Level of adherence to the Mediterranean diet among children from Cyprus: the CYKIDS study

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Abstract

Background: The Mediterranean diet (MD) prototype is widely used as an educational tool in public health programmes; few studies, however, have been conducted on the adherence of children to this diet.
Objective: To evaluate the quality of Cypriot children's diet by assessing the degree of adherence to the MD.
Methods: A national cross-sectional study among 1140 children (mean age = 10·7 (SD 0·98) years), using stratified multistage sampling design, was conducted in primary schools of Cyprus. Dietary assessment was based on a 154-item semi-quantitative FFQ and the two supplementary questionnaires (a Food Groups Frequency Questionnaire and a Short Eating Habits Questionnaire). Adherence to the MD was assessed by the KIDMED index. The association between the frequencies of consumption of various food groups and the level of adherence to the MD (poor *v.* average *v.* good KIDMED score) was also evaluated. Multiple logistic regression analyses were used to adjust for potential confounders.
Results: Only 6·7 % of the sample was classified as high adherers of MD, whereas 37 % had a poor KIDMED score. Multiple logistic regression analysis has shown that children with at least an average KIDMED score were more likely to eat frequently seafood and fish, legumes, nuts, bread, fruits, leafy vegetables, olives, low glycaemic index foods and unrefined foods. Effect size of associations was from medium to high.
Conclusion: Higher adherence to MD is associated with better diet quality in children. The MD prototype may thus represent a useful educational tool for promotion of healthy eating habits in children.

The Mediterranean diet (MD) is regarded as a prototype model for healthy eating and has generally been associated with longevity. A growing body of scientific evidence suggests that the MD is protective against several morbid conditions including CVD, diabetes mellitus, arthritis and cancer[1–7]. In particular, adherence to the traditional MD has been associated with lower overall mortality as well as with lower CVD mortality[1,4]. Although studies on children are limited and the vast majority of scientific publications refer to adults, emerging evidence from studies on children suggests that the MD may be a health-promoting factor for children, as well.

A study conducted in Spain among 3166 youngsters aged 6–24 years has shown that the MD is a nutritionally rich diet for children[8]. Degree of adherence to the MD was assessed by a tool developed by the researchers for this purpose, the KIDMED index, and was positively related to better nutrient intake. Moreover, two recently published studies concluded that the MD has a beneficial effect on asthma and allergy[9,10]. In the first study[9], the diet of 690 children in rural Crete, aged 7–18 years, was assessed by a slightly modified version of the KIDMED index. The investigators compared the scores derived via the KIDMED index with those derived via another tool that has been developed for adults, the MD Score introduced by Trichopoulou *et al.*[4] (which was modified to exclude alcohol presumed protective, rather than detrimental, effect of dairy products), and found that both scores gave similar results[9]. In the second study, conducted in Spain among 20 106 children aged 6–7 years, MD was assessed by a modified version of the MD Score mentioned above[10].

Two previous small Italian studies[11,12] have reported that adherence to the principles of the MD, as defined by Italian experts, leads to favourable lipid profiles in children on the one hand[11], and that deviation from the MD is associated with unfavourable lipid profiles, on the other[12].

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The MD prototype is used as an educational tool in Mediterranean as well as in some non-Mediterranean countries in order to promote healthy eating habits among children. Despite the widespread use of the MD prototype in public health programmes in Cyprus, to the best of our knowledge, there are no data assessing the dietary habits and adherence to the MD among Cypriots, including children.

The objective of our study was to evaluate the quality of Cypriot children's diet by assessing the degree of adherence to the MD and to examine how the intake of various food groups varies with different levels of adherence to the MD.

Subjects and methods

Study population

A total of 1589 children of the 4th, 5th and 6th grade (9–13-years-old, mean age = 10·7 (SD 0·98) years) in twenty-four randomly selected primary schools in Cyprus were identified as eligible participants, while 1140 agreed to participate (72% participation rate, 532 boys and 637 girls), representing 3·7% of the total population of school-age children (participation ranged from 2·6% in the urban area of Nicosia to 7·8% in the rural area of Paphos). Sampling was stratified multistage design and was based on the number of students in each of the five provinces of the island (data are not published, printed data available on request from the Department of Primary Education) and by place of residence (place of school was used as a proxy), urban or rural, as provided by the Cyprus Statistical Service[13].

In the first step, at least four schools were selected from each of the four provinces and two from the fifth as most of it is not inhabited by the population due to occupation. At least two of the selected schools in each province were based in an urban area. Schools in urban areas were selected so that they included at least one school in the upper quarter of socio-economic status (SES) and at least one school in the lower quarter, because SES is one of the most powerful confounding factors to which many of the differences between urban and rural areas are attributed[14]. Schools in rural areas were selected according to the geomorphologic classification, countryside/mountainous area, to control for the confounding factor of geomorphologic characteristic, which might interact with the rural environment[15]. Schools in rural areas could not be divided by SES, as in most rural areas in Cyprus there is only one school. The criterion of geomorphologic characteristic, on the other hand, could not be used in urban areas, as in Cyprus all urban areas are located, more or less, on the sea level.

