Socio-economic and demographic determinants of childhood obesity prevalence in Greece: the GRECO (Greek Childhood Obesity) study

Paul Farajian1, Demosthenes B Panagiotakos2, Grigoris Risvas1, Konstantina Karasouli1, Vasiliki Bountziouka2, Nikolaos Voutzourakis1 and Antonis Zampelas1,*

1Unit of Human Nutrition, Department of Food Science and Technology, Agricultural University of Athens, Iera Odos 75, Athens 11855, Greece; 2Department of Science of Dietetics–Nutrition, Harokopio University, Athens, Greece

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Abstract

Objective: Given the rapid increase in the prevalence of childhood obesity, identifying the sociodemographic influences on obesity status is important for planning and implementing effective prevention initiatives. However, this type of data is limited for Greek children. Therefore the aim of the present study was to identify possible sociodemographic factors associated with childhood obesity at the national level.

Design: Cross-sectional, population-based survey, carried out from October to May 2009.

Setting: Under the context of the GRECO (Greek Childhood Obesity) study, a nationwide sample of 2315 primary-school children.

Subjects: Children aged 10–12 years and their parents were voluntarily enrolled. Direct anthropometric measurements of the children were obtained and information on sociodemographic characteristics of the parents, as well as their self-reported values of body weight and height, were collected.

Results: Overweight and obesity prevalence was 29.5% and 13.1%, respectively, among boys; 29.5% and 9.0%, respectively, among girls. Multiple logistic regression analysis revealed that the most important sociodemographic predictors of childhood obesity were mother’s age, parental BMI classification and father’s type of occupation. More specifically, increased mother’s age and normal BMI status of the parents seemed to have a protective effect on the likelihood of having an overweight/obese child. Additionally, the odds of a female child of being overweight/obese were reduced when the father’s type of occupation tended to be less manual.

Conclusions: Anti-obesity health policy interventions have to address to the parents and promote their active involvement, to effectively confront the alarming magnitude of the paediatric obesity problem in Greece.

Obesity among children and adolescents is a growing public health problem. Previous cross-sectional studies conducted at local and regional level have reported that the prevalence of childhood obesity in Greece is among the highest in Europe(1). According to Lobstein and Frelut(2), who provided estimates of the prevalence of overweight/obesity in European countries, Greece was ranked fourth highest in obesity rate for 7–11-year-olds. Recently published results from the GRECO (Greek Childhood Obesity) study(3), using nationally representative data from 10–12-year-old children and classification according to the International Obesity Taskforce cut-offs, verified the alarming magnitude of the paediatric obesity problem in all areas and regions of Greece, showing that the overall prevalence of overweight was 29.5% and the prevalence of obesity was 11.7%, the highest ever reported in Greece.

The rapid increase in the prevalence of obesity in Greece during recent decades suggests that behavioural factors play a primary role, these being influenced by genetic, social and economic environments. Although obesity and particularly childhood obesity has a multifactorial nature, it has been shown that obesity status differs by social class and demographic factors(4,5). However, a recent review by Shrewsbury and Wardle(5) highlighted the fact that the relationship between childhood overweight/obesity and socio-economic status (SES) depends on the SES indicator used and that, consequently, it is important to identify the correct sociodemographic influences on obesity status in contemporary societies in order to design and implement...
effective prevention initiatives. Early prevention is more effective in managing the epidemic of obesity, in comparison with treating obesity in later life.

For the Greek childhood population, such data are scarce and sometimes conflicting. This is probably because they have predominantly been derived from regional studies with populations of different cultural backgrounds, or because of the different SES indicators used. Therefore the aim of the present paper, under the context of the GRECO study, was to identify and present for the first time several possible socio-economic and demographic factors that are associated with the very high childhood obesity rate at the national level.

Methods

Sampling

The GRECO study was carried out from October to May 2009. A stratified sampling scheme by age and sex group, based on the population distribution (National Statistical Services, 2001 census) in ten regions of the whole country (i.e. Attica, Macedonia, Peloponnosis, Sterea Ellada and Evia, Ipeiros, Thessalia, Thrace, Aegean islands, Ionian islands and Crete), was used to obtain a representative sample of 5000 children. The number of children had been pre-specified using statistical power calculations in order to achieve 85% power at 5% type I error when evaluating odds ratios equal to 1-10. Thus, using also the official catalogues provided by the regional directorates of primary education, a total of 5859 fifth and sixth grade schoolchildren from fourteen prefectures were invited for potential inclusion. The prefectures were grouped based on their population into ‘large urban areas’ with a population size greater than 1 000 000 inhabitants and ‘urban and semi-urban areas’ with a population size ranging from 10 000 to 100 000 inhabitants.

