 4 negative and total 16 questions in this scale. Each 'yes' answer in positive questions gives +1 point and participants get -1 point from negative questions. Total score of KIDMED is 12 points and a score of ≤3 means 'very low', between 4-7 'moderate' and ≥8 refers to 'high' adherence to the Mediterranean diet (16).

Diet diversity score (DDS)

DDS was developed to determine the quality of diet according to minimum 24-h dietary recall. In this study, DDS was designed to include nine subgroups. Consumption of ≥8 groups once in a day provides '10 points', consumption between 5-7 groups provides '5 points' and consumption of ≤4 groups provide '0 points'. 10 points means 'high', 5 points means 'moderate' and 0 point means 'low' quality of diet diversity (17,18).

Statistical analysis

Statistical Package for Social Sciences (SPSS, Version 18.5) program was used to analyze the results of the study. Descriptive Statistics was used to determine the distribution of qualitative data, whereas arithmetic mean, minimum, median and maximum values of quantitative data. Independent Sample t Test, Kruskal Wallis Test - Post Hoc Bonferroni Test and Spearman's Correlation Coefficient tests were used to evaluate quantitative data according to the groups. Kolmogorov Smirnov Z Test was used to evaluate qualitative data by groups. Qualitative data obtained are stated as frequency and percentage (%). Statistical significance of the data was shown by 'p' value. P value <0.05 was regarded as statistically significant value throughout the study.

Results

The study was conducted with 70 preschool children and their mothers, in a total of 140 participants. The mean age of mothers was 33.98±4.91 years. According to our results; 51.4% of mothers were university graduates. This was followed by 28.6% of mothers having master or PhD degrees, 18.6% high school and 1.4% secondary school graduates (Table 1). In total 87.1% of mothers were married (Table 1). The average MEDAS scores of mothers were 8.17±1.72 (Table 1). According to MEDAS; 47.1% of mothers had high, 37.2% had moderate and 15.7% had low adherence to the Mediterranean diet (Table 1).

The mean age of children who were participated in the study was 3.21±0.94 years old. In addition, 55.7% of children participants were boys and 44.3% were girls. Children's mean KIDMED score was 9.05±2.02 and DDS was 5.07±2.16. When the children's mean KIDMED score and DDS were compared in terms of gender; male participants had higher scores than females although the difference was not statistically significant (p>0.05). A significant number of children (78.6%) had high adherence to the Mediterranean diet and 81.4% of them had moderate diet diversity. There was no significant difference between gender and adherence to the Mediterranean diet and diet diversity level. Children (n: 55) who had high adherence to the Mediterranean diet had higher DDS values but the difference was not statistically significant (n: 15, p>0.05) (Table 2).

Children's mean KIDMED scores were affected by mother's adherence to the Mediterranean diet. Children; whose mothers with high adherence to the Mediterranean diet had non-significant higher KIDMED scores (p>0.05). In addition, mother's adherence to the Mediterranean diet reflected on children's DDS, children of mothers with high and moderate adherence to the Mediterranean diet had significantly higher scores of DDS than the ones with low adherence (p<0.05) (Table 3).

There was a significant positive low correlation between mother's MEDAS scores and children's KIDMED scores and positive medium correlation with DDS values (p<0.05, Table 4). According to correlation results, as mother's MEDAS scores increases, children's KIDMED scores and DDS values also increases (p<0.05, Table 4).

Discussion

The study was conducted in the northern part of the island of Cyprus which is a country with a coast to the Mediterranean Sea. The average MEDAS scores of the mothers participated in the study were found to be 8.17 ± 1.72 (Table 1). In a similar study by Pontes et al. (2015), the average MEDAS scores of 81 women were found to be 6.30±0.18 who were living in Spain which is a Mediterranean country like Cyprus (19). In another study conducted with 309 women participants in Iran, the average MEDAS score was found to be 5.53 ± 0.09 (20). The scores were lower when compared with the current study. This might be due to geographical differences between these two countries as Iran is not a Mediterranean country whereas Cyprus is. Another study carried out in Spain, by Jurado et al. (2012) showed similar trends with the current study, finding mean MEDAS scores of women as 8.3±1.8 (21). The current scientific literature shows that individuals living in Mediterranean countries show more