At the last stage of sampling, whole school classes were selected. Whenever the school was small (up to two classes from each grade), all children from target grades were contacted, whereas in larger schools classes were

selected based on availability and cooperation. The study was approved by the Ministry of Education and Culture (Department of Primary Education). Informed consent forms were signed by the corresponding parent or guardian of each participating child.

Dietary assessment

Dietary assessment was based on a semi-quantitative FFQ, consisting of 154 food items including all of the commonly used foods of the local Greek-Cypriot cuisine. Two supplementary sections, which evaluated other aspects of dietary habits, were attached to the FFQ: a Food Groups Frequency Questionnaire (FGFQ) and a Short Eating Habits Questionnaire (SEHQ). The first evaluates children's weekly consumption of major food groups and the second assesses information on basic dietary habits (such as breakfast intake, eating while watching TV, religious fasting practices, etc.). Questions regarding the type of fat used in cooking and frying and removal of visible fat in meat and poultry were answered by parents via a short questionnaire that was attached to the consent form.

The children's FFQ was administered to all students of each class during school hours, from February to June of 2005, by the principal investigator, according to a written protocol describing a standardized methodology for data collection. On the basis of the FFQ, all participants were asked about their usual frequency (average over the last year) of consumption of the foods, which were classified into fifteen groups (milk and dairy, eggs and products, meat and mince, delicatessen and smoked meat, fish and seafood, pasta, bread and cereals, potatoes, legumes, fresh legumes and olives, nuts, miscellaneous (mixed dishes, confectionery, pastries, ethnic food, cakes and biscuits, other snacks), drinks, fruits and vegetables).

Response categories for all food items, except items from fruits and vegetable (F&V) groups, ranged from 1/d, 2–3/d, 4–5/d, ≥6/d, 1/week, 2–4/week, 5–6/week, 1–3/month to seldom/never, whereas the scale for F&V intake consisted of eight response categories, ranging from 1/d, ≥2/d, 1–2/week, 3–4/week, 5–6/week, 1/month, 2–3/month to never. Standard size of food portions that could be easily understood by children, such as F&V, was included in the questions, whereas food models from the USA Dairy Council[16] and NASCO[17] were used for all other food groups as children's aids to visualise the regular portion. Food models were also used to help children recognize/identify unknown food items.

A total of 154 food items from the FFQ were collapsed to thirty-three defined food groups (Table 2), which may have practical importance in daily diet and daily clinical practice. In addition, the above groups may be closely approximated to food groups that have been previously reported in the literature. Some individual food items were preserved as a single group because they were suspected to represent distinct dietary patterns (olives,

fried potatoes, regular and diet soft drinks, herbal tea, poultry and hare/rabbit meat).

Assessment of Mediterranean diet patterns

The KIDMED index (Mediterranean Diet Quality Index for children and adolescents) was used to evaluate the degree of adherence to the MD. The index[18] includes sixteen components, which are based on the principles of the MD and summarise a score that ranges from 0 to 12. More specifically, the KIDMED index presumes the daily consumption of at least one serving for F&V, while consumption of at least two servings from each group is preferred. Level of recommended consumption for dairy products is at least three servings daily: one dairy product in breakfast and at least two servings of yoghurt and/or cheese during the day. Daily consumption of grains and cereals is recommended during breakfast, while pasta or rice should be consumed at least five times per week. A weekly consumption of at least two to three servings is presumed for nuts and fish, and of at least two servings for pulses. Olive oil is recommended for culinary use, but no frequency is suggested. Dietary behaviours that are viewed as detrimental and alien to the principles of the MD include the frequent intake of sweets and candies (we defined this as more than twice daily), the use of commercially baked goods and pastries in breakfast, having meals in fast-food outlets and the abstainance from breakfast.

According to KIDMED scoring, 0–3 reflects a poor diet in relation to the MD principles, whereas values 4–7 and values 8–12 correspond to average and good adherence to the principles of the MD, respectively. Our questionnaire did not include the original KIDMED questionnaire; rather, we recoded questions from the FGFQ, the SEHQ and the short questionnaire that was completed by the parents, in order to derive the response categories of the KIDMED questionnaire.

Assessment of other co-variables

Sociodemographic variables

Data on sociodemographic characteristics such as age, gender, place of residence and family size were provided by the children. Information on the parents' educational level, income and parents' occupation were collected via a short questionnaire that was completed by the parents. Socio-economic status was assigned based on the parents' educational level and occupation.

