

Results from the nationwide CYKIDS study

The CYKIDS (Cyprus Kids Study) was conducted between the years of 2004 – 2006 amongst 1140 preteens school children (9 - 13 years old) and collected data on the diet and physical activity of children. The prevalence of overweight and obesity in this population was 22.7% and 7.6% respectively.

Below, are the summaries of international journals' articles, reporting on the following topics: obesity levels and associated factors, patterns of physical activity, television viewing and sedentary lifestyle, eating habits of children with special reference to the Mediterranean Diet, degree of fasting observance and correlation with health indicators, blood pressure and relation to quality food and physical activity, self-image in relation to food quality and nutrition - eating habits. For more information contact Dr. Lazarus Stalo Dietician-Nutritionist at stalolaz@logosnet.cy.net

1. **Lazarou C, Panagiotakos DB, Panayiotou G Matalas A-L. Overweight and obesity in preadolescent children and their parents, in Cyprus: prevalence and associated socio-demographic factors –the CYKIDS study; *Obesity Reviews*. 2008 May;9(3):185-93.**

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Obesity status differs by socio-demographic factors, but data for Cyprus is scarce. An in-depth understanding of this relationship may be useful in designing public health programmes. The objective of the present study is to estimate overweight and obesity (OW/OB) prevalence among children and adults in Cyprus and identify related sociodemographic variables. National cross-sectional study of 1140 children (mean age 11 +/- 0.98 years) and their parents (mean age 42.5 +/- 5.8 years, total n = 1954). Obesity was defined according to the World Health Organization classification for adults and according to IOTF (International Obesity Task Force) criteria for children. Overweight and obesity prevalence among girls was 18.3% and 2.9%, respectively, while in boys, 19.0% and 6.0%. Among parents, OW/OB prevalence was, respectively, women, 22.6% and 5.8%; men, 47.1% and 14.1%. Logistic regression analysis in both children and adults revealed that the most important socio-demographic predictors of obesity status are factors of built environment. Higher prevalence of OW/OB was observed in adults living in a house as opposed to an apartment, in older adults, in younger children, and in men, irrespective of age. There is a severe obesity problem in the Cypriot population; almost one in two adults and at least one in four preadolescent children are overweight or obese. Prevalence of OW/OB was related to socio-demographic factors, especially among adults and women.

2. **Lazarou C, Kalavana T , Matalas A-L. The influence of parents' dietary beliefs and behaviours, on children's dietary beliefs and behaviours: The CYKIDS study; *Appetite* 2008. Nov;51(3):690-6.**

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We investigated the association between parental dietary beliefs and behaviours (DBB) and those of their children behaviours. Data were derived from a national cross-sectional study using multistage sampling design, among 1140 children (9-13 years). Principal component analysis was employed to extract the main factors out of eight variables assessing children's dietary beliefs and behaviours (N=991); those eight factors were then regressed, on 16 dependent variables, describing different parental dietary beliefs and behaviours, adjusted for potential confounders. Three factors emerged as important in explaining the variance in children's dietary beliefs and behaviours: "guilty about eating" (factor 1), "concerned about own body weight" (factor 2) and "eating all my food" (factor 3). Children with types 1-3 behaviour: were 30% more likely to have parents who did not control what and how much their child ate, have parents who are 40% more likely to think that their child is overweight/obese and seem to have more availability of high fat foods, respectively. Breastfeeding was associated with the acquisition of positive dietary beliefs and behaviours by children, independently of child's age, gender, place of residence, socio-economic status, diet quality, and child's and parents' obesity status. We propose that parents are likely to exert their influence in shaping eating habits and subsequently obesity development in their children, by influencing their children's dietary beliefs and behaviours.

3. **Lazarou C, Panagiotakos D.B. , Matalas A-L. FoodE-KINDEX is associated with reduced blood pressure levels in children: The CYKIDS study.** *Journal of American Dietetic Association.* 2009;109:1070- 1075.