The number of schools that agreed to participate in the GRECO study was 117 from all over the country (fourteen prefectures). From the overall number of children who were invited to participate in the study, signed parental consent forms were obtained for 4965 children (corresponding 84.9% participation rate). After checking the quality of the data obtained from the children and whether participants met the criteria for inclusion in the analysis, the resultant sample consisted of a total of 4786 children.

The research and all methods used in the study were approved by the Hellenic Ministry of Education (Department of Primary Education) as required by law for any study conducted in the school environment, during formal school hours, in Greece and the Agricultural University of Athens Research Committee. Before the initiation of measurements, an extended letter explaining the aims of the study was sent to the principal of each primary school. Additionally, each parent or guardian having a child in the contacted schools was provided with a letter explaining the aims of the study and a consent form. Those parents who agreed to participate in the study had to sign the consent form and send it back to the school.

Children’s anthropometry and obesity definition

The measurements were conducted by investigators and staff of the Unit of Human Nutrition of the Agricultural University of Athens. All investigators followed a series of planning meetings and were trained in survey methods in training sessions that included practical experience in weighing and measuring techniques. Additionally, before the initiation of the study all investigators followed a two-week practice period in primary schools that were not included in the final study sample in order to get familiarized with the procedures. All study sites used the same measuring equipment and procedures and in each class the team of investigators consisted of at least two people.

All measurements were performed during morning hours. Body weight was recorded to the nearest 100 g with the use of a digital scale (Tanita TBF 300, Japan) and with the child standing without shoes in light clothing. Standing height was measured using a portable stadiometer (Leicester height measure, Germany) to the nearest 0.1 cm without shoes, with the head positioned in the Frankfort plane. BMI (kg/m²) was calculated by dividing body weight in kilograms by the square of standing height in metres. Waist and hip circumferences were measured to the nearest 0.1 cm with the use of a non-elastic tape (Seca, Germany) and with the child in standing position. Waist circumference was measured at the end of a gentle expiration after placing the measuring tape in a horizontal plane around the trunk, midway between the lower rib margin and the iliac crest. Obesity and overweight among children were calculated using the International Obesity Taskforce age- and gender-specific BMI cut-off criteria (6).

Information obtained from parents/guardians

Information on socio-economic and demographic characteristics, such as parents’ age, current weight and height, years of education, annual family income, employment status, profession, type of occupation (manual workers (lower values) to executive/skilled workers (higher values)) and ownership of the residence, was collected via a questionnaire, attached to the consent form. Parents were also asked about the frequency of physical activity alone or together with their children, as well as the frequency of meals consumed with the whole family and the frequency of meals ‘out of home’. Of the 4786 consent forms obtained, in the case of 2318 children we also obtained answered parental questionnaires. Parental obesity and overweight percentages were estimated from self-reported values of body weight and height. BMI was calculated and BMI measures were used to define adult (parental) obesity (BMI ≥ 30 kg/m²) and overweight.
Obese 136
Normal weight 595
(BMI = 25–0–29 kg/m²) according to the WHO classification[17]. The final number of parental questionnaires
and families included in the analysis of the present paper was 2315.

Working sample
In the present paper, data from 2315 children (45% males
and 55% females) for whom information about body
weight and height was available, as well as the parents’
questionnaire was completed, were used. The studied
(working) sample can be considered representative of
the overall study population (i.e. the 4786 children included
for analysis in the GRECO study) with regard to age and
BMI distributions (P > 0.05), as differences in age group
and BMI distributions were not evident (working sample v.
overall sample: 24% v. 24% aged 10 years, P = 0.79; 49% v.
t. 48% aged 11 years, P = 0.70; 27% v. 28% aged 12 years,
P = 0.56; 60% v. 60% normal weight, P = 0.99; 29% v.
29% overweight, P = 0.99; 11% v. 11% obese, P = 0.99).
However, differences were revealed regarding gender
(P < 0.05) and regional distribution (P < 0.01). Specifically,
the working sample comprised 45% boys (v. 49% of
the overall sample, P = 0.027) and 46% were from urban
areas (v. 52% of the overall sample, P = 0.002).