Physical activity variables

Children responded to a 32-item, semi-quantitative questionnaire, which assessed both organised and free-time physical activity. Principal component analysis (varimax rotation) was employed to extract the main factors out of twenty-one variables from this questionnaire, assessing children's frequency and duration of physical activity.

Eight factors emerged as important, explaining approximately 63% of the total variance in children's physical activity and sedentary patterns. These are 'physical activity and sports after school'; 'home chores and outside home chores, aerobics, gymnastics, sports'; 'Sports for all, after school activities (except sports)' 'video, electronic games and computers'; 'watching TV, video and DVD'; 'homework and private lessons'; 'theatre cinema, use of mobile phone'; 'afternoon sleep, less private lessons'.

Anthropometry and obesity index

Children's height and weight were reported by parents. Obesity and overweight among children were calculated using the International Obesity Task Force (IOTF) age- and sex-specific BMI cut-off criteria[19]. Parents' obesity was also calculated from self-reported values of body weight and height. Parents' overweight and obesity was assigned for BMI = 25–29·9 kg/m^2 and BMI ≥ 30 kg/m^2, respectively.

Statistical analysis

Continuous variables are presented as mean (SD), whereas categorical variables are presented as absolute and relative frequencies. Normality of variables' distribution was tested by the Kolmogorov–Smirnov test. Associations between normal distributed variables were tested ANOVA, with Bonferroni correction to account for the inflation of type-I error due to multiple comparisons made, whereas the Kruskal–Wallis test was used for non-normally distributed continuous variables. Associations between categorical variables were tested by contingency tables and the χ^2 test.

The association between the frequencies of consumption of various food groups and the level of adherence to the MD (as assessed by the KIDMED score) was tested by applying the χ^2 test. We further applied multiple logistic regression analysis evaluating the association between the levels of adherence to the MD (as assessed by the KIDMED score) with the frequencies of consumption of several food groups adjusted for potential confounders (age, gender, place of residence, children's BMI, SES level and physical activity).

All reported P values are based on two-sided tests and were based on the 0·05 as the level of statistical significance. Statistical analyses were performed using the Statistical Package for Social Sciences statistical software package version 13·0 (SPSS Inc., Chicago, IL, USA).

Results

Characteristics of the sample

Table 1 presents the characteristics of the study population for boys and girls, by level of adherence to a pattern of eating consistent with the MD, as assessed by the KIDMED score.

Table 1 Selected demographic and lifestyle characteristics of the study sample, by KIDMED score

