

Dietary patterns, overweight and obesity rates in children aged 9-12 in primary schools of Greek island Lemnos

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A-Conception and study design; **B** -Collection of data; **C** - analysis; **D** - Writing the paper; **E** - Review article; **F** – Approval of the final version of the article; **G** - Other

ABSTRACT

Purpose: Children obesity consists a fundamental problem of public health in Greece. The understanding of the factors which is correlated to is a requirement for the implementation of intervening policy and treatment. The aim of the study was to investigate the dietary habits of the students in Lemnos Island and their correlation to obesity and overweight rates.

Materials and methods: 130 students of the 4th, 5th and the 6th grade from three primary schools of Lemnos Island completed a food frequency questionnaire (FFQ). A weigh measurement followed BMI calculation with the use of growth charts in order to estimate the rates of obese, overweight and underweight children. Correlations were carried out between children dietary patterns and their BMI.

Results: The majority of the children follow a balanced diet according to the nutritional reco-

mmendations. The obesity prevalence and the overweight rates of the Lemnos students was 8.2% and 16.4%, respectively. 72.4% of the students had normal weight, whereas 3% of them were underweight. There was no correlation of obesity/overweight rates with the dietary patterns and physical activity. Boys consume breakfast more frequently in comparison to girls and are more occupied with athletic activities. In the 4th grade the breakfast consumption was more frequent in comparison to the 6th grade.

Conclusions: The students of Lemnos appear low rates of overweight, in comparison with other studies in Greek land, by following a balanced diet. The environment and the living conditions of the children on the island may contribute to adapting a healthier way of living.

Key words: Children, obesity, nutritional habits

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INTRODUCTION

The World Health Organization (WHO) defines obesity as excess fat mass, so as cause increased morbidity risk, change of physical, psychological, social status or well-being. At the last decade, obesity is one of the most important public issues in both adults and children [1]. Childhood obesity has been recognized as an epidemic in most developed and developing countries and has classified as one of the most important health problems worldwide [2], giving the fact that the growing trend of childhood obesity can lead to increasing morbidity and mortality in adulthood [3]. In 2010 it was estimated that 43 million children worldwide were overweight or obese and 92 million were at risk of being overweight [4]. In 2013 it was estimated that 2 billion people were overweight or obese. In the same year in the developed countries it was found that 23.8% of boys and 22.6% of girls (children and adolescents) were overweight or obese [5]. According to the World Health Organization's 1 in 3 children aged 11 years in Europe are obese or overweight [6].

Childhood obesity is a health problem of high importance in Greece. Particularly, in 2001 the percentages of overweight children aged 10-16 accounted to 14.8% [7], while in 2002 in a sample of children aged 11.5-15.5 it was found that 9.1% of girls and 21.7% of boys were overweight and 1.2% of girls and 2.5% of boys were obese [8]. In 2006 it was found that 25.8% and 14.8% of Greek children aged approximately 9 years old were overweight and obese respectively [9]. In 2010, the 44% of boys and 38% of girls in Greece were overweight and obese [10].

The childhood obesity increases the risk of multiple and chronic medical problems and psychological problems, such as low self-esteem and depression, which may persist into adulthood and affect negatively the quality of life [11]. It is a health problem that could be faced by multifactorial ways with basic aim to change the lifestyle (eating habits, exercising, education of the behavior of parent and child), following drugs therapy and in selected cases by surgical treatment [6]. Studying the factors that could lead to obesity, such as the large food consumption, the reduced physical activity and the family and friendly child's environment, nutritionists could suggest alternative ways to deal with the problem, based on the nutritious agricultural products of the Mediterranean diet.

The purposes of this study was to investigate the nutritional habits of children aged 9-12 years old in primary schools of Lemnos, an island of North Greece, and their

correlation with obesity and overweight rates, given that the socioeconomic characteristics of Lemnos' population, as mainly agricultural region, may affect the nutritional attitudes of inhabitants and especially children.

