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Original article

Urbanization influences dietary habits of Cypriot children: the CYKIDS study

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Abstract

Objectives: Nutrition transition and urbanization have been linked to the adoption of a Western diet. An increasing number of Cypriot have abandoned their traditional eating habits and replaced them with a more westernized diet. Therefore, we aimed to examine the relationship between dietary habits of preadolescent children in Cyprus and their place of residence, with reference to nutrition transition.

Methods: CYKIDS is a national, cross-sectional study, among 1140 children (10.7 ± 0.98 years). Dietary assessment was based on a 154-item semi-quantitative food-frequency questionnaire Adherence to the Mediterranean diet was evaluated by the KIDMED index.Logistic regression and bivariate analyses were used for data analysis.

Results: Differences between children from urban and rural areas were not major, but it was found that children from rural areas consumed more traditional foods, were less likely to eat fast food [OR = 0.66, 95 % CI (0.49–0.88)] and more likely to have meals with the family [OR = 2.49, 95 % CI (1.62–3.81)].

Conclusions: The minor differences relating the dietary patterns to the place of residence reflect the changes in eating habits and the abandonment of the traditional Mediterranean diet, which may be attributed to the nutrition transition and urbanization phenomena.

Keywords: Traditional – Mediterranean diet – Cyprus – Urbanization – Nutrition transition – Dietary patterns.

Introduction

Childhood obesity is globally regarded as one of the most important public health concerns. It is, associated with severe metabolic consequences in youth, which in turn could also persist during adulthood if not addressed early on[1]. The ongoing trend towards the increasing incidence of overweight children is mainly attributed to environmental factors. Urbanization, which has been connected with the phenomenon of nutrition transition, is one of the environmental factors that has been associated with childhood obesity[1,4,5]. Nutrition transition is usually considered in reference to the shift from a traditional diet to a Western diet that is accompanied with analogous negative changes in physical activity habits and changes in body composition[4,5].

Concerning Cyprus, there have been some indications of nutrition transition, from the traditional Mediterranean type of diet to the western diet, which has been paralleled to demographic transition[6–9]. The only available data for Cypriots' dietary habits are from the Food Agricultural Organization's (FAO) food balance sheets (1969/71–1999/2001)[10], and support the epidemiological changes regarding chronic disease risk factors (e.g. obesity) in children and adults. However, the only available evidence concerning Cypriot children's diet and its relation to the place of residence is based on a study that measured the LDL cholesterol levels and body composition of rural and urban children[9,11]. Specifically, the study presented differences in LDL cholesterol and body composition in favor of the rural children (n = 8614)[9]. Thus, someone one can argue that these results are associated with differences in dietary habits.

The present study aims to examine, the relationship between dietary habits and environment (urban/rural) of residence in a nationwide sample of preadolescents children in Cyprus.

Methods

This study was nation-wide and is based on 1140 children (3.7 % of the reference population of corresponding ages) of 4th, 5th and 6th grade (9–13 years, x = 11 ± 0.98) from 24 primary schools.

A cluster stratified sampling procedure was used as follows: twenty four primary schools were randomly selected using as main criteria the type of community (urban-rural), as provided by the Cyprus Statistical Service[12] and the average socioeconomic status of the families they serve. At least two of the selected schools in each province were based on urban and another two on rural areas. Selection of schools in urban areas was based on the socioeconomic level of the area located at: at least one of high and at least one of low socioeconomic background. Socioeconomic (SES) level is considered one of the most powerful confounding factors to which many of the differences between urban and rural areas are attributed to[13–16]. The classification of schools by SES was based on personal views/estimates of the teachers, with whom we communicated, from all provinces, as no such classification is available from the Ministry of Education, the Statistical Service or from any available data, we could locate. The above classification was confirmed as true after the collection of the data by stratifying sample by all participating schools by SES definition, and by statistically checking the hypothesis. SES definition was given by the InterCollege Research Center (Cyprus), and takes into consideration parents' education and profession.

The schools from the rural areas of each province were selected according to the geomorphologic classification, lowland/ mountainous area, to control for the confounding factor of geomorphologic characteristic, which might interact with rural environment[17]. Schools in rural areas could not be divided by SES, as was reported by the teachers, since in most rural areas in Cyprus there is only one school. On the other hand, the criterion of geomorphologic characteristic could not be used in urban areas, since all urban areas in Cyprus are lowland. At the last stage whole classes were selected.

