

## Research

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# Overweight and Obesity Prevalence in Young Children Living in Athens

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## ABSTRACT

**Background:** The last decades, the epidemiological dimensions of childhood obesity are of major concern worldwide. Given its long-term health consequences, research findings regarding overweight and obesity prevalence in young children are valuable if policies against childhood obesity are to be planned and implemented. As Greece, is one of the countries facing the problem of obesity, the aim of the present study was to assess overweight and obesity status in young children living in the capital of Greece, Athens.

**Methods:** Seven hundred and fifty-two children (320 boys; 432 girls), aged 4-8 years (6.37±1.17 years) volunteered to participate and were divided into four age groups (4-5, 5-6, 6-7 and 7-8-year-old). Children's body mass index (BMI) was calculated by dividing each participant's weight (kg) by the square of standing body height (m<sup>2</sup>). Overweight and obesity definition was based on the International Obesity Task Force (IOTF) gender- and age-specific cut-off criteria.

**Results:** The overall prevalence of overweight was 18.2% (18.1% boys; 18.3% girls) and of obesity 7.4% (5.6% boys; 8.8% girls). The  $\chi^2$  tests revealed that there were no significant differences in prevalence of overweight or obesity between boys and girls ( $\chi^2=2.76$ ,  $p=.25$ ). Regarding age groups, there was only one significant difference; that was between 6 and 7-year-old boys, with the 7-year-old surpassing the 6-year-old.

**Conclusions:** The overweight/obesity is apparent among young Greek children at alarming levels. Carefully designed policy interventions are of great importance in order children's dietary and physical activity patterns to be improved.

**KEYWORDS:** Obesity; Overweight; BMI; Children; Greece.

**ABBREVIATIONS:** BMI: Body Mass Index; IOTF: International Obesity Task Force.

## INTRODUCTION

In recent decades, the prevalence of obesity has reached alarming levels worldwide,<sup>1,2</sup> having affected not only adults<sup>3,4</sup> but also children.<sup>5,6</sup> There are several studies reporting an upward trend of childhood obesity over the years in several countries, like New Zealand,<sup>7</sup> USA,<sup>8</sup> Brazil,<sup>9</sup> China<sup>10</sup> and Taiwan.<sup>11</sup> This global trend has affected European countries too,<sup>10,12,13</sup> with the British islands and the countries in the Mediterranean region presenting the highest rates of overweight and obesity in pre-school age.<sup>14</sup>

The increase in the prevalence of obesity is considered to be due to changes in environmental factors, such as poor nutrition<sup>15</sup>; increase in the calorie intake and physical inactivity<sup>16-18</sup>; prolonged television watching<sup>19,20</sup>; working and playing on computer<sup>20</sup>; family socio-economic status<sup>7,21,22</sup>; parental body mass index (BMI)<sup>2,23,24</sup> and parental separation.<sup>25</sup>

Childhood obesity is associated with a wide range of serious health complications, such as cardiovascular disease<sup>26</sup> and metabolic abnormalities,<sup>27-29</sup> while it is thought to influence social and psychological functioning<sup>30</sup> and be associated with low self-esteem, depression and bullying at school.<sup>31</sup> Moreover, several longitudinal studies have revealed that children's

BMI levels track to adulthood,<sup>26,32-34</sup> with approximately 70% of children who are obese between 6 to 10 years of age to remain obese in their adulthood.<sup>35</sup>

Due to the aforementioned negative consequences on children's life quality, the epidemiological aspects of childhood obesity have strongly worried the research community,<sup>36</sup> while many countries have set childhood obesity as a major public health issue.<sup>37,38</sup> A positive result of the society's sensitivity on the issue of obesity, given the several recent research findings, may be the likelihood of decrease<sup>39,40</sup> or stabilization in childhood obesity prevalence.<sup>6,14,41-43</sup>

Greece is a small country in the Mediterranean region facing the problem of obesity.<sup>38</sup> Moreover in the last decade, the country undergoes a financial crisis that may have affected childhood obesity prevalence, through changes in children's dietary habits.<sup>44</sup> However, in the last decade, very few studies investigating obesity prevalence in pre-school or older children have been conducted in Greece. To our knowledge, there are only three studies focusing on pre-school children (one of them, published in two papers), that report high percentage (21.2-23.2%) of overweight (including obesity).<sup>19,23,45,46</sup> As far as older Greek children are concerned, prevalence of overweight (including obesity) among 6- to 12-year-olds was found to be 31.2%<sup>47</sup> and among 8- to 9-year-olds ranged from 30%<sup>48,49</sup> to 38.3%.<sup>50</sup> Moreover, a higher percentage (40%) was found in 10- to 12-year-old Greeks.<sup>51,52</sup>

Taking into consideration that childhood and adolescence seem to be the most critical periods for the development of obesity,<sup>53</sup> as well as that obesity appears to occur as early as children enter kindergarten<sup>54</sup> and it is difficult to reverse in older children and adults,<sup>55</sup> its timely prevention is of great importance. The first step for the development of effective prevention and intervention programs is the estimation of current obesity levels and the understanding of its trends. Regarding Greece, as it was noted above, there is insufficient scientific evidence regarding obesity prevalence in young children. Such evidence would be valuable if national/municipal policies against childhood obesity are to be planned and implemented. Thus, the aim of the present cross-sectional study was to assess overweight and obesity status in young children living in the capital of Greece, Athens.