Statistical analysis
Continuous variables are presented as means and standard
deviations, and categorical variables as frequencies and
percentages. The normality of continuous variables was
tested graphically according to P-P and Q-Q plots. Compar-
sions of continuous variables between groups were
performed using the independent-samples t test (for vari-
ables that were normally distributed). Associations between
categorical variables were tested using the Pearson χ² test
(bivariate level), while correlations between continuous
variables were performed using Pearson’s r. Unadjusted
(univariate; i.e. child’s gender, child’s age, mother’s and
father’s age, mother’s and father’s type of occupation,
mother’s and father’s educational level, place of residence,
animal family income and parental BMI classification) and
multiple logistic regression analysis were used to evaluate
the main effect of several sociodemographic characteristics
on childhood obesity prevalence. Variables included in the
model of multiple logistic regression analysis were selected
according to the results of unadjusted models (i.e. P < 0.05)
and as such to avoid collinearity. Specifically, child’s age
and gender, mother’s age, father’s type of occupation,
father’s educational level, place of residence, annual
family income and parental BMI classification were includ-
ed in the final model. Results are presented as odds
ratios and the corresponding 95% confidence intervals. The
Hosmer–Lemeshow statistic was used to test the models’
goodness-of-fit. All tested hypotheses were two-sided.
P < 0.05 was considered as statistically significant. The
PASW Statistics 18 statistical software package was used
for all calculations (SPSS Inc., Chicago, IL, USA).

Results
The mean age of the 2315 children with anthropometric
measurements and information regarding sociodemographic
factors of their parents was 10.87 (SD 0.73) years, with 54%
and 46% coming from large urban and urban plus semi-
urban areas, respectively. In order to check for any bias
regarding the data analysis of the sample of children used
in the present study compared with the children for whom we
did not obtain parental information, we compared the BMI
of the two groups and found no differences (P > 0.05).

The descriptive characteristics of the population and
the prevalence of overweight and obesity according to
gender are presented in Table 1. In addition, comparisons
of normal-weight and overweight/obese schoolchildren in
relation to several sociodemographic factors and parental
BMI classification are presented in Table 2. Concerning the
obesity status of the parents, 25.5%, 55.2% and 19.3% of
the fathers and 65.3%, 26.7% and 8.0% of the mothers
were classified as normal weight, overweight and obese,
respectively. BMI of the mothers and fathers was posi-
tively correlated with BMI and waist circumference of
the children, in both genders (P < 0.001). Furthermore, no
differences were observed in the prevalence of overweight,
obesity or overweight/obesity combined in the overall
sample and in both genders according to residence in large
urban or urban plus semi-urban areas (P > 0.05 for all).

Table 1 Descriptive characteristics of the population and prevalence of overweight and obesity according to gender: nationwide sample of primary-school children aged 10–12 years, GRECO (Greek Childhood Obesity) study, October–May 2009

<table>
<thead>
<tr>
<th>Boys (n 1037)</th>
<th>Girls (n 1278)</th>
<th>Total (n 2315)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Age (years)</td>
<td>10.91</td>
<td>0.75</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>20.47</td>
<td>3.97</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>70.50</td>
<td>10.23</td>
</tr>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Normal weight</td>
<td>595</td>
<td>57.4</td>
</tr>
<tr>
<td>Overweight</td>
<td>306</td>
<td>29.5</td>
</tr>
<tr>
<td>Obese</td>
<td>136</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Downloaded from https://www.cambridge.org/core. IP address: 54.191.40.80, on 08 Apr 2017 at 08:26:42, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/S1368980012002625
Regarding the physical activity levels of the parents, 40% of the fathers and 42% of the mothers were considered as physically active. Differences regarding the categorization of the parents according to their physical activity levels and the prevalence of overweight/obesity in their children were observed only for the fathers ($\chi^2 = 7.14, P = 0.008$). Specifically, for the overweight/obese children, 63% of their fathers were categorized as not physically active, in comparison to 57% of the fathers of normal-weight children. In addition, regarding the frequency of fathers' or mothers' physical activity together with their children, there were no differences regarding the prevalence of overweight/obese children ($\chi^2 = 0.08$, $P = 0.99$ and $\chi^2 = 4.9$, $P = 0.17$, respectively; data not shown in tables). Concerning the frequency of meals ‘out of home’ no differences were observed between normal-weight and overweight/obese children even after adjusting for children’s gender ($P > 0.05$ for all; data not shown in tables). In addition, no differences were observed in the distribution of frequency of meal consumption with the whole family with respect to overweight/obesity prevalence ($P > 0.05$ for all; data not shown in tables).