Permission for this study was granted by Cyprus Ministry of Education and Culture which is responsible to ensure that ethical standards have been followed. The study's procedures were approved by Harokopio University Ethics Committee.

Power analysis showed that the number of participants was adequate to evaluate an increase/decrease in odds ratio by 10 % between the levels of the investigated independent variables, achieving a statistical power of 85 % at $p < 0.005$ (two-sided hypotheses).

Dietary assessment was based on a semi-quantitative food-frequency questionnaire (FFQ), consisting of 154 foods. The FFQ was adapted from the Harokopio FFQ for Children and Adolescents[18] to include all the commonly used foods of the local Greek- Cypriot cuisine and culture. The questionnaires were administered by a trained dietician during school hours, between February 2005 and June 2005, following a specific protocol to ensure that the same conditions were held for all participants. The 154 foods in the FFQ were organized under 15 headings-corresponding the food category that each food might belong to [Milk & dairy, Eggs & products, Meat & Mince, Delicatessen & smoked meat, Fish & Seafood, Pasta, Bread & Cereals, Potatoes, Legumes, Fresh Legumes & Olives, Nuts, Miscellaneous (Mixed dishes, Confectionery, Pastries, Ethnic Food, Cakes & Biscuits, Other Snacks), Drinks, Fruits, Vegetables].

The participants were asked about their usual frequency (average of last year) of consumption. Response categories (with an exception of the items from the Fruit & Vegetable (F&V) categories), ranged from 1/day, 2–3 /day, 4–5/day, ≥6/day, 1/week, 2–4/week, 5–6/week, 1–3/month, to seldom/never. The F&V, scale intake consisted of 8 response categories, ranging from 1/day, ≥2/day, 1–2 /week, 3–4/week, 5–6/week, 1/month, 2–3/month to never. Standard portion size of foods that could be easily understood by children (e.g. one piece of fruit, vegetable) was included in the questions. More specifically, USA Dairy Council[19] and the NASCO[20] food models used to visualize the regular portion or to recognize/ identify unknown food items.

The 154 types of food were recoded into 30 food groups, which may have practical importance in daily diet and daily clinical practice. Also four more categories emerged from the above 154 types of food but they were defined as single groups because they were suspected to represent distinct dietary patterns (olives, game meat, other poultry, poultry-rabbit meat).

The KIDMED index (Mediterranean Diet Quality Index for children and adolescents) (Serra – Majem et al.)[21] was used in order to evaluate the differences in the percentages of the adherence gradient to the Mediterranean diet by place of residence. It measures 16 components, based on principles of the Mediterranean diet. According to Serra-Majem et al.[21] a score of 0–3 reflects a poor diet in relation to the Mediterranean diet principles, whereas values 4–7 and values 8–12, describes average and good adherence to the principles of the Mediterranean diet, respectively.

The FFQ questionnaire, answered by children, had a separate section with questions on demographic characteristics such as age, gender, place of residence and size of family. All other information such as parents' educational level, income and profession, were included in another, short questionnaire, which was attached to the consent form and was answered by 1068 parents. Socioeconomic status was computed on the

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Table 1. Demographic characteristics of the study sample, by place of residence.