MATERIALS AND METHODS

Subjects

130 students of 4th, 5th and 6th class, aged 9-12 years, from three schools of Lemnos island, Greece, the 1st and 3rd Primary School of Myrina and the Atsiki's Primary School, were voluntary participated to the study after their parents sign of participation form. The three schools were randomly selected from the total primary schools of Lemnos. Specifically, 59 students participated from the 1st Primary School of Myrina, 44 from the 3rd Primary School of Myrina and 27 children from the Primary School of Atsiki.

Study design

The study conducted in collaboration with Primary Address of Lesvos, Ministry of Education of Greece from October 2014 to June 2015. The protocol of the study and informed consent were in compliance with the Helsinki Convention and were approved by local Ethics Committee. Children who participated to the study completed, with the help of the University team and the teachers, a Food Frequency Questionnaire (FFQ) with aim to investigate their nutritional habits. Then, children's height and weight were measured for Body Mass Index (BMI) calculation. The weight was measured with an analytical scale (Tanita BC-545N) and the height with a stadiometer (Gima Tape Height Measure).

Dietary patterns evaluation

The food frequency questionnaire (FFQ) used was configured to check if the children follow the dietary recommendations according to the Mediterranean diet pattern, namely the frequency of specific food groups consumption [7]. In the first part of the questionnaire the gender and class was recorded. In the second part the frequency of cereal, rice / pasta, fruit, vegetables, dairy, legumes, fish / seafood, red meat, oily food, fast food, carbonated soft drinks, fruit juices, standardized juices, salty and sweet standardized snacks consumption was recorded. The possible answers were "every day", "1-2 times a week", "3-5 times a week" and "never". The third part consisted of 5 multiple choice questions. The 1st question assessed whether eating breakfast or not. The 2nd question focused on the origin of their school's snack with

possible answers "Standardized (from the bakery / refreshment)" or "Homemade (fruit / sandwiches / toast)". The 3rd and 4th questions focused on how many times per week they spend their free time by doing extracurricular activities and playing electronic games. The possible answers were "Every day" or "3-5 times a week" or "1-2 times a week". The 5th and last question requested children if they believe that they generally eat healthy.

Obesity, overweight and underweight rates calculation

Student’s classification according to their weight (obese, overweight, underweight and normal weight) was performed using the growth charts, which are considered as the most useful nutritional assessment tool for children at all stages of development. The growth charts of Body Mass Index (BMI)-age-gender which used are based on the Greek population [12]. BMI of each student was calculated according to the data of height and weight that was measured. Children with BMI between the 5th and 85th percentile of the growth charts were considered to have normal weight. Children with BMI between the 85th and 95th percentile were considered overweight, while if BMI was above the 95th percentile children were considered obese and under 5th percentile were considered underweight [13].

Statistical Analysis

The statistical analysis of the survey data was performed with the SPSS 17.0 program (Statistical Package for Social Sciences). The variables used in the present study were mainly categorical, however few were continuous. Initially it was performed grouping data to examine analytically the results in which we wanted to focus and study. The results were performed by frequency distribution (Frequencies) and specifically by using Descriptive Statistics. Associations between categorical variables were examined using the χ^2 test. Differences was considered significant at $p < 0.05$, Coefficient Interval 95%.

RESULTS

From 130 children who completed the questionnaires, 68 students were girls and 62 students were boys. Table 1 presents the classification of Lemnos’ children according to the prevalence of their weight. Regarding to the total sample, the prevalence of obese and overweight students were 8.2% and 16.4% respectively, while the highest range of students (72.4%) had a normal weight and only 3% were underweight. Boys presented higher prevalence of obesity and overweight and specifically 24.2% and 9.7% of the boys were overweight and obese respectively, whereas the prevalence of overweight and obesity at girls was 10.3% and 5.9%, respectively.