Unadjusted logistic regression models were used to evaluate the effect of selected sociodemographic characteristics on the likelihood of child overweight/obesity. From the aforementioned factors, mother’s age, mother’s and father’s type of occupation, mother’s profession, father’s educational level and parental obesity status were significant predictors of children’s overweight/obesity status. More specifically, a 1 year increase in mother’s age reduced the odds for child overweight/obesity by approximately 3% (OR = 0.97, 95% CI 0.95, 0.99). In addition, the odds of being an overweight/obese child were reduced when the mother’s or father’s type of occupation tended to be non-manual (OR = 0.94, 95% CI 0.91, 0.98 and OR = 0.95, 95% CI 0.92, 0.98, respectively). The same

Table 2 Comparison of normal-weight and overweight/obese schoolchildren in relation to socio-economic and demographic factors and obesity status of the parents: nationwide sample of primary-school children aged 10–12 years, GRECO (Greek Childhood Obesity) study, October–May 2009

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal-weight children</td>
<td>Overweight/obese children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
</tr>
<tr>
<td>Mother’s age (years)</td>
<td>2054</td>
<td>39.9 ± 4.8</td>
<td>39.3 ± 4.5</td>
</tr>
<tr>
<td>Father’s age (years)</td>
<td>2018</td>
<td>44.3 ± 5.4</td>
<td>44.0 ± 5.6</td>
</tr>
<tr>
<td>Mother’s years of education</td>
<td>1847</td>
<td>13.6 ± 3.7</td>
<td>13.4 ± 3.6</td>
</tr>
<tr>
<td>Father’s years of education</td>
<td>1796</td>
<td>13.5 ± 4.1</td>
<td>12.6 ± 4.2</td>
</tr>
<tr>
<td>Father’s type of occupation (1 = manual to 10 = non-manual)</td>
<td>1620</td>
<td>6.5 ± 2.8</td>
<td>6.1 ± 2.8</td>
</tr>
<tr>
<td>Mother’s type of occupation (1 = manual to 10 = non-manual)</td>
<td>1762</td>
<td>6.1 ± 2.7</td>
<td>5.7 ± 2.8</td>
</tr>
<tr>
<td>Owns house</td>
<td>0.001</td>
<td>7.0 ± 5.2</td>
<td>21.4 ± 4.0</td>
</tr>
<tr>
<td>Owns house</td>
<td>0.031</td>
<td>7.9 ± 7.9</td>
<td>7.9 ± 7.9</td>
</tr>
<tr>
<td>Annual family income</td>
<td>0.062</td>
<td>19.9 ± 21.4</td>
<td>52.6 ± 57.0</td>
</tr>
<tr>
<td>Low</td>
<td>0.225</td>
<td>47.1 ± 44.4</td>
<td>52.9 ± 55.6</td>
</tr>
<tr>
<td>Average</td>
<td>0.001</td>
<td>47.4 ± 43.0</td>
<td>52.0 ± 55.2</td>
</tr>
<tr>
<td>High</td>
<td>0.001</td>
<td>52.6 ± 57.0</td>
<td>52.0 ± 55.2</td>
</tr>
<tr>
<td>Place of residence</td>
<td>0.001</td>
<td>19.1 ± 19.3</td>
<td>29.1 ± 19.3</td>
</tr>
<tr>
<td>Urban and semi-urban areas</td>
<td>1154</td>
<td>52.9 ± 55.6</td>
<td>52.9 ± 55.6</td>
</tr>
<tr>
<td>Mother’s BMI classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>0.001</td>
<td>72.0 ± 55.2</td>
<td>72.0 ± 55.2</td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>0.001</td>
<td>28.0 ± 44.8</td>
<td>28.0 ± 44.8</td>
</tr>
<tr>
<td>Father’s BMI classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>0.001</td>
<td>29.1 ± 19.3</td>
<td>29.1 ± 19.3</td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>0.001</td>
<td>70.9 ± 80.7</td>
<td>70.9 ± 80.7</td>
</tr>
<tr>
<td>Parental obesity status</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No parent overweight/obese</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One parent overweight/obese</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both parents overweight/obese</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3 Results from logistic regression analysis to evaluate the main effect of various socio-economic and demographic characteristics of parents on the likelihood of childhood overweight/obesity, stratified by gender: nationwide sample of primary-school children aged 10–12 years, GRECO (Greek Childhood Obesity) study, October–May 2009