Table 1. Mother's general background information and MEDAS scores (n: 70)

Mother's background information				
	Mean ± Standart deviation	**Median**	**Minimum**	**Maximum**
Age (year)	33.98±4.91	33.00	24.00	55.00
	Education level	**n**		**%**
	Secondary school	1		1.4
	High school	13		18.6
	University	36		51.4
	Master or PhD	20		28.6
	Total	**70**		**100.0**
	Marital status	**n**		**%**
	Married	61		87.1
	Divorced	9		12.9
	Total	**70**		**100.0**
MEDAS				
	Mean ± Standart deviation	**Median**	**Minimum**	**Maximum**
Score	8.17±1,72	8.00	3.00	12.00
	Status of adaptation	**n**		**%**
	High	33		47.1
	Modearate	26		37.2
	Low	11		15.7
	Total	**70**		**100.0**

Table 2. Children's background information, mean KIDMED scores and DDS values (n: 70)

Children's background information					
	Mean ± Standart deviation	**Median**	**Minimum**	**Maximum**	
Age (year)	3.21±0.94	3.00	2.00	6.00	
	Gender		**n**	**%**	
	Male		39	55.7	
	Female		31	44.3	
	Total		**70**	**100.0**	
Mean KIDMED score					
Gender	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[1]**
Male	9.20±1.77	9.00	6.00	13.00	
Female	8.87±2.31	9.00	2.00	12.00	0.497
Total	9.05±2.02	9.00	2.00	13.00	

(continued)

Table 2. (continued)

Mean DDS					
Gender	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[2]**
Male	5.12±2.14	5.00	0.00	10.00	
Female	5.00±2.23	5.00	0.00	10.00	0.808
Total	5.07±2.16	5.00	0.00	10.00	

Children's adherence to the Mediterranean diet							
	High		**Moderate**		**Poor**		***p*[3]**
Gender	**n**	**%**	**n**	**%**	**n**	**%**	
Male	31	79.5	8	20.5	0	0.0	0.134
Female	24	77.4	6	19.4	1	3.2	
Total	55	78.6	14	20.0	1	1.4	

Children's diet diversity level							
	High		**Moderate**		**Very Low**		***p*[4]**
Gender	**n**	**%**	**n**	**%**	**n**	**%**	
Male	4	10.2	32	82.1	3	7.7	0.08
Female	3	9.7	25	80.6	3	9.7	
Total	7	10.0	57	81.4	6	8.6	

Comparison between the Mediterranean diet adherence and DDS					
Adherence classification	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[5]**
High (n: 55)	5.27±2.24	5.00	0.00	10.00	0.138
Moderate and poor (n: 15)	4.33±1.75	5.00	0.00	5.00	

Data is expressed as means ± SD, p^{1-2-5}: Independent samples t test, p^{3-4}: Kolmogorov Smirnov z test

adherence to the Mediterranean diet model and get higher scores from MEDAS scale (22). The people who live in Mediterranean countries have common nutritional habits such as; high consumption of vegetables, legumes, whole grains, fruits, seeds and nuts, low consumption of meat and dairy products and moderate consumption of red wine. Main source of fat is olive oil. So patterns of the Mediterranean diet are fairly heterogeneous among the Mediterranean countries (23).

According to the KIDMED index, our results showed that 78.6% of children show high adherence to the Mediterranean diet, while 20% and 1.4% of children KIDMED score's outcome found to be moderate and low adherence respectively (Table 2). In a meta-analysis study in which 18 studies were examined, the results showed that only 10% of children showed high adherence while 69% had moderate and 21% had low adherence to the Mediterranean diet (24).