	Boys							Girls						
	0–3		4–7		8–12		P	0–3		4–7		8–12		P
	Mean/ frequency	SD/%	Mean/ frequency	SD/%	Mean/ frequency	SD/%		Mean/ frequency	SD/%	Mean/ frequency	SD/%	Mean/ frequency	SD/%	
Age (years)	10·67	0·98	10·71	0·95	10·67	0·94	0·934	10·63	1·02	10·73	0·95	11·08	0·64	0·089
Place of residence							0·191							0·333
Urban	82	59·4	110	58·2	13	41·9		100	58·8	143	52·4	12	48·0	
Rural	56	40·6	79	41·8	18	58·1		70	41·2	130	47·6	13	52·0	
Grade							0·664							0·016
4th	47	34·1	58	30·7	8	25·8		60	35·3	76	27·8	1	4·0	
5th	43	31·2	65	34·4	14	45·2		54	31·8	94	34·4	14	56·0	
6th	48	34·8	66	34·9	9	29·0		56	32·9	103	37·7	10	40·0	
Socio-economic level							0·179							0·693
High	23	19·0	43	25·0	9	31·0		34	22·2	54	21·8	6	26·1	
Average	58	47·9	62	36·0	13	44·8		70	45·8	105	42·3	7	30·4	
Low	40	33·1	67	39·0	7	24·1		49	32·0	89	35·9	10	43·5	
Geomorphologic characteristics of residence place							0·367							0·724
Plain	109	79·0	144	76·2	20	64·5		124	72·9	211	77·3	17	68·0	
Mountainous	19	13·8	33	17·5	9	29·0		31	18·2	39	14·3	5	20·0	
Sub-mountainous	10	7·2	12	6·3	2	6·5		15	8·8	23	8·4	3	12·0	
Home-maid service							0·376							0·044
Yes	50	37·0	58	31·4	13	41·9		58	34·7	64	23·8	6	25·0	
No	85	63·0	127	68·6	18	58·1		109	65·3	205	76·2	18	75·0	
Children's obesity status							0·356							0·023
Normal weight	90	73·2	111	73·5	20	87·0		126	82·9	167	75·6	17	100·0	
Overweight/obese	33	26·8	40	26·5	3	13·0		26	17·1	54	24·4	0	0·0	
Father's obesity status							0·374							0·985
Normal weight	46	35·7	74	43·5	12	42·9		60	38·2	91	38·2	8	36·4	
Overweight/obese	83	64·3	96	56·5	16	57·1		97	61·8	147	61·8	14	63·6	
Mother's obesity status							0·494							0·301
Normal weight	91	69·5	125	72·7	24	80·0		111	73·5	169	69·8	17	85·0	
Overweight/obese	40	30·5	47	27·3	6	20·0		40	26·5	73	30·2	3	15·0	
Physical activity factors (from PCA)														
Factor 1: physical activity and sports after school	0·09	0·92	0·36	1·12	0·50	0·82	0·205	−0·31	0·73	−0·31	0·79	−0·65	0·46	0·169
Factor 2: video, electronic games and computers	0·12	1·03	0·20	1·22	0·39	1·10	0·624	−0·21	0·84	−0·12	0·79	−0·20	0·80	0·215
Factor 3: watching TV, video and DVD	0·02	0·93	−0·07	1·04	−0·57	0·84	0·038	0·21	1·07	−0·02	0·97	−0·06	1·07	0·190
Factor 4: homework and private lessons	0·01	0·85	−0·03	0·99	−0·06	0·75	0·701	0·24	1·16	0·01	0·92	0·26	1·51	0·273
Factor 5: home chores and outside home chores, aerobics, gymnastics, sports	−0·16	0·98	0·01	1·07	−0·07	0·83	0·410	0·03	1·09	0·06	0·90	0·11	0·89	0·685
Factor 6: theatre cinema, use of mobile phone	−0·17	1·02	−0·03	0·92	0·05	0·87	0·624	0·18	1·07	0·08	0·92	0·15	1·14	0·475
Factor 7: afternoon sleep, less private lessons	0·04	0·93	0·05	1·04	0·12	0·80	0·919	−0·01	1·07	0·01	0·95	0·10	0·87	0·946
Factor 8: sports for all, after school activities (except sports)	0·10	1·02	−0·02	1·00	−0·09	0·87	0·707	0·30	0·92	−0·14	1·04	−0·11	1·01	<0·0001

PCA, principal components analysis.
Continuous variables (e.g. age) are presented as mean (SD) and categorical variables (e.g. socio-economic level) as frequencies and percentages.
The Bonferroni rule was applied in order to account for multiple comparisons.
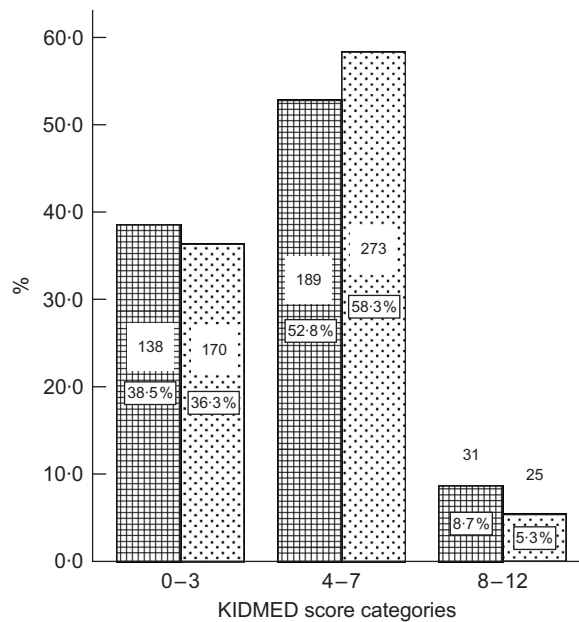
Fig. 1 Level of adherence to Mediterranean diet, showing number and percentage of children, by the KIDMED score categories (▦, boys; ▨, girls)

Only minor differences were observed among the three groups of adherence to the MD between the two genders. It should be noted, however, that a significant inverse association between obesity status (normal weight *v.* overweight/obese) and the KIDMED score categories was revealed in girls, while in boys this tendency did not reach the level of statistical significance (Table 1).

Similarly, an inverse relationship between the KIDMED score and the frequency and duration of watching TV, video and DVD was observed in boys, while in girls this trend did not reach statistical significance.

Level of adherence to the Mediterranean diet
Overall, only 6·7% of the sample was classified in the highest category of the KIDMED score, whereas more than one-third of the sample had a low KIDMED score (Fig. 1). Even though no significant difference emerged by gender ($P = 0.097$), a higher percentage of boys (8·7 *v.* 5·3%) were classified in the higher KIDMED score category, but at the same time, a slightly higher percentage of boys (38·5 *v.* 36·3%) were also classified in the lower KIDMED score category (data not shown here).