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th></th>
<th>Boys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s age (years)</td>
<td>1.00 [0.77, 1.29]</td>
<td>0.77 [0.59, 1.00]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s age (years)</td>
<td>0.94 [0.90, 0.99]</td>
<td>0.95 [0.91, 0.99]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father’s type of occupation (1 = manual to 10 = non-manual)</td>
<td>0.91 [0.83, 0.99]</td>
<td>1.01 [0.92, 1.10]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father’s years of education</td>
<td>1.00 [0.94, 1.05]</td>
<td>0.98 [0.92, 1.03]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large urban areas</td>
<td></td>
<td></td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>Urban and semi-urban areas</td>
<td></td>
<td></td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>Family income</td>
<td>1.01 [0.69, 1.47]</td>
<td>1.64 [1.12, 2.40]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2.14 [1.21, 3.78]</td>
<td>0.91 [0.52, 1.60]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1.60 [0.87, 2.93]</td>
<td>0.96 [0.53, 1.72]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental BMI classification</td>
<td></td>
<td></td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>One parent overweight/obese</td>
<td>1.92 [1.09, 3.39]</td>
<td>1.20 [0.73, 1.98]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both parents overweight/obese</td>
<td>4.13 [2.25, 7.56]</td>
<td>2.66 [1.50, 4.71]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A recent review of cross-sectional studies published between 1990 and 2005 found that SES was inversely associated with children's overweight or obesity in 42% of the reviewed studies, with the rest of the studies reporting a mixture of inverse or no associations. The choice of SES variable obviously influenced these relationships, with the evidence being less conclusive when using family income as a possible variable explaining childhood obesity, while parental education showed the most consistent inverse relationship with children’s obesity risk. In addition, studies examining secular trends in the effect of SES factors from childhood to adulthood have revealed a particularly important effect of SES during childhood on obesity status in adulthood.

According to the results of the present study, family income, the number of cars owned and house ownership did not seem to be related to the likelihood for children to be overweight or obese both at the bivariate level and in the multiple regression analysis performed. In contrast, the type of occupation of the parents, evaluated via a 10-point scale from unskilled (manual workers (lower values)) to executive (skilled workers (higher values)), which is considered indicative of social class and family financial and educational status, did seem to affect the likelihood of having an overweight or obese child. However, we have to remark that the number of parental questionnaires with data concerning annual family income was smaller compared with the rest of the data provided, which may have introduced respondent bias from higher SES groups (Table 2).

In addition, paternal but not maternal education level seemed to be an important protective factor for childhood obesity, when analysed at the bivariate level. As reported in the literature, the most important sociodemographic factor explaining children's obesity status is parental education level, which is consistently inversely associated with children’s body weight and adiposity. Our results are

Discussion

The present nationwide study is the first in Greece to examine associations between several socio-economic and demographic factors and obesity status among children.
reflective of such a relationship, suggesting that the level of education of the father is more likely to influence beliefs, knowledge on nutrition and health behaviours of the family, which in turn are involved in weight control through better nutritional and physical activity habits of the children\(^{(5,12-14)}\).

Although maternal education level did not seem to influence the odds for overweight/obesity, an interesting finding of our study was that maternal profession appeared to influence the likelihood of the child being overweight/obese at the bivariate level. One possible explanation for the finding that children whose mothers were private servants/employees or self-employed had greater rates of overweight/obesity than children whose mothers were unemployed, housewives or public servants/employees is the possible difference in work hours. Although we did not specifically assess the hours of daily work of the parents, it could be hypothesized that self-employed and private employees in Greece have longer work schedules, keeping them outside the home. This is probably associated with the time dedicated to nutritional guidance and education of the child, as well as both the quality and quantity of the child’s diet\(^{(15-17)}\).

However, when the aforementioned factors that were considered significant for developing overweight/obesity during childhood at the bivariate level were evaluated together with other parameters, adjusted for children’s age and gender, only mother’s age and parental obesity status (either one parent or both parents overweight/obese) were significant predictors for childhood overweight/obesity status (data not shown in tables). When the analysis was further stratified by children’s gender, results revealed that mother’s age was a protective predictor for both girls’ and boys’ overweight/obesity status, while parents’ obesity status had a positive effect on the likelihood of being an overweight/obese child (Table 3). Additionally, father’s type of occupation was found to be related to the prevalence of overweight/obesity among girls, and particularly the odds of a female child being overweight/obese were reduced when the father’s type of occupation tended to be less manual. The finding that the rural area of residence was positively related to the prevalence of overweight/obesity among boys was not shown in the analysis of the whole children’s sample\(^{(53)}\); nor has it been verified in previous cross-sectional studies in Greece where no differences were shown in the prevalence of overweight/obesity between children from different geographical areas (urban, semi-urban, rural areas)\(^{(18,19)}\).