	Total (n = 1140)		Urban areas (n = 635)		Rural areas (n = 505)		P
Male gender	531	46,7 %	291	46,0 %	240	47.5 %	0.632
Age	10.67 (0.98)		10.72 (0.99)		10.61 (0.96)		0.241
Grade							0.584
4th	408	33.9 %	223	33.1 %	185	35.0 %	
5th	401	33.3 %	233	34.6 %	168	31.8 %	
6th	394	32.8 %	218	32.3 %	176	33.3 %	
Socioeconomic level							<0.001
High	198	21.5 %	173	33.9 %	25	6.1 %	
Average	390	42.4 %	224	43.9 %	166	40.5 %	
Low	328	35.7 %	112	22.2 %	216	52.7 %	
Non-employed and housewives	4	0.4 %	1	0.2 %	3	0.7 %	
Ethnicity							<0.001
Greek	887	88.3 %	466	84.3 %	421	93.3 %	
Foreigners	33	3.3 %	30	5.4 %	3	0.7 %	
Mixed	84	8.4 %	57	10.3 %	27	6.0 %	
Geomorphologic characteristics of residence							<0.001
Plain	397	33.0 %	213	31,6 %	184	34.8 %	
Plain/ coastal	536	44.6 %	461	68,4 %	75	14.2 %	
Mountainous	174	14.5 %	0	0.0 %	174	32.9 %	
Hilly	31	2.6 %	0	0.0 %	31	5.9 %	
Hilly / coastal	65	5.4 %	0	0.0 %	28.6	12.3 %	
Residence in a refugee camp	74	6.99 %	57	10.0 %	17	3.5 %	<0.001
Place of living in certain lifetime stages							
Place of birth							<0.001
Rural	197	19.9 %	18	3.2 %	179	41.7 %	
Suburban	67	6.8 %	51	9.1 %	16	3.7 %	
Town	728	73.4 %	494	87.7 %	234	54.5 %	
Place of upbringing							<0.001
Rural	444	45.2 %	20	3.6 %	424	97.7 %	
Suburban	77	7.8 %	74	13.5 %	3	0.7 %	
Town	462	47.0 %	455	82.9 %	7	1.6 %	
Place of present residence							<0.001
Rural	442	45.3 %	19	3.5 %	423	99.1 %	
Suburban	91	9.3 %	89	16.2 %	2	0.5 %	
Town	442	45.3 %	440	80.3 %	2	0.5 %	
Frequent visits in rural areas (by urban children) and in urban areas (by rural children)	647	59.7 %	277	46.6 %	370	75.7 %	<0.001
Type of residence							<0.001
Apartment	151	13.8 %	138	23.0 %	13	2.6 %	
House with a yard	886	80.7 %	430	71.7 %	456	91.6 %	
House without a yard	61	5.6 %	32	5.3 %	29	5.8 %	
Ownership of residence	964	90.0 %	483	83.7 %	481	97.4 %	<0.001
Home maid service	331	29.9 %	239	39.4 %	92	18.4 %	<0.001

Continuous variables are presented as mean (± SD), and categorical variables as frequencies and percentages in parentheses.

basis of measures of parents' education and occupation, as reported by the parents.

Apart from use of the place or residence, as a criterion to assess the impact of urbanization on children's dietary habits, we used an urbanization index created by the Statistical Office of the European Communities (Eurostat) in cooperation with EU National Statistical Services, for all EU countries. According to this index, all areas can fall into three catego-

	Total		Urban areas		Rural areas		P
Body Mass Index Classification- Children							
Under & Normal weight	635	77.2 %	349	75.9 %	286	78.8 %	0.322
Overweight & Obese	188	22.8 %	111	24.1 %	77	21.2 %	
Body Mass Index Classification- Mothers							
Under & Normal weight	662	72.03 %	396	75.4 %	266	67.5 %	0.008
Overweight & Obese	257	27.97 %	129	24.6 %	128	32.5 %	
Body Mass Index Classification- Fathers							
Under & Normal weight	359	39.15 %	205	39.7 %	154	38.4 %	0.683
Overweight & Obese	558	60.85 %	311	60.3 %	247	61.6 %	

Table 2. Percentages of overweight and obesity of children and their parents, by place of residence.

ries: a) Densely-populated areas b) Intermediate areas c) Thinly-populated areas.(Personal communication, by email with a National Statistical Service officer).

Children's height and weight were reported by parents via a short socio-demographic questionnaire sent out from the schools. Obesity and overweight among children were calculated using the International Obesity Task Force (IOTF) age and sex -specific Body Mass Index (BMI) cut – off criteria[22]. Parents' obesity and overweight percentages were also estimated from self reported values of body weight and height. BMI measures were used to define adult (parents) obesity (BMI $\geq 30\,kg/m^2$) and adult overweight (BMI 25–29.9 kg/m^2), according to the World Health Organization classification for adults.