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Dietary modification is, in general, the preferred method when attempting reductions in blood pressure (BP) among adults. In children, however, few studies, have examined the relationship between dietary patterns and levels of BP, and the reported results are conflicting. The objective of this study was to investigate the association between levels of Foods E-KINDEX score and levels of BP in children. Measurements included BP, height, weight, and waist circumference. Diet quality was assessed by the Foods E-KINDEX diet score. The index includes 13 components that assess consumption frequency of 11 major food groups or foods, as well as two cooking techniques (fried and grilled foods). Its score ranges between 0 and 37. A subsample of 622 Cypriot children (mean age=11.7+/-0.83 years) from the CYKIDS national cross-sectional study was used. Logistic regression analysis was performed in order to examine the relationship of systolic BP, diastolic BP, and BP with diet quality (as assessed by the Foods E-KINDEX score). The median systolic BP and diastolic BP were 110 mm Hg (interquartile range [IQR]=100 to 120 mm Hg) and 68 mm Hg (IQR=60 to 70 mm Hg) for boys and 110 mm Hg (IQR=100 to 120 mm Hg) and 63 mm Hg (IQR=60 to 70 mm Hg) for girls, respectively. Mean Foods E-KINDEX score was 23.4+/-4.9 in boys and 24.3+/-4.8 in girls (P=0.487). Compared with children with a low diet score, those with at least an average Foods E-KINDEX score were 57% (odds ratio=0.43; 95% confidence interval: 0.19 to 0.98) less likely to have elevated systolic BP levels, regardless of various potential confounders. The Foods E-KINDEX score is independently associated with lower BP among healthy children. This finding might have implications in public health and should be further explored.

4. **Lazarou C, Panagiotakos D.B. , Matalas A-L. Children's Adherence to the Mediterranean diet in Cyprus: The CYKIDS study;** *Public Health Nutrition.* 2010;12(7):991-1000.

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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.

5. **Lazarou C, Soteriades ESS. Physical activity patterns among preadolescent children in Cyprus: The CYKIDS study; *Journal of Physical Activity and Health*. 2009;6:185-94.**

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PURPOSE: The purpose of this study was to summarize patterns of correlations between variables and reduce a large number of variables to a smaller number of factors. **METHODS:** During 2005 we conducted a national, cross-sectional, multistage study among 1140 children (mean age=10.70+/-0.98). Principal component analysis was employed to extract the main factors out of 21 variables assessing children's duration of physical and sedentary activities. **RESULTS:** Eight factors emerged as important, explaining 63% of the total variance in children's PA patterns. The combined explained variance of 3 factors for exercise was 24.1% (PA and sports after school [11.6%]; home and outside home chores, aerobics, gymnastics, sports [6.8%]; Sports for All, after-school activities [except sports] [5.7%]) and of 5 factors for sedentary activities was 38.9% (video, electronic games, and computers [10.2%]; watching TV, video, and DVD [9.5%]; homework and private lessons [7.3%]; theater cinema, use of mobile phone [6.2%]; afternoon sleep, less private lessons [5.8%]). Further analyses of the emerged factors by gender showed that boys, on a daily basis, are engaged in higher duration in physical activity and sports after school (factor 1) and in electronic games and computers (factor 2), whereas they are engaged in lower durations in factor 4 type behavior (homework and private lessons) and factor 6 type behavior (theater cinema, use of mobile phone). **CONCLUSION:** Use of the above factors will inform further research and enable researchers to identify potential differences in physical and sedentary activities patterns by various environmental and sociodemographic variables. Furthermore, associations of factors by gender may inform public health programs.

6. **Lazarou C, Panagiotakos DB, Matalas A-L. Lifestyle factors are determinants of children's blood pressure levels: The CYKIDS study. *Journal of Human Hypertension* 2009;23(7):456-63.**