Bivariate analyses
Associations between the frequencies of consumption of several food groups (as assessed by the FFQ) and levels of adherence to the MD are presented in Table 2. It should be pointed out here that the KIDMED score was derived from the two other diet assessment parts of the FFQ (a short FGFQ and an SEHQ) and the parents' questionnaire, which are presented in the section 'Subjects and methods').

Compared with the low adherers, those with higher adherence to a Mediterranean-type diet consumed more dairy products, poultry and rabbit meat, legumes, fish and seafood, nuts, bread, ready-to-eat cereals, whole-grain products, fruits, vegetables, fresh leguminous seasonal vegetables, potatoes (other than fried), olives, low glycaemic index foods, traditional Cypriot food and unrefined foods. It is noted however that high MD adherers also reported higher intakes of refined foods and foods high in sugar.

Multiple logistic regression analyses
After applying multiple logistic regression analysis in order to control for various potential confounders (i.e. children's age, gender, place of residence, BMI class, SES level and physical activity) and estimate the effect size of any observed differences, several of the differences that bivariate analyses showed diminished. Specifically, compared with low adherers, children with at least an average KIDMED score were more likely to eat more frequently seafood and fish, legumes, nuts, bread, fruits, leafy vegetables, olives, low glycaemic index foods and unrefined foods. Consumption of most of the other groups mentioned above as significantly associated with the higher KIDMED score (and some other associations that were revealed by the multivariate analysis) did not follow a consistent pattern: i.e. average-degree adherers to the MD consumed dairy products, poultry and rabbit meat, fruit juices and potatoes – other than fried – more frequently than either high or low adherers (Table 3). Children in the highest KIDMED score category, on the other hand, consumed fruits from the 'other fruits' group and traditional Cypriot foods and foodstuffs more frequently than either low or average adherers. It should be noted that after the application of multiple logistic analysis, the positive associations between the KIDMED score and the frequency of consumption of refined foods and foods rich in sugar disappeared in the highest KIDMED score category, but not in the average KIDMED score category.

Effect size of the observed differences was of medium to high order.

Discussion

The present study assessed Cypriot children's diet quality by the level of adherence to the MD, as evaluated by the KIDMED score, and examined how intake of various food groups varied with the level of adherence.

Results have shown that the percentage of high adherers to the MD was only slightly above 6·5%, whereas more than one-third of the children followed a poor-quality diet.

The dietary pattern profile that characterizes children who had the highest KIDMED score, after controlling for potential confounders, suggests that their diet is rich in