Statistical analysis

Continuous variables are presented as means ± SDs, whereas qualitative variables are presented as absolute and relative frequencies. Normality of variables' distribution was tested by Kolmogorov-Smirnov test. Associations between normal distributed variables were tested by Student's independent t- test, whereas Mann-Whitney U test was used for not- normally distributed continuous variables. Respectively, one-way ANOVA using Bonferroni correction for multiple comparisons and Kruskall-Wallis were applied having as the dependent variable the "urbanization index". Associations between categorical variables were tested by contingency tables and chi-square test.

Logistic regression analyses were then applied with place of residence (urban/rural), and urbanization index (high, medium, low) as the dependent variables, in order to estimate the effect size of any observed differences (by calculating odds ratios and the corresponding 95 % CI) and to adjust differences for the potential confounders.

Furthermore, in order to estimate the size of difference between children of the two living environments and the degree of adherence to the Mediterranean diet, discriminant analysis was applied, using as the dependent variable the "frequency category of the KIDMED score".

To facilitate simplicity in the presentation of the results, consumption of foods and food groups are presented *in terms of weekly consumption i. e. frequency of total of consumption of each food group per week* (Tab. 3). Additionally, frequency categories for dietary habits were collapsed into two categories (Tab. 4),

All reported *p* values were based on two-sided tests and compared to a significance level of 5 %. SPSS 13.0 software (Statistical Package for Social Sciences, Chicago, IL, USA) was used for all statistical analyses.

Results

Overall 55.88 % and 44.30 % of the participants were living in urban and rural areas, respectively.

As shown in Tab. 1, in respect to place of residence- statistically significant differences were found regarding the following: having access to a garden with vegetables or fruits, children's attendance and having lunch in the All Day School and in the frequency that mother and grandmother cook for the family

Tab. 2 presents comparisons of obesity and overweight percentages among children and their parents. It seems that statistically significant differences, in respect to the place of living exist only in mothers.

Diet and dietary habits

Tab. 3 presents results from bivariate analyses carried out to examine the associations between the categories of food intake and the place of residence.

From a total of 32 comparisons (which included the 30 food groups mentioned in methods section and two single food items, olives and wild game, that were also referred as such in the FFQ) only 9 food groups or single food items were

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Table 3. Food consumption as mean of weekly frequency among urban and rural children.

Food groups	Frequency of consumption/week*		p**
DAIRY	Urban	Rural	
Dairy products	20.29	18.9	0.306
Food stuff rich in milk/dairy products	9.52	8.40	0.050
MEAT & ALTERNATIVES			
Eggs	4.34	4.92	0.084
Meat(including poultry)	3.77	4.77	0.050
Red meat	2.86	4.16	0.021
Other food stuff high in meat or meat products	3.41	3.00	0.411
Poultry & rabbit meat	4.12	4.01	0.351
Other poultry eating other poultry	1.21	2.27	0.001
Wild game meat	1.03	2.94	<0.001
Delicatessen	5.60	6.56	0.917
Fish & seafood	3.35	4.14	0.482
Legumes	2.89	3.44	0.448
Nuts nuts2	3.05	4.98	<0.001
CEREALS, GRAINS &PRODUCTS			
Pasta	4.73	3.92	0.269
Bread	7.75	8.20	0.102
Breakfast cereals	6.38	6.36	0.809
Whole grain products	3.80	4.24	0.638
Baked wheat products & puff pastry	5.50	5.14	0.899
Corn products	7.30	7.16	0.915
Food stuff with high content in rice	3.80	2.32	<0.001
FRUITS			
Fruit juices	8.43	8.00	0.515
Fruits	5.66	5.97	0.337
VEGETABLES			
Vegetables	3.41	3.43	0.400
Fresh legumes, other seasonal consumed vegetables & olives	2.71	3.55	0.006
Potatoes & potatoes dishes	5.22	5.17	0.968
Olives	2.25	3.44	0.002
OTHER GROUPINGS			
High fat foods	4.55	5.02	0.176
Foods high in sugar (including beverages)	6.83	7.23	0.078
Traditional Cypriot food & food stuff	3.45	3.84	0.059
Low glycemic index foods (<55 units)***	4.06	3.85	0.199
Medium glycemic index foods	3.10	2.71	0.143
High glycemic index foods (>70 units)	5.06	6.24	0.062

*Frequency of consumption per week is presented as mean.
from Mann Whitney test * excluding foods with little or no carbohydrate

found to be, statistically significantly related to the place of residence, The following categories were significantly related to rural areas: 'meat(including poultry)', 'red meat' 'other poultry', 'game meat', 'nuts', 'olives', and 'Fresh legumes, other seasonal consumed vegetables & olives'. On the other hand, 'Food stuff with high content in rice' and 'Food stuff rich in milk/dairy products', were in favor of urban children. Furthermore, of marginal statistical significance were the differences observed in higher frequency of weekly consumption of 'Traditional Cypriot food & food stuff', 'Foods high in sugar (including beverages)' and 'High glycemic index foods' by rural children (Tab. 3).