Table 1. Prevalence of overweight, obesity, underweight and normal weight in Lemnos’ students

	Weight classification of Lemnos’ students					
	Boys (n= 62)		Girls (n= 68)		Total (n=130)	
Weight classification	n	%	n	%	n	%
Underweight	1	1.6	2	2.9	3	3.0
Normal	40	64.5	55	80.9	95	72.4
Overweight	15	24.2	7	10.3	22	16.4
Obese	6	9.7	4	5.9	11	8.2

The students’ dietary patterns and specifically the frequency of specific foods consumption and their activities rates are presented in Table 2. Most of children answered that consume pastries and cereals, fruit and vegetables, dairy products, fresh juices and breakfast on a daily basis. Less often, namely 1-2 times a week, the highest percentage of the

students responded that consumes pasta, legumes, fish and seafood, red meat, oily foods, fast foods, salty and sweet snacks, drink carbonated beverages and standard juices. The majority of the students (79.89%) answered that consume breakfast daily. Most of the participants stated that usually consume homemade snacks at school. Also, an equal

percentage of children answered that they are engaged with curricular sports daily and 3-5 times a week (approximately 2 hours each

time). Finally, the majority of children, answered they believe that follow a proper and healthy diet.

Table 2. Dietary patterns and children’s pastime with extracurricular activities or electronic games

Food Groups/Activities	Dietary patterns and pastime of Lemnos’ students			Never
	Every day	3-5 days/week	1-2 days/week	
Bakery-Cereals	64.60%	19.50%	14%	1.80%
Pasta	4.90%	40.90%	51.80%	2.40%
Vegetables	56.70%	25.60%	12.20%	4.30%
Fruit	71.30%	20.70%	6.70%	0.60%
Dairy	50.00%	29.30%	18.30%	0.60%
Legumes	11.00%	30.50%	55.50%	3.00%
Fish/ Seafood	1.20%	20.10%	71.30%	7.30%
White meat	0.60%	23.20%	70.70%	4.30%
Red meat	1.20%	11.60%	71.30%	13.40%
Oily food	7.30%	25.00%	54.30%	11.60%
Fast food (junk food)	2.40%	6.70%	70.10%	17.10%
Carbonated beverages	3.70%	15.20%	42.70%	37.20%
Fresh juices	54.30%	26.80%	14.60%	1.80%
Standard juices	9.80%	19.50%	54.30%	14.60%
Salty snack	1.20%	12.80%	56.70%	26.20%
Sweet snack	6.10%	17.10%	59.80%	15.90%
Extracurricular activities	39.60%	39.60%	19.50%	0.60%
Electronics games	15.90%	15.90%	48.80%	18.90%

After carrying out correlation analysis between students’ BMI and weigh state (normal, underweight, overweight, obese) with specific factors, was observed that BMI and weight state was not associated with dietary patterns (food frequencies) and also with weekly sports activities (data are not shown) ($p > 0.05$).

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A correlation between the frequency of oily food consumption and the students’ gender ($p < 0.05$) was observed. Specifically boys consume more often oily food (eg vegetables cooked with olive oil) than girls (35.1% of boys and 16.6% of girls consumed 3-5 times per week oily food, respectively). Moreover, a

correlation between gender with the daily breakfast’s consumption, the weekly sports activities and the time student spend playing computer games was also observed. Specifically, the boys consume more often breakfast (87.8% daily), involved in sport activities (49.7% daily) and play more systematically computer (21.6% daily) games than girls (74.4%, 32.6% and 10.5% respectively) (Table 3).

No correlation was observed between food frequency consumption with students’ age ($p > 0.05$). Nevertheless, participants’ age was associated with the daily consumption of breakfast and the weekly sport activities (Table 4). Especially, the students in the 4th class (9 years old) appeared increased breakfast consumption and physical activity ($p < 0.05$). 86.8% of students of 4th class answered that consume breakfast daily and 52.8% that have physical activity daily, while the percent for the other classes was 75% and 32% respectively.