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Elevated blood pressure (BP) levels represent an important risk factor for cardiovascular disease. Lifestyle factors associated with increased BP levels have been extensively investigated in adults, but not in children. Therefore, we aimed to explore associations among modifiable lifestyle and levels of BP in 10-to13-year-old children. A subsample of the CYKIDS (Cyprus KIDS) national cross-sectional study consisting of 622 children (11.7 \pm 0.83 years) was used to evaluate the research hypothesis. Measurements included BP, height, weight and waist circumference. Body mass index (BMI) was calculated according to the International Obesity Task Force (IOTF) criteria. Adherence to the Mediterranean diet was assessed by the KIDMED (Mediterranean Diet Quality Index for children and adolescents) diet score, whereas physical activity was assessed through a physical activity index. Results have shown that the cutoff value of 120/80 mm Hg was significantly associated with various lifestyle indices. BMI was positively associated with systolic BP (SBP) $>$ 120 mm Hg (odds ratio (OR)=1.21, 95% confidence interval (CI) 1.11-1.32); diastolic BP (DBP) $>$ 80 mm Hg (OR=1.13, 95% CI 1.01-1.27) and SBP/DBP $>$ 120/80 mm Hg (OR=1.20, 95% CI 1.10-1.31). Moreover, children who reported that they frequently eat while watching television were about two times more likely to have elevated SBP or overall BP, whereas children with low socioeconomic status levels were more than 2.5 times more likely to have elevated BP levels. Finally, compared with those with at least an average KIDMED score, children with low score were 75% less likely to have elevated DBP levels, whereas they exhibited a nonsignificant trend for lower SBP (by 29%) and lower overall BP levels (by 30%). Similar results emerged when the above analyses were repeated using the American reference values. Conclusively, our study suggests that lifestyle factors play an important role in determining BP levels in children; a finding that underlines the importance of lifestyle modifications in children.

- 7. Lazarou C, Kalavana T. The association between urbanization and dietary habits, among children, in Cyprus: the CYKIDS study; International Journal of Public Health. 2009;54(2):69-77.**

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OBJECTIVES: Nutrition transition and urbanization have been linked to the adoption of a Western diet. An increasing number of Cypriots 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 \pm 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.

8. **Lazarou C, Panagiotakos DB, Chrysohoou C, Andronikou M, Matalas A-L. C-reactive protein levels are associated with adiposity in mountainous Cypriot children: The CyFamilies Study.** Journal of Clinical Nutrition [In press]

Conference presentation: Award for best oral presentation. Panhellenic Dietetics' Association conference. 13.11.2009- 15.11.2009

Abstract

Background & Aims: Inflammatory marker levels have long been associated with obesity status in adult populations, but relevant data are scarce in children, especially in diverse races. The aim of this study was thus to examine the association between overall and central obesity and C-reactive protein (CRP) levels in Cypriot children of Greek ancestry. **Methods:** Eighty three children (9.2 ± 1.7 years) were studied. Body mass index (BMI) was calculated according to the age-sex specific International Obesity Task Force(IOTF) criteria while body fat percentage (BF%) was measured via leg-to-leg bioelectric impedance(BIA). Central obesity was defined as waist circumference ≥ 75 th percentile. Physical activity was assessed using a pedometer and diet quality was evaluated by applying the KIDMED index. An inflammatory foods' index, composed of nine foods/food groups, was also calculated. CRP levels were measured using a high-sensitivity (hs) immunoassay. **Results:** Obese children, children with excess BF% and children with $WC \geq 75$ th percentile were 7.35, 6.84 and 7.81-times ($P < 0.05$) respectively more likely to have hs-CRP levels ≥ 0.10 mg/dL; a high score of the dietary inflammation index was positively associated with CRP levels. **Conclusions:** Obesity is associated with increased hs-CRP levels in 6-12 year old children, a finding that supports the inflammation-obesity hypothesis at an early stage of life. Furthermore, frequent consumption of inflammatory foods is positively related to CRP-levels.

9. **Lazarou C, Panagiotakos D.B. Kouta, C , Matalas A-L. "Dietary and other lifestyle characteristics of Cypriot children: Results from the nationwide CYKIDS study."** *BMC Public Health*. 2009 May 20;9(1):147