Further analysis after adjusting for various potential confounders (i.e. children's' age, gender, BMI class, SES level

Table 4. Meal patterns among urban and rural children.

Dietary habits *(the two compared frequency categories are shown after the name of the dietary habit)*		Category 1 %	Category 2 %	OR (95 % CIs)*
Intake of breakfast: *≥5 times/week vs. ≤4 times/week*	Urban	77.7	22.3	1.01 (0.71–1.42)
	Rural	79.2	20.8	
Number of main meals & snacks daily: *≤3/day vs. ≥4/day*	Urban	34.0	66.0	1.41 (1.03–1.91)
	Rural	41.9	58.1	
Number of snacks per day: *≤1 per day vs. ≥2 per day*	Urban	25.4	74.6	0.85 (0.61–1.19)
	Rural	22.9	77.1	
Eating outside home or order fast food in past 2 days: *0 times vs. ≥1 times*	Urban	53.1	46.9	1.51 (1.13–2.03)
	Rural	63.5	36.5	
Have meals with family: *≥5 times/week vs. ≤4 times/week*	Urban	80.0	20.0	2.49 (1.62–3.81)
	Rural	87.8	12.2	
Have meals alone: *≥5 times/week vs. ≤4 times/week*	Urban	41.0	59.0	0.77 (0.57–1.04)
	Rural	32.4	67.6	
Have lunch at school: *4 times/week vs. ≤3 times/week*	Urban	9.8	90.2	1.80 (1.15–2.81)
	Rural	16.4	83.6	
Eat fried food: *≥3 times/week vs. ≤2 times/week*	Urban	41.6	58.4	1.59 (1.20–2.11)
	Rural	53.8	46.2	
Eat grilled food: *≥3 times/week vs. ≤2 times/week*	Urban	38.4	61.6	0.97 (0.73–1.30)
	Rural	39.5	60.5	

*Adjusted for child age, sex & BMI class (NW vs. OW/OB) and parents' SES

Table 5. KIDMED index in Cypriot children by environment of living.

KIDMED index	**Urban %**	**Rural %**	**OR (95 % CIs) Not adjusted**	**OR (95 % CIs) Adjusted ***
Poor (0–3)	39.5	34.6	1 (reference category)	1 (reference category)
Average (4–7)	55.1	57.0	1.18 (0.89–1.58)	1.04 (0.67–1.60)
Good (8–12)	5.4	8.4	1.77 (0.99–3.15)	1.81 (0.77–4.25)

* Adjusted for children's age, sex, refugee state, BMI class, mother's BMI class, ownership of house, kind of residence, frequency of visits in town/village, home maid service and child's nationality. (SES and geographic characteristics of the residence area were excluded from the model because of collinearity)

and mother's BMI class), revealed that only 4 of those differences were still statistically important and that the mean effect size of those was of low to medium order. Particularly, rural children seemed to be almost 3 times more likely to eat traditional Cypriot foods ≥5 times per week [OR 2.90 95 % CI (1.05–7.99)]. Similarly, they were also 4 times more likely to eat traditional Cypriot foods on a weekly basis (2–4 times/week) [OR 4.04 95 % CI (1.31–12.49)] and on a monthly basis (1–4 times /month) [OR 3.83 95 % CI (1.41–10.39)]. Moreover, food products with high content of rice were 30 % less likely to be consumed by rural children OR 0.67, 95 % CI (0.47–0.97). On the other hand rural children appeared almost 2 times more likely to consume "olives" on a monthly basis -OR 1.99 95 % CI (1.36–2.92)], and lastly they were about two times more likely to eat wild game meat ≥2 times/week.[OR 2.25 95 % CI (1.26–4.02)]. Further analysis on the Cypriot traditional foods group showed that differences were of borderline statistical significance when the food item of olives was excluded from the equation (p = 0.059).Clearly, stratifying the Cypriot foods into two categories such as "Cypriot traditional foods-including olives" and "Cypriot traditional desserts" revealed that differences were statistically significant (p = 0.031) only for the desserts group. This particularly was true only for the consumption on weekly [2–4 times/week- OR 2.29, 95 % CI (1.04–5.06)] or on monthly (1–4 times/week- OR 1.76, 95 % CI (1.10–2.81)] basis.