Table 3. Correlations between participants' gender with oily food consumption, breakfast consumption, weekly sports activities and computer games

Correlation of Gender - Pearson Chi-Square			
	<i>Value</i>	<i>df</i>	<i>Pv</i>
Oily food	8.423	3	0.038
Daily breakfast	5.868	1	0.015
Weekly Sports Activities	10.756	3	0.013
Computer games	11.422	3	0.01

Table 4. Correlations between age with breakfast consumption and weekly sports activities

Correlation of Age - Pearson Chi-Square			
	<i>Value</i>	<i>df</i>	<i>Pv</i>
Daily breakfast	6.189	2	0.045
Weekly Sports Activities	14.938	6	0.021

DISCUSSION

The first important finding of this study was that the majority of pupils aged 9-12 years in the Greek island Lemnos had normal weight and the prevalence of overweight were relative lower than the average of Greek children population. Specifically, in our study 16.5% of children were overweight, 8.2% were obese, 3% underweight and 72.4% had normal weight. Compared with some studies conducted in Greece in sample of children with similar age, it is observed that the rates of obesity and especially overweight, which note Lemnos' students, was at lower levels than children in the rest of Greece. In Pyrgos Ilias, the children's rates of obesity were 8.6% and of overweight were 18.6% [14]. In Ioannina the rates of obesity were 9.6% and overweight were 34.3% [15]. In Thessaloniki the rates of obesity and overweight in children aged 6-10 years were 4.1% and 22.2% respectively [16].

In 2005 in Athens the obesity was close to 11.1% and overweight to 27.1% [17], while in a sample of children 4-10 years old in north Greece were 14% [18]. The geographic and socioeconomic characteristics of Lemnos could explain these results, giving the fact that Lemnos is an agricultural area that gives to children the ability to be more active and consume more natural foods.

The second important finding reported herein was that children in Lemnos seem to

follow dietary habits close to the dietary recommendations and in accordance with the basic patterns of Mediterranean diet. More specifically, the majority of children of the total sample consume daily pastries, fruits, vegetables, juices and dairy products. They also consume pasta, legumes, fish / seafood, white and red meat, oily and " ready " fast food type food, sweet and savory snacks, drinks standard juices and carbonated soft drinks 1-2 times a week. Additionally, the majority of children consume breakfast daily, while the snack at school is homemade. The students are active in sports or other physical activities daily or 3-5 times a week, whereas play computer games 1-2 times a week. Therefore, it seems that children follow generally balanced diet closed to Mediterranean, while they devote considerable time for physical activities. It is underlined that a limitation of the study is that the questionnaires responses were containment, which focused on a weekly scale. Some answers were therefore probably be reasonable in approach, for example if some kids eat special food about 2 or 3 times a month may be answered either that consume '1-2 times" or " never " in the week.

As well known the Mediterranean diet recommends daily consumption of fruits, non-starchy and starchy vegetables, unprocessed cereals, dairy products low in fat, legumes, unsaturated and monounsaturated fats (olive oil and nuts). It is recommended weekly

consumption of eggs, fish, seafood, and poultry. Also, monthly recommend red meat consumption and even more limited consumption of sweet and savory snacks [19]. Several studies have been carried out in order to assess the dietary habits of children compared to the Mediterranean diet, and they usually used the KIDMED index. In a study of Spain in children and adolescents aged 2-24 years found that 46.4% of them followed an optimal Mediterranean diet [20], while in a study in Greece with children aged 3-18 years, 11.3% of children and 8.3% of adolescents followed the principles of the Mediterranean diet. Older data support that younger generations modestly followed traditional eating habits of Mediterranean countries [21]. Also noteworthy is that the last few decades the time children and adolescents devote in physical activity have been changed, as the time children spent watching television or computer has been increased and the opportunities for physical activity in schools and communities have been reduced [7].