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BACKGROUND: Dietary and lifestyle behaviors at young ages have been associated with the development of various chronic diseases. Schools are regarded as an excellent setting for lifestyle modification; there is a lack, however, of published dietary data in Cypriot school children. Thus, the objective of this work was to describe lifestyle characteristics of a representative segment of Cypriot school children and provide implications for school health education. **METHODS:** The CYKIDS (Cyprus Kids Study) is a national, cross-sectional study conducted among 1140 school children (10.7 ± 0.98 years). Sampling was stratified and multistage in 24 primary schools of Cyprus. Dietary assessment was based on a 154-item semi-quantitative food-frequency questionnaire and three supplementary questionnaires, assessing dietary patterns and behaviors. Adherence to the Mediterranean diet was evaluated by the KIDMED index (Mediterranean Diet Quality Index for children and adolescents). Physical activity was assessed by a 32-item, semi-quantitative questionnaire. **RESULTS:** Analysis revealed that 6.7% of the children were classified as high adherers, whereas 37% as low adherers to the Mediterranean diet. About 20% of boys and 25% of girls reported "not having breakfast on most days of the week", while more than 80% of the children reported having meals with the family at least 5 times/week. Some food-related behaviors, such as intake of breakfast, were associated with sociodemographic factors, mostly with gender and the geomorphological characteristics of

the living milieu. With respect to physical activity, boys reported higher levels compared to girls, however, one fourth of children did not report any kind of physical activity. **CONCLUSION:** A large percentage of Cypriot school children have a diet of low quality and inadequate physical activity. Public health policy makers should urgently focus their attention to primary school children and design school health education programs that target the areas that need attention in order to reduce the future burden of metabolic disorders and chronic diseases.

10. Lazarou C, Panagiotakos D.B. , Matalas A-L. Physical activity mediates the protective effect of the Mediterranean diet on children's obesity status: The CYKIDS study. *Nutrition (Elsevier 2009); 2010 Jan;26(1):61-7.*

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OBJECTIVE: There is some evidence regarding the association between adherence to the Mediterranean diet (MD) and obesity among adults; to our knowledge, however, no relevant data exist for children. We investigated the association between adherence to the MD and obesity status in children. **METHODS:** A national cross-sectional study among 1140 children (mean age 10.7 \pm 0.98 y) was carried out in Cyprus using stratified multistage sampling design. Body mass index was calculated according to International Obesity Task Force criteria, from parental reference. Adherence to the MD was assessed by the Mediterranean Diet Quality Index for children and adolescents (KIDMED diet score). To test the research hypothesis, a logistic regression analysis was applied with two dependent variable categories of obesity status, normal weight (NW) versus overweight/obese (OW/OB), and the three categories of the KIDMED score independently, after controlling for several potential confounders. **RESULTS:** Compared with low MD adherers, children with a high KIDMED score were 80% less likely to be OW/OB (95% confidence interval 0.041- 0.976), adjusted for age, gender, parental obesity status, parental educational level, and dietary beliefs and behaviours (model 2). When physical activity was taken into account, however, the aforementioned relation was not significant (model 3; odds ratio 0.20, 95% confidence interval 0.021-1.86). Furthermore, male gender, maternal obesity, and dietary beliefs and behaviors emerged as more significant in predicting obesity in children compared with their KIDMED score. **CONCLUSION:** Adherence to the MD is inversely associated with obesity in this sample of 9- to 13-year-old children; however, other behaviors, and in particular physical activity, maternal obesity, dietary beliefs and behaviors, seem to be more significant.

11. Lazarou C, Soteriades ESS. Children's TV watching, physical activity and obesity in Cyprus: the CYKIDS study. *European Journal of Public Health 2010 Feb;20(1):70-7.*

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BACKGROUND: Even though there is a severe obesity problem in Cyprus, information about the contribution of predisposing lifestyle factors is limited. Our aim was to investigate the relationship between physical activity (PA), sedentary behaviour and various obesity indices [i.e. body mass index (BMI), waist circumference (WC), percentage of body fat (BF%) and 'total & abdominal obesity'(TAO)]. **METHODS:** A national cross-sectional study of 1140 children (mean age = 10.7 \pm 0.98 years) selected by multistage sampling in Cyprus was conducted during 2004-05. Children completed a 32-item, semi-quantitative PA questionnaire, which assessed organized and free-time PA and sedentary behaviours. Weight, height and WC were collected from a