Olive oil use in cooking (baking and frying) was assessed based on the parents' answers. Parents from rural areas reported using almost every time olive oil when cooking, either in frying (38.9 % vs. 29.7 %, p = 0.002) or in baking (60.0 % vs. 44.1 %, p < 0.0001). This relationship remained significant even after adjustment of the potential confounders [OR 1.55 95 % CI (1.36–1.68) for use of olive oil in baking and OR 1.51 95 % CI (1.30–1.66) for use in frying].

Tab. 4 presents comparisons of meal patterns, such as types and location of meals, family company with meals and methods of cooking, by place of living. As shown, rural children were less likely to eat alone and to eat outside home. In con-

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trast, they were more likely to eat together with the rest family members, and to have more meals per day (Tab. 4).
Level of adherence to the Mediterranean diet and the place of residence, showed no significance difference (Tab. 5).
Discriminant analysis confirmed the above results. The analysis showed that the size of difference between children from rural and urban areas and their degree of adherence to the Mediterranean diet was about 1 % (Wilk's lambda 0.991, p = 0.016). Also, the classification of children by frequency category of the KIDMED index provided very low correct classification rate (i. e. overall: 52.5 %, urban: 44.9 % rural: 61.8 %) (Data not shown).
Applying the urbanization index, in all the aforementioned analyses, revealed mostly identical results as by urban / rural place of living. Where significantly statistical differences were observed, these, in most cases, were following a pattern of gradually increasing or decreasing association, from low to average to high degree of urbanization areas and vice versa. (Data not shown).

Discussion

The present study is the first to report data regarding the dietary patterns of Cypriot children in regards to the place of living.
Results showed that children from rural areas consumed more traditional Cypriot food and especially foods high in glycemic index. More clearly, it was found that children from rural areas consumed desserts (sweets) more frequently compared to children from urban areas. This could lead to query of how this can be justified, since traditional foods are considered healthier and in line to the new scientific nutrition model of Mediterranean diet. However, it should be noted that although differences observed for traditional Cypriot desserts persisted even after taking into consideration confounders, this was not true for differences of low or high glycemic food groupings. Therefore, it seems possible that rural people still prefer traditional desserts among other desserts. Another explanation for this finding is that bakeries and confectioneries are in most cases absent in walking distances in rural Cyprus, and thus, desserts are mostly home-made. It could be also suggested that since more mothers in rural areas do not work (data not shown), they spend more time at home, and thus may choose to prepare deserts for the family. As it has been reported before, a higher percentage of mothers from rural areas cook everyday for their family. The fact that more mothers cook for their families in rural areas may also explain the reported differences regarding meal patterns such as having more meals with the family, not eating alone, and eating less fast food. (Tab. 4).