The researchers also reported that participants living in Mediterranean countries had higher adherence to the Mediterranean diet than people living outside of the Mediterranean region (24). A study in North Cyprus by Kabaran and Gezer (2013) evaluated the adherence of 9-18-year-old children to the Mediterranean diet, found out that 22.7% of participants had high Mediterranean diet adherence, followed by moderate 59%, and low adherence with 18.3% (14). According to another study, the children living in Turkey KIDMED scores showed that 39.9% of children had high, 55.7% had moderate and 24.7% low scores and adherence to the Mediterranean diet (15). Therefore, it can be assumed that participants who are living in Mediterranean countries such as Turkey, Cyprus etc. show more adherence to the Mediterranean diet

Table 3. Effects of mother's education level and MEDAS values on children's KIDMED scores and DDS

Effects of mother's education level on Children's KIDMED scores					
Education level	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[1]**
High and secondary school (n: 14)	8.57±1.50	9.00	6.00	11.00	
University (n: 36)	9.02±2.29	9.00	2.00	12.00	0.381
Master or doctorate (n: 20)	9.45±1.82	9.00	6.00	13.00	
Effects of mother's education level on children's DDS					
Education level	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[2]**
High and secondary school (n: 14)	4.64±1.33	5.00	0.00	5.00	
University (n: 36)	5.13±2.53	5.00	0.00	10.00	0.695
Master or doctorate (n: 20)	5.25±1.97	5.00	0.00	10.00	
Effects of mother's MEDAS values on children's KIDMED scores					
Adherence classification	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[3]**
High (n: 33)	9.36±1.79	10.00	5.00	12.00	
Moderate (n: 26)	9.11±2.04	9.00	6.00	13.00	0.253
Low (n: 11)	8.00±2.44	9.00	2.00	11.00	
Effects of mother's MEDAS values on children's DDS					
Adherence classification	**Mean ± Standart deviation**	**Median**	**Minimum**	**Maximum**	***p*[4]**
High (n: 33)	5.75±2.20	5.00	0.00	10.00	
Moderate (n: 26)	5.00±1.41	5.00	0.00	10.00	**0.03***
Low (n: 11)	3.18±2.52	5.00	0.00	5.00	

Data is expressed as means ± SD p[1-2-3]: Kruskal Wallis test p[4]: Kruskal Wallis test, Post Hoc Bonferroni Test

**Group comparisons High-Moderate p: 0.126, High-Low p: 0.004, Moderate-Low p: 0.009*

Table 4. The correlation of mother's MEDAS scores with children's KIDMED scores and DDS values (n: 70)

		Mother's MEDAS scores*
Children's KIDMED scores	**r**	0.243
	p	**0.042***
Children's DDS	**r**	0.403
	p	**0.001***

p: Spearman's Correlation Coefficient

(22,25). In another study which was conducted with children living in Southern Spain, showed that 48.6% of children had high, 49.5% had moderate and 1.6% had low adherence to the Mediterranean diet and female participants Mediterranean diet scores were significantly higher when compared to male participants (26). In contrast, it had been observed that male participants had non-significant but overall higher

KIDMED scores than females in the current study (Table 2). Preschool age is a period in which boys mostly adopt their mothers as role models (3). The results of the current study stated that nearly all mothers (84.3%) had a minimum of either high or moderate adherence to the Mediterranean diet (Table 1).

In the current study, the education level of mothers was a factor affecting adherence to the Mediterranean diet. Similar results had been observed in another study. It had been found out that the level of education found to influence the MEDAS score, likewise our study, the difference was also non-significant (20). Nutrition knowledge is affected by the education level. Mothers who have higher education levels tend to be able to search more robust, evidence based information and comply with the health professionals suggestions better than mothers with low education levels. Robust and evidence based nutrition knowledge can enhance healthy dietary habits and choices (27,28).

In this study, the adherence of married mothers to the Mediterranean diet was found to be non-significantly higher ($p > 0.05$). Jurado et al. (2012) reported a similar result showing that there was a significant relationship between the marital status and the Mediterranean diet, and married women had higher adherence to the Mediterranean diet (21). Married mothers usually spend more time engaging in culinary activities as mothers are generally responsible for the family's overall well-being in the Mediterranean region. Married mothers are also managing the family's grocery shopping, while choosing more diverse food (29,30). In addition, our results also showed that married mothers had higher education levels which were found to be correlated with higher MEDAS (Table 1).