In our study, we observed that the students of Lemnos seems to adopt dietary habits that are closed to Mediterranean diet; nevertheless, a basic limitation of the study was that we did not use any research tool for this assessment, such as KIDMED index or other. Furthermore, another limitation of the study is the relative small sample. The children in Lemnos Island follow balanced diet, which is in accordance with the low percentages of overweight and obese. This could be explained by the geographical characteristics of the island, the agricultural region, which promote the increased production of fruits, vegetables, the fishery and the lack of urban characteristics, which may be correlated with decreased fast food consumption and increased physical activity [22]. Regarding to physical activity, it supposed that the regional characteristics of the Island permit children to spent more time in physical activities and this explain that 80% of the sample answered that had extracurricular activities every day or 3-5 days per week.

The third important result of this study was that the weight classification of the children as normal, overweight, obese or underweight, was not associated with any of their eating habits and physical activity. The overweight is a problem that exists in Greece and in other Mediterranean countries and likely to be associated with reduced physical activity in combination with the extremely high energy balance [19]. As reference of body weight and obesity, some researchers observed an inverse association between dietary habits and specifically the Mediterranean diet with BMI

[23,24], whereas others found no association [19]. The results of study, which took place in Greece, indicated correlation and protective effect between the selected dietary behaviors, such as consumption of breakfast and adherence to the Mediterranean diet, with obesity or overweight in children and adolescents [21]. However, according to other studies the correlation of the Mediterranean diet and overweight or obesity is complex. There are limitations and methodological differences between the studies, which lead to difficulties in comparison of the results. Although all the data is contradictory, there is evidence for possible protective effect of the Mediterranean diet in the prevention of obesity or overweight [25].

Another important finding of our study was that about 80% of the students consume daily breakfast. Nevertheless, the daily breakfast consumption was not correlated with the BMI and weight classification of children in the total sample. Several studies have shown a correlation between consumption of breakfast with BMI. In a systematic review Szajewska and Ruszczyński (2010) concluded that eating breakfast may reduce the risk of children becoming overweight and obese, while skipping breakfast is associated with increasing BMI [26]. In Greek schools of Attica region [27] and Pyrgos Ilias [14] a negative correlation between breakfast cereals consumption and childhood obesity was found. It is noted that BMI correlation factor is not only the skip or the consumption of the meal, but the quality and type of food consumed at breakfast [28].

In our study, the physical activity, which included in the standards of the normal lifestyle, was not correlated with the BMI and weight classification of children. Similar results were recorded in 2010 in other study of Greek population [25]. Wareham et al (2005) concluded that the increasing prevalence of obesity caused by reducing energy expenditure from physical activity. Long-term studies show that high levels of physical activity may lead to low probability for weight gain. However, studies differ in their conclusions for various reasons, such as methodological differences. The majority of studies indicate weak correlation between low levels of activity and future weight gain [29].

Although no correlation was observed in this study between BMI, weight classification and physical activity with dietary habits, correlations were detected regarding to student age and gender. Specifically, boys consume more often oily food and breakfast, involved in sport activities and play computer games more systematically than girls. This finding is in contrary with the result that 24% of boys and

10.3% of girls are overweight, while 9.7% of boys and 5.9% of girls are obese; thus it seems that boys have higher rates of overweight and obesity than girls. It is possible that the energy consumption of boys is greater than their energy expenditure, despite their increased physical activity. Also, in this study students that eat breakfast daily, belong mainly to the fourth grade, while fewer belong to fifth and sixth grades. This could indicate that the lower age of children, the better nutritional habits and physical activity they follow.

CONCLUSION

The study concluded that children aged 9-12 years old in Lemnos Island seem to follow a balanced diet, closed to Mediterranean diet, and have decreased rates of overweight in comparison with other studies in Greek land. No correlation between their BMI and dietary patterns was observed. The environment and the living conditions of the children on the island may contribute to adapting a healthy way of living.

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Conflicts of interest

There is no any commercial, financial, or other associations that could pose a conflict of interest in relation with this article.

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