As it has been generally acknowledged the assessment of the diet should be done holistically[23], taking into consideration consumption of all foods, food groups and diet patterns, such as meal patterns. We thus, used the KIDMED index to assess the quality of the whole diet of the children of CYKIDS study, in reference to the Mediterranean diet model. Results, regarding differences in KIDMED index score, appear to be in line with the magnitude of the differences reported in frequency of consumption of all major food. Thus, even though higher percentages of children living in rural areas seem much more likely to follow a Mediterranean diet, after adjustment for possible confounders this difference gradually disappeared (Tab. 5). Overall the percentages of children who are high adherers of the Mediterranean diet are very low. As adherence to the Mediterranean diet is associated with better diet quality in this sample as we have also demonstrated elsewhere[24], these findings might indicate that the quality of diet in Cypriot children has been worsening, irrespectively to the environment of living.
Even though similar studies, which compare dietary habits of children by the environment of living, are scarce, the results from other studies seem to agree with ours. In a recent study in Italy, which has many common elements in food culture with Cyprus, showed complete similarity of dietary habits between 927 eight-year-old, rural and urban children[25]. Two studies from Greece, (a country with which Cyprus shares a very similar food culture), concluded that differences regarding diet composition of rural and urban children either do not exist[26], or there are minor differences that do not even follow a consistent pattern[27]. Contrary to the above, a similar study (1988–2000) in another European country Croatia, among 315 children with a mean age of 12–13, showed that rural children had more healthy dietary choices, compared to their urban counterparts who had significantly higher consumption of fast food, soft drinks and chocolates[28].
On the other hand the results regarding the few and small differences among urban and rural areas, could be interpreted in at least two ways: either that differences in rural and urban areas have indeed disappeared, or it might be possible that large differences do exist but only for some rural areas, probably for those with the largest distance from urban areas, or for areas with certain environmental characteristics. Thus, future studies should investigate and identify the particular characteristics of rural environment that may have a contribution to the higher degree of adherence to the Mediterranean diet. Such elements could be future targets in public health planning.
Additionally, the results regarding the obesity rates among rural and urban children are not significant, suggesting that

the two main factors of energy equilibrium in group level, energy intake as food intake and energy expenditure as physical activity do not differ. This is further supported from a study done in Cyprus[11] and from our study[29] which demonstrated that differences are minor and of no practical importance. Furthermore, our findings are in agreement with the literature, arguing that in developed countries, where urbanization is quite high -such as in Cyprus, a gradual disappearance of the differences in diet and body composition between urban and rural areas is observed[30].

The present study has certain limitations which should be taken into account when interpreting the data. First, it was a cross-sectional study design. Therefore, conclusions cannot be attributed to plausible causes, but instead they are valuable indications that can be used in future investigations. Even though sample selection was multistage and stratified, it was not random. In spite of this the inclusion of 1.3 %–3.7 % of the total reference population of Cyprus in the study and the statistical analyses permits generalization of the results.

Sampling for the criterion of residence place (urban/ rural) used school place as a proxy examination of the final sample, showed that only 23 children were misclassified and, therefore, the use of this proxy did not bias the selection of the sample.

In conclusion, our findings demonstrate that the differences in frequency of food groups' consumption between the two groups of children are minor. Moreover, even if rural children are significantly much more likely to follow a Mediterranean diet, the difference is quite small. The impact of urbanization seems to be the main reason behind decreasing differences between groups of rural and urban children and this is further supported by the finding that differences by urbanization index in most cases followed a constant pattern from low to high index areas.

Since no significant differences in dietary habits between urban and rural areas in developed countries such as Cyprus seem to exist, public health programs cannot differentiate by place of residence. Thus, future research should concentrate on the development of urbanicity[31] models, which could investigate plausible characteristics of the environment that may possibly influence populations' dietary habits.

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References

1. August GP, Caprio S, Fennoy I, et al. Prevention and Treatment of Pediatric Obesity: An Endocrine Society Clinical Practice Guideline Based on Expert Opinion. J Clin Endocrinol Metab 2008;93:4576–99.

2. Maziak W, Ward KD, Stockton MB. Childhood obesity: are we missing the big picture? Obes Rev. 2008;9:35–42.

3. Barlow SE; Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics. 2007;120 Suppl 4:164–92.

4. Popkin BM. Urbanization, lifestyle changes and the nutrition transition. World Dev 1999;27: 1905–16.

5. Grundy SM. Multifactorial causation of obesity: implications for prevention. Am J Clin Nutr. 1998;67(suppl): 563–72.

6. Ministry of Health. Annual Medical Report for the year 1970. Republic of Cyprus, 1970. (Accessed March, 14, 2008 at http://www.moh.gov.cy/).

7. Department of Statistics and Research, Ministry of Finance. Demographic Report 2002. Series II. Report no 40.Nicosia, Cyprus: Printing Office of Republic of Cyprus; 2003. (In Greek) (Accessed March, 14, 2008 at http://www.mof.gov.cy/mof/cystat/statistics.nsf/publications_gr).