The finding that the odds of developing overweight/obesity decreases with increasing maternal age could be partly explained by the notion that individual and as a consequence family health awareness is higher in mothers of advanced age. Although not many well-organized anti-obesity health policy interventions have taken place in Greece in recent years, there is extensive media attention to issues around obesity (diet and physical activity).

Therefore it is possible that older mothers respond more actively to media health-related messages or seek guidance from health professionals. These results are consistent with the idea that mothers have the same if not greater influence than fathers on children’s behaviours and often hold the role of the head of the household. Another possible explanation could be that older mothers to a lesser extent misclassify their child’s weight status as being lower than actual, an ability which is an important determinant of a child’s healthy body weight development\(^{(20)}\). However, in a recent publication examining maternal perceptions of pre-school children’s weight status, mother’s age did not seem to affect the ability to classify children’s weight status correctly\(^{(20)}\).

The present study also demonstrates that parental obesity status seems to be a highly influential factor on children’s obesity status. Particularly when both parents were overweight/obese, the likelihood of male and female children to be overweight/obese was 2-66 and 4-13 times greater, respectively, than when children had no parent overweight/obese. An influence of parental obesity has been shown in many studies\(^{(21-23)}\) and may be explained by genetic as well as environmental and behavioural factors since parents play a direct role in shaping children’s eating and activity habits\(^{(24,25)}\). In a recent study performed in Greece (Crete) it was also shown that parental BMI status had the greatest effect on children’s BMI classification, as children with two obese parents had 11-6 times higher likelihood of being overweight or obese than their peers with normal-weight parents\(^{(26)}\). These findings were confirmed in another study of Greek pre-school children, in which children with one obese parent had 91 % greater odds for being overweight than those with no obese parent, while the likelihood for being overweight was 2-38 times greater for children with two obese parents\(^{(27)}\). Children learn about eating not only through their own experiences but also by watching others, and especially their parents, who act as role models. A growing body of research demonstrates similarities between parents’ and children’s food acceptance, preferences and intake\(^{(15)}\).

The main strength of our study is the nationwide and relatively large sample of schoolchildren aged 10–12 years. Additionally, overweight and obesity rates of the children were estimated with direct anthropometric measurements, allowing us to estimate overweight and obesity prevalences and assess the contribution of several SES factors in overweight and obesity variance. An important limitation that has to be acknowledged is that the age range of the study population, which was late childhood and pre-adolescence, does not cover all age sections and that we have not assessed the pubertal status of the children. Puberty, in particular, is a period of rapid growth in which boys and girls increase fat-free mass substantially, and in girls is associated with considerable increase in body weight and body fat mass; therefore
adolescence could be a critical period for developing obesity. It is in our future plans to proceed to conduct school-based childhood obesity prevention programmes. It has been suggested that these kinds of programmes should target 10–14-year-old children, since it has been demonstrated that prevention trials including older children have positive outcomes in terms of reducing BMI.

Another important limitation is the low response rate of the parental questionnaires, which may have introduced respondent bias from lower SES groups that are more likely to be either non-responders in survey research and overweight or obese. However, in order to check for any bias regarding the data analysis of the sample of children used in the present study compared with the children for whom we did not obtain parental information, we compared the BMI of the two groups and found no differences. In addition, parental self-reported anthropometric values, although they may have some errors, are considered valid in identifying relationships in epidemiological studies, as when investigating associations with sociodemographic factors. Finally, because the study had a cross-sectional design, it provides only evidence valuable for future investigations, but no definitive conclusions on causality.

Conclusions

The present study shows that the alarming magnitude of the paediatric obesity problem in all areas and regions of Greece is associated with several socio-economic and demographic factors. The major sociodemographic determinants for childhood obesity in Greek children that retained statistical significance in the final multivariate model seem to be parental overweight, mother’s age and father’s type of profession.

Taking into account recent studies suggesting that childhood obesity in most cases tracks into adulthood, the current findings are indicating an increased likelihood or even higher rates of obesity in adolescence and adulthood in the near future, exceeding those currently reported for the Greek adult population. The data from the present survey stress the emerging need for preventive measures and anti-obesity health policy interventions that have to address to the parents and promote their active involvement, to effectively confront the paediatric obesity epidemic.

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References

Sociodemographic determinants of obesity