In this current study, in which the diet diversity level of children was evaluated by using the DDS-9 scale, it was found that 10 % of children had high, 81.4% had moderate and 8.6% had low level diet diversity. The average DDS-9 score was found as 5.07 ± 2.16 and there was no statistically significant relationship between gender and DDS-9 score (Table 2). In a study with a similar design, the average DDS-9 score of 1-8-year-old children living in South Africa was found to be 3.6±1.4 (31). Another study had found that the average DDS-9 scores of children aged 3-12 were 6.3 ± 1.5 in China (32). A study which used DDS-12 score as study design criteria found out that only 1.3% of children participated to the study had high diet diversity with mean DDS-12 scores of children being 6.04±4.18 conducted in Nigeria (33). Diet diversity is associated with food intake and shows nutrition quality (34). It is also expected that the socioeconomic status of parents who are residents in developed countries to be higher, and this directly have a positive effect on the nutritional status of children (35).

Current study results showed that as DSS-9 scores increase, which is an important marker of dietary diversity, adherence to the Mediterranean diet increases (Table 2). The Mediterranean diet is a dietary model which favours food diversity achievement by recommendation of different foods from diverse food groups and optimal food consumption frequency (8).

Meanwhile, it was observed that the children of the mothers who had a high Mediterranean diet adherence had an effect on KIDMED and DDS scores, resulting in an overall increase (Table 3 and 4).

It is thought that the nutritional habits of parents, especially the mothers, are adopted as role models for the children and the nutritional preferences of the mothers are reflected in the preferences of the child. In addition, children are expectedly commonly exposed to mothers meals so they are adapted and familiar with mothers food choices (6). Therefore, it is expected that higher MEDAS which favours food diversity would also increase DDS of children (Table 4).

In addition, in this study, as the education levels of mothers increased, the average KIDMED and DDS of children increased although, the change was non-significant (Table 3). Al-Shookri et al. (2011) similarly, in a study conducted with 154 participants, found that as the education level of the mothers increased, the quality of the diet of the children also increased (36). Likewise, similar studies had concluded that mother's education levels affected the children's nutritional status, and as the education level increased the children's obtained nutritional values were closer to the reference nutritional values (37,38). It had been showed that parent's education level, occupation, socioeconomic income and marital status might have an effect on child's nutrition and overall health (39).

Potocka and Jacukowicz (2017) with a similar study design found out that the demographic back-

ground information (age, education level etc.) and dietary habits of the mothers had a significant effect on the dietary habits and behaviors of preschool children (40). It had been shown that mothers nutritional habits, even prior to birth, have effects on child's dietary habits due to their adaptation of mother as a role model and adaptation of the foods consumed through placenta in intrauterine life during pregnancy period (6,41).

The current study, to the best of our knowledge, was the first study to evaluate adherence to the Mediterranean diet of both mothers and children at the same time and once again a solid proof that parent's dietary habits affect on children's choice as well. In addition, effects of the Mediterranean diet on diet diversity level were presented in our study. The limitation of our study was the age group of participants, preschoolers, which the data was collected. The children participants mean age was 3.21±0.94. This caused a tremendous amount of effort to get the required information. In addition, majority of the data of children participants were collected with the help of their mothers. This could cause possible alteration of the information that would otherwise be given by the children due to declaration of the data by mothers rather than children.

Conclusion

This study aimed to determine the effects of the mother's nutritional habits and general information on preschooler's nutritional habits in North Cyprus. Mother's education level had shown to have positive effects on overall children's nutrition habits and nutritional status. In addition, the mother's high adherence to the Mediterranean diet caused a significant increase in the children's adherence to the Mediterranean diet and diet diversity. The study showed the importance of parent, especially the mother's dietary habits, having significant effects on children's food consumption patterns. Therefore, the importance of adherence to the healthy Mediterranean diet should be emphasized to the parents via education programs organized by health professionals. Adherence to the Mediterranean diet from an early age might also decrease the risk of developing chronic diseases throughout the adult life. In conclusion, the Mediterranean diet should be promoted through education of primarily parents and then children through parenthood to minimize the development of chronic diseases and increase health benefits.

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Declaration of Interest Statement

The authors declare no conflicts of interest in connection with this article.

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