8. Department of Statistics and Research, Ministry of Finance. Health Survey 2003. Series II. Report no 6. Cyprus: Printing Office of Republic of Cyprus; 2005. (In Greek) (Accessed March, 14, 2008 at http://www.mof.gov.cy/mof/cystat/statistics.nsf/publications_gr).

9. Kourides Y, Tornaritis M, Kourides C, Savva SC, Hadjigeorgiou C, Shamounki M. Obesity in children aged 11 to 12 years in Cyprus. Significant increase during the past 8 years. Pediatriki. 2000;63:137–44. (in Greek).

10. Food and Agriculture Organization. Food balance sheets; 1999–2001 average. Rome, 2003.

11. Loucaides CA, Chedzoy SM, Bennett N. Differences in physical activity levels between urban and rural school children in Cyprus. Health Educ Res. 2004; 19:138–47.

12. Department of Statistics and Research, Ministry of Finance. Statistical Codes of Districts, Municipalities, Communities and Quarters of Cyprus. Series I. Report no 3. Cyprus: Printing Office of Republic of Cyprus; 2000. (In Greek).

13. Meredith HV. Research between 1950 and 1980 on urban- rural differences in body size and growth rate of children and youths. Adv Child Dev Behav. 1982;17:83–138.

14. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. Am J Clin Nutr 2002;75:971–77.

15. Knuiman JT, Hermus RJ, Hautvast JG. Serum total and high density lipoprotein (HDL) cholesterol. Atherosclerosis 1980;36:529–37.

16. Hakeem R, Thomas J, Badruddin SH. Food habits and nutrient density of diets of Pakistani children living in different urban and rural settings. J Health Popul Nutr 2002;20:255–63.

17. McMurray, RG, Harrell JS, Bangdiwala SI, Deng S. Cardiovascular disease risk factors and obesity of rural and urban elementary school children. J Rural Health 1999;15:365–74.

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18. Kosti RI, Panagiotakos DB, Zampelas A, et al. The association between consumption of breakfast cereals and BMI in schoolchildren aged 12–17 years: The VYRONAS study. Public Health Nutr 2008;11:1015–21

19. National Dairy Council. National Diary Council food model comparison cards. Rosemont, IL. 1994.

20. NASCO. Life/form® Replicas & Models. Fort Atkinson, WI.

21. Serra-Majem L, Ribas L, Ngo J, et al. Food, youth and the Mediterranean diet in Spain. Development of KIDMED, Mediterranean Diet Quality Index in children and adolescents. Public Health Nutr 2004;7:931–35.

22. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320:1240–43.

23. Hu FB.Dietary pattern analysis: a new direction in nutritional epidemiology. Curr Opin Lipidol 2002;13:3–9.

24. Lazarou C, Panagiotakos DB, Matalas AL. Level of adherence to the Mediterranean diet among children from Cyprus: the CYKIDS study. Public Health Nutr. Published online by Cambridge University Press 27 Aug 2008 doi:10.1017/S1368980008003431.

25. Tognarelli M, Picciolli P, Vezzosi S, et al. Nutritional status of 8-year-old rural and urban Italian children: a study in Pistoia, Tuscany. Int J Food Sci Nutr 2004;55:381–87.

26. Yannakoulia M, Karayiannis D, Terzidou M, Kokkevi A, Sidossis LS. Nutrition-related habits of Greek adolescents. Eur J Clin Nutr 2004;58:580–86.

27. Roma-Giannikou E, Adamidis D, Gianniou M, Matsaniotis N. Nutrition of Greek children. Pediatrics. 1994;57:496–515. (In Greek).

28. Colic- Baric I, Kajfez R, Satalic Z, Cvjetic S. Comparison of dietary habits in the urban and rural Croatian schoolchildren. Eur J Clin Nutr 2004;43:169–74.

29. Bathrellou E, Lazarou C, Panagiotakos DB, Sidossis LS. Physical activity patterns and sedentary behaviors of children from urban and rural areas of Cyprus. Cent Eur J Public Health. 2007;15:66–70.

30. Yusuf S, Reddy S, Ounpuu S, Anand S.Global burden of cardiovascular diseases: Part II: Variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation 2001;104:2855–64.

31. Vlahov D, Galea S. Urbanization, urbanicity, and health. J Urban Health 2002;79:1–12.

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