Table 2 Food consumption by frequency category by the KIDMED score category

Food groups categories*	KIDMED score category						
	0–3		4–7		8–12		
	Frequency	%	Frequency	%	Frequency	%	P†
Dairy							
Milk and dairy products	70	25·8	166	41·7	24	52·2	<0·0001
7 times/week v. ≤6 times/week	201	74·2	232	58·3	22	47·8	
Dairy desserts	70	26·1	135	32·6	21	43·8	0·028
≥2 times/week v. ≤1 time/week	198	73·9	279	67·4	27	56·3	
Meat and alternatives							
Red meat	51	17·1	78	17·4	14	26·4	0·242
≥2 times/week v. ≤1 time/week	248	82·9	370	82·6	39	73·6	
Other foodstuffs high in meat or meat products (mixed dishes)	37	12·9	74	17·6	10	19·6	0·184
≥2 times/week v. ≤1 time/week	250	87·1	346	82·4	41	80·4	
Poultry and rabbit meat	39	12·8	89	19·5	13	24·1	0·023
≥2 times/week v. ≤1 time/week	265	87·2	367	80·5	41	75·9	
Delicatessen	53	18·3	93	21·4	13	25·0	0·415
≥5 times/week v. ≤4 times/week	237	81·7	341	78·6	39	75·0	
Fish and seafood	35	11·6	90	20·0	16	30·2	0·001
≥2 times/week v. ≤1 time/week	267	88·4	361	80·0	37	69·8	
Legumes	64	20·9	142	31·0	25	44·6	<0·0001
≥2 times/week v. ≤1 time/week	242	79·1	316	69·0	31	55·4	
Nuts	45	14·5	121	26·0	25	44·6	<0·0001
≥2 times/week v. ≤1 time/week	266	85·5	345	74·0	31	55·4	
Eggs and egg-rich foodstuffs	69	25·7	126	32·0	19	38·8	0·084
≥2 times/week v. ≤1 time/week	200	74·3	268	68·0	30	61·2	
Cereals, grains and products							
Bread	46	15·1	119	26·2	22	40·7	<0·001
≥7 times/week v. ≤6 times/week	259	84·9	336	73·8	32	59·3	
Breakfast ready-to-eat cereals	26	8·7	65	14·6	14	25·0	0·002
≥5 times/week v. ≤4 times/week	272	91·3	379	85·4	42	75·0	
Whole-grain products	18	6·2	52	11·9	11	21·6	0·001
≥5 times/week v. ≤4 times/week	273	93·8	386	88·1	40	78·4	
Baked wheat products (such as cakes and biscuits) and puff pastry	20	7·8	36	9·3	6	12·8	0·528
≥5 times/week v. ≤4 times/week	235	92·2	350	90·7	41	87·2	
Pasta and food stuffs with high content in rice	26	9·5	52	13·3	7	13·2	0·323
≥5 times/week v. ≤4 times/week	247	90·5	340	86·7	46	86·8	
Fruits							
Fresh fruits	43	18·3	133	35·4	24	52·2	<0·0001
≥7 times/week v. ≤6 times/week	192	81·7	243	64·6	22	47·8	
Fruit juices	55	18·3	143	31·6	16	30·2	<0·0001
≥7 times/week v. ≤6 times/week	246	81·7	310	68·4	37	69·8	
Other fruits (dried, canned fruit salad)	38	12·4	78	17·2	19	33·9	<0·0001
≥2 times/week v. ≤1 time/week	268	87·6	376	82·8	37	66·1	
Vegetables							
Vegetables	23	9·7	36	10·7	9	22·0	0·066
≥7 times/week v. ≤6 times/week	214	90·3	301	89·3	32	78·0	
Leafy vegetables	67	23·4	154	36·3	27	56·3	<0·0001
≥5 times/week v. ≤4 times/week	219	76·6	270	63·7	21	43·8	
Fresh legumes, other seasonal consumed vegetables	11	3·7	46	10·3	7	13·2	0·002
≥5 times/week v. ≤4 times/week	288	96·3	401	89·7	46	86·8	
Potatoes and potatoes dishes (excluding fried potatoes)	59	19·9	112	25·7	18	34·6	0·035
≥2 times/week v. ≤1 time/week	238	80·1	323	74·3	34	65·4	
Fried potatoes	203	66·1	308	67·0	37	66·1	0·968
≥2 times/week v. ≤1 time/week	104	33·9	152	33·0	19	33·9	
Olives	75	24·2	170	36·8	27	49·1	<0·0001
≥2 times/week v. ≤1 time/week	235	75·8	292	63·2	28	50·9	
Drinks							
Regular soft drinks	136	44·0	225	48·6	25	46·3	0·457
≥5 times/week v. ≤4 times/week	173	56·0	238	51·4	29	53·7	
Diet soft drinks	70	22·9	126	27·5	15	27·8	0·344
≥2 times/week v. ≤1 time/week	236	77·1	333	72·5	39	72·2	
Herbal tea (excluding black – at winter)	112	37·1	220	48·0	34	61·8	<0·0001
≥2 times/week v. ≤1 time/week	190	62·9	238	52·0	21	38·2	
Other groupings							
High-fat foods (including snacks)	22	10·6	36	11·4	6	15·0	0·728
≥5 times/week v. ≤4 times/week	185	89·4	279	88·6	34	85·0	
Foods high in sugar (including beverages)	22	7·9	60	14·5	7	14·6	0·030
≥5 times/week v. ≤4 times/week	255	92·1	354	85·5	41	85·4	
Traditional Cypriot foods and foodstuffs	30	14·6	65	21·2	14	38·9	0·002
≥2 times/week v. ≤1 time/week	176	85·4	241	78·8	22	61·1	

Table 2 *Continued*

	KIDMED score category						
	0–3		4–7		8–12		
Food groups categories*	Frequency	%	Frequency	%	Frequency	%	P†
Low glycemic index foods‡	24	10·9	63	20·5	14	38·9	<0·0001
Daily *v.* not daily	196	89·1	245	79·5	22	61·1	
Refined foods	17	7·5	49	14·5	8	17·8	0·021
≥5 times/week *v.* ≤4 times/week	210	92·5	289	85·5	37	82·2	
Unrefined foods	14	10·1	50	24·4	13	48·1	<0·0001
≥5 times/week *v.* ≤4 times/week	125	89·9	155	75·6	14	51·9	

*Frequency categories of each food group are described below each food group category. The first frequency category corresponds to the first row, while the second frequency category corresponds to the second row.
†From χ^2 test, df = 1.
‡Excluding foods with little or no carbohydrate.