random sub-sample of 622 children and obesity was defined by IOTF criteria. Body fat percentage was calculated, and TAO status was computed based on obesity status and WC [i.e. (i) both BMI/WC, (ii) either BMI/WC abnormal and (iii) both BMI/WC abnormal]. Linear and logistic regression analyses with obesity indices as dependent variables were applied after adjusting for several potential confounders. RESULTS: Only variables describing sedentary behaviours were retained in the final regression models in both boys and girls. Girls who spent ≥ 4 h/day on TV and DVD watching were almost three times more likely to be overweight or obese [OR = 2.84 (95% CI 1.08-7.47)], three times more likely to have WC ≥ 75 th percentile [OR = 3.25 (95% CI 1.06-9.98)] and 3.5 times more likely to have $\geq 30\%$ body fat [OR = 3.63 (95% CI 1.01-12.98)], while in boys, even though the same variable was retained in almost all final models, it did not reach statistical significance. CONCLUSION: Sedentary behaviours such as TV watching may be more important predictors of children's various obesity indices than PA behaviours. Interventions targeting sedentary behaviours, such as TV watching, may help in the prevention and treatment of obesity among Cypriot children.

12. Bathrellou E, Lazarou C, Panagiotakos DB, Sidossis LS. **Physical activity patterns and sedentary behaviors of children from urban and rural areas of Cyprus.** *Central European Journal of Public Health* 2007; 15 (2): 66–70

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BACKGROUND: A sedentary lifestyle among children is becoming increasingly common and has been linked to future risk of degenerative diseases. Urban residence has been suggested to be a contributing factor to a less active lifestyle; however, not all available studies support this link. In the present study we examined the physical activity patterns and sedentary behaviours of children living in urban and rural areas of Cyprus, where major demographic shifts have occurred the last decades. METHODS: We studied 1140 children (531 boys; 609 girls), aged 10-12 years, registered in 24 selected elementary public schools from five urban and rural districts of Cyprus. Children completed a semi-quantitative physical activity questionnaire regarding frequency and duration of everyday physical and sedentary activities. Weight and height of the children, as well as demographic and socioeconomic information was collected from children and their guardians. RESULTS: Rural children reported being slightly more active after school and occupied weekly with outdoors chores compared to urban children, who on the other hand reported engaging in sports on a weekly basis more than their rural peers (all $p < 0.10$). However, the average weekly time spent by urban and rural children on vigorous (8.6 ± 4.7 and 9.1 ± 4.8 h/w, respectively; $p = 0.193$) or moderate-to-vigorous (14.9 ± 7.6 and 15.2 ± 7.6 h/w, respectively; $p = 0.612$) activities, as well as total screen time, were not different. The distribution of children with regards to most other physical activity and inactivity pursuits was similar between urban and rural areas. CONCLUSION: We found no substantial differences in the physical activity habits and sedentary behaviours among children living in urban and rural areas of Cyprus. Hence public health awareness directed to enhance physical activity and decrease sedentary lifestyle among youngsters should focus equally to urban and rural children.

13. Lazarou C, Matalas A-L. Lazarou C, Matalas AL. **A critical review of current evidence, perspectives and research implications of diet-related traditions of the Eastern Christian Orthodox Church on dietary intakes and health consequences.** *International Journal of Food Science and Nutrition*. 2010 May 12. [Epub ahead of print] PubMed PMID: 20459365.

Certain dietary guidelines which provide for a type of periodic vegetarianism, during a total period of 180-200 days in a year, are prescribed for symbolic and spiritual reasons in Eastern Christian Orthodox Church (ECOC); however its potential implication on health has only recently begun to be investigated. We aimed to review evidence on the potential association of ECOC's dietary guidelines to health and disease indices and explore research and dietetics' practice perspectives. Eleven publications were identified, providing data from prospective, cross-sectional, and case-control studies conducted among adults and from one cross-sectional study, among children. Data retrieved suggest that compared to non fasters, adult and child fasters enjoy better dietary quality and have healthier blood lipid profiles. The available evidence however, is very limited and further investigation is warranted. It is being deemed important that dietitians and health professionals are able to exploit this dietary scheme of periodic vegetarianism and advise the ECOC adherents on how to further improve their meal planning.