Table 3 Odds ratios and 95 % CI, derived from multiple logistic regression analysis, showing the association between adherence to Mediterranean diet and children's consumption of selected food groups

	Average (4–7) *v.* poor quality (0–3)		Very good (8–12) *v.* poor quality (0–3)	
	OR	95 % CI	OR	95 % CI
Dairy				
Milk and dairy products				
7 times/week *v.* ≤6 times/week	1·862	1·149, 3·019	1·509	0·546, 4·173
Dairy desserts				
≥2 times/week *v.* ≤1 time/week	1·183	0·726, 1·929	0·937	0·329, 2·667
Meat and alternatives				
Red meat				
≥2 times/week *v.* ≤1 time/week	0·942	0·521, 1·702	1·193	0·370, 3·847
Other foodstuffs high in meat or meat products (mixed dishes)				
≥2 times/week *v.* ≤1 time/week	1·583	0·760, 3·298	0·552	0·092, 3·328
Poultry and rabbit meat				
≥2 times/week *v.* ≤1 time/week	2·209	1·121, 4·353	1·242	0·290, 5·318
Delicatessen				
≥5 times/week *v.* ≤4 times/week	1·161	0·671, 2·008	0·919	0·266, 3·172
Fish and seafood				
≥2 times/week *v.* ≤1 time/week	2·574	1·331, 4·977	2·851	0·838, 9·696
Legumes				
≥2 times/week *v.* ≤1 time/week	1·717	1·060, 2·782	4·875	1·887, 12·598
Nuts				
≥2 times/week *v.* ≤1 time/week	1·971	1·121, 3·466	4·449	1·604, 12·339
Eggs and eggs-rich foodstuffs				
≥2 times/week *v.* ≤1 time/week	1·400	0·838, 2·338	0·681	0·425, 1·092
Cereals, grains and products				
Bread				
≥7 times/week *v.* ≤6 times/week	2·302	1·303, 4·068	3·657	1·235, 10·828
Breakfast ready-to-eat cereals				
≥5 times/week *v.* ≤4 times/week	1·397	0·699, 2·793	2·249	0·656, 7·705
Whole-grain products				
≥5 times/week *v.* ≤4 times/week	1·209	0·531, 2·751	2·654	0·702, 10·034
Baked wheat products (such as cakes and biscuits) and puff pastry				
≥5 times/week *v.* ≤4 times/week	1·537	0·604, 3·907	1·192	0·189, 7·516
Pasta and food stuffs with high content in rice				
≥5 times/week *v.* ≤4 times/week	1·991	0·876, 4·526	1·085	0·179, 6·575
Fruits				
Fresh fruits				
≥7 times/week *v.* ≤6 times/week	4·151	2·221, 7·757	13·637	4·514, 41·198
Fruit juices				
≥7 times/week *v.* ≤6 times/week	2·054	1·214, 3·477	1·034	0·309, 3·465
Other fruits (dried, canned fruit salad)				
≥2 times/week *v.* ≤1 time/week	1·302	0·680, 2·493	4·021	1·250, 12·933
Vegetables				
Vegetables				
≥7 times/week *v.* ≤6 times/week	3·068	0·639, 14·735	5·648	0·635, 50·243
Leafy vegetables				
≥5 times/week *v.* ≤4 times/week	1·819	1·093, 3·025	3·340	1·218, 9·163

Table 3 Continued

	Average (4–7) *v.* poor quality (0–3)		Very good (8–12) *v.* poor quality (0–3)	
	OR	95 % CI	OR	95 % CI
Fresh legumes, other seasonal consumed vegetables				
≥5 times/week *v.* ≤4 times/week	16·400	2·078, 129·409	33·973	3·138, 367·758
Potatoes and potatoes dishes (excluding fried potatoes)				
≥2 times/week *v.* ≤1 time/week	1·656	0·947, 2·897	1·570	0·477, 5·168
Fried potatoes				
≥2 times/week *v.* ≤1 time/week	0·856	0·555, 1·321	0·458	0·178, 1·178
Olives				
≥2 times/week *v.* ≤1 time/week	2·351	1·479, 3·736	3·764	1·463, 9·684
Drinks				
Regular soft drinks				
≥5 times/week *v.* ≤4 times/week	1·144	0·761, 1·721	0·665	0·255, 1·734
Diet soft drinks				
≥2 times/week *v.* ≤1 time/week	0·986	0·600, 1·619	2·427	0·879, 6·700
Herbal tea (excluding black – at winter)				
≥2 times/week *v.* ≤1 time/week	1·326	0·875, 2·009	2·007	0·795, 5·068
Other groupings				
High-fat foods (including snacks)				
≥5 times/week *v.* ≤4 times/week	1·281	0·524, 3·131	0·796	0·130, 4·867
Foods high in sugar (including beverages)				
≥5 times/week *v.* ≤4 times/week	3·409	1·290, 9·007	1·689	0·257, 11·119
Traditional Cypriot food and foodstuffs				
≥2 times/week *v.* ≤ 1 time/week	1·438	0·673, 3·074	7·796	2·214, 27·453
Low glycaemic index foods†				
Daily *v.* not daily	3·353	1·492, 7·531	10·959	3·357, 35·774
Refined foods				
≥5 times/week *v.* ≤4 times/week	2·540	0·999, 6·459	2·182	0·424, 11·212
Unrefined foods				
≥5 times/week *v.* ≤4 times/week	8·315	2·501, 27·643	21·583	4·425, 105·284

*Adjusted for age, gender, socio-economic status, place of residence, BMI class, physical activity (as factors derived from PCA).
†Excluding foods with little or no carbohydrate.

seafood and fish, legumes, nuts, bread, fruits, leafy vegetables, olives, low glycaemic index foods and unrefined foods.

As mentioned above, only two other studies[8,9] have evaluated the degree of adherence to MD in children. The first was conducted in Spain among 3850 children and youngsters aged 6–24 years. Results for the first age category of 2–14 years, which includes the age category of our sample, show that the distribution of the sample in the three KIDMED index categories differs substantially from our results, especially in the lowest and highest index categories: i.e. only 2·9 % had a very low KIDMED index results, whereas 48·6 and 48·5 % had intermediate and high index results, respectively[8,18]. The second study, which was conducted in Crete[9] and evaluated adherence to MD according to a modified KIDMED index, included 690 children aged 7–18 years and reported results similar to ours in relation to the lowest KIDMED category: i.e. almost one-third (27·9 %) of the children had a poor MD score, but the percentage of children who scored at the highest score category was four-fold higher (28·5 % as opposed to 6·5 %).

In spite of the above differences with the other two studies, results of our study provide evidence of the association between level of adherence to the principles of MD and diet quality in children. In particular, we have shown that consumption of 'healthful' foods, such as fruits, vegetables, seafood, legumes, low glycaemic index foods, bread, nuts and olives is higher in children who have a higher KIDMED score (Table 3). There is a large body of published data that provides conclusive evidence that quality of diet, as assessed by food consumption, is highly correlated with the intake of nutrients in children[20–22]. There is therefore substantial basis for arguing that adherence to the MD is independently associated with diet quality in children. Our results are in line with the findings of Serra-Majem *et al.* who reported that the adequacy of MD in the age range of 6–14 years increased with increased mean intakes of fibre and most of the vitamins and minerals while it decreased for inadequate intakes ($<2/3$ of the Reference Nutrient Intake) of Ca, folate and vitamin C in both genders and of Fe, vitamin B_6, vitamins A and D in females[8].

It should be noted that no differences emerged between high and low adherers, with regard to the frequency of consumption of poultry, eggs, meat and delicatessen items, foods that according to the MD prototype should not be consumed daily or even weekly. We speculate that this outcome may be related to current dietary recommendations for children[23], which suggest a more frequent consumption of these foods (meat, poultry and eggs) than the MD scheme.

Furthermore, this may be related to the phenomenon of nutrition transition, the abandonment of the traditional MD and the high urbanisation which have occurred in Cyprus during the last decades[24,25].

Strengths and limitations

We are aware of some limitations in our study. First, its cross-sectional methodology can only be suggestive of the relationship between adherence to MD and diet quality in children. In spite of this, the positive relationship between adherence to MD and better diet quality that we observed is consistent with the evidence provided in the literature. A second limitation relates to the fact that the various Mediterranean cultures exhibit variations in their traditional diets and there is an inherent difficulty in describing one uniform MD prototype. We have here used the criteria adopted specifically for children by a Spanish group of experts, feeling that they describe well the basic characteristics of all 'MD'.

Strengths of our study include that it is a nation-wide study, the first in Cyprus, which reports on diet quality on any segment of the population and only the third internationally which reports on the adequacy of the MD in children.

Implications

Our results strengthen the position that the MD prototype represents a nutritionally adequate and balanced diet and could thus be used as an educational tool for promoting healthy eating habits in children. Further studies are therefore needed in order to evaluate interventions based on the MD as opposed to more 'traditional' ones, which are based on current recommendations for paediatric nutrition. Such interventions, besides the children, could also include parents and overall family environment, in order to assess their success when family environment is addressed, as opposed to just children. Evaluation should focus on differences between the two approaches with respect to the development of obesity, various biochemical indices and nutrition knowledge.

Conclusions

In conclusion, we report that preadolescent Cypriot children follow a diet of rather poor quality, as assessed by the principles of MD, and that adherence to a Mediterranean-type dietary pattern is, independent of potential confounders, associated with better diet quality. Future studies should further investigate this issue and collect more data among children in Mediterranean as well as in non-Mediterranean countries.

Acknowledgements

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