## MATERIALS AND METHODS

Seven hundred and fifty-two randomly selected children (320 boys; 432 girls), aged 4-8 years (6.37±1.17 years) volunteered to participate in this study (response rate 85%). All the participants lived in Athens, the capital of Greece. Their parents (or legal guardians) signed a written informed consent before children's participation in the study, which was conducted in accordance with the Helsinki Declaration.

Anthropometric data as well as data for age and gender were collected by trained physical educators between October 2014 and May 2016. Body mass measurement was conducted with an electronic scale to the nearest 100 gr (Beam Balance 710, Seca). Standing height measurement was performed with a Stadiometer to the nearest 0.5 cm (Stadiometer 208, Seca). The above measurements were conducted in the morning, with participants barefooted and lightly dressed. BMI was calculated by dividing each participant's weight (in kg) by the square of standing body height (in m<sup>2</sup>). Overweight and obesity definition was based on the International Obesity Task Force (IOTF) gender- and age-specific cut-off criteria.<sup>56,57</sup>

For the statistical analyses, participants were divided into four groups according to their age (4-5, 5-6, 6-7 and 7-8-year-old) and chi-square tests were used, with statistical significance set at  $\alpha=0.05$ . Statistical analyses were performed using IBM SPSS Statistics 22.0.

## RESULTS

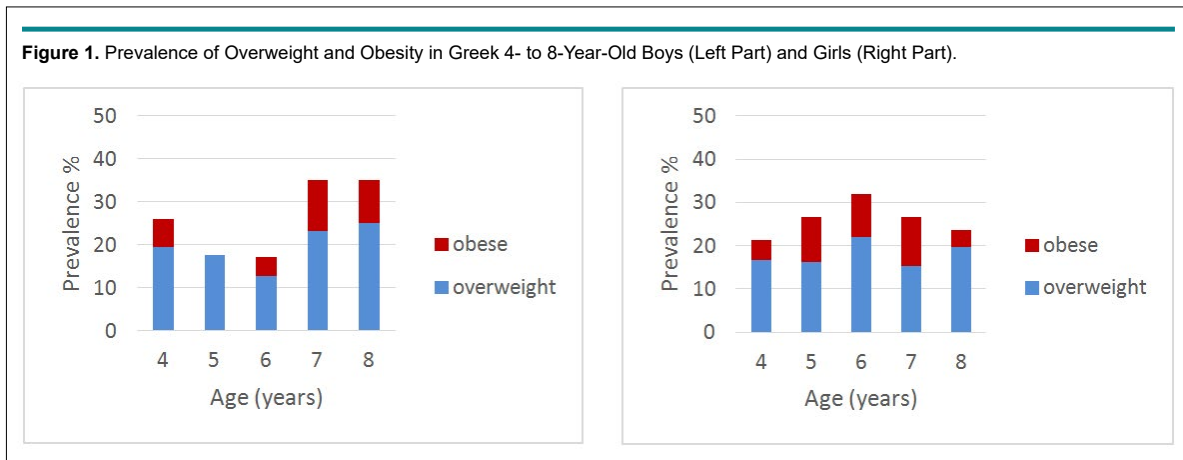
Anthropometric characteristics of boys and girls, by age groups are presented in Table 1.

According to the cut-offs of the IOTF, the overall prevalence of overweight was 18.2% (18.1% for boys and 18.3% for girls) and that of obesity was 7.4% (5.6% for boys and 8.8% for girls). Prevalence of overweight and obesity in both genders by age groups are presented in Figure 1.

The prevalence of overweight and obesity in girls was increasing with age in pre-school years, whereas a decrease with age was observed in the first school years. Specifically, in 4- to 6-year-old girls, the prevalence of overweight and obesity were

**Table 1:** Body Mass Index of Greek Boys and Girls by Age Category.

Age group	BMI (kg/m <sup>2</sup> )		
	Boys	Girls	Overall
4 years	16.62±1.45 (n=31)	16.56±1.81 (n=66)	16.58±1.69 (n=97)
5 years	16.04±1.35 (n=79)	16.50±2.16 (n=105)	16.31±1.86 (n=184)
6 years	16.24±1.84 (n=109)	16.51±2.35 (n=131)	16.39±2.14 (n=240)
7 years	17.38±2.69 (n=60)	16.85±2.51 (n=79)	17.08±2.59 (n=139)
8 years	17.80±2.62 (n=41)	17.02±2.75 (n=51)	17.37±2.71 (n=92)
Overall	16.64±2.10 (n=320)	16.64±2.31 (n=432)	16.64±2.22 (n=752)



19.3% and 10.5%, respectively, while in 7-8 years, the corresponding rates were 16.9% and 8.5%, respectively. In boys, on the other hand, a higher percentage of obesity and overweight prevalence was found in 7- and 8-year-old (24% overweight and 11% obese) than in 4- to 6-year-old (15.5% and 3.2%, respectively).

In the overall sample, there were no significant differences in prevalence of overweight and obesity between boys and girls ( $\chi^2=2.76, p=0.25$ ). The same result was revealed after combining overweight and obese into the same category ( $\chi^2=1.07, p=0.30$ ). As far as overweight and obesity prevalence among age groups is concerned, in girls there were no significant differences, while in boys, significant differences were found between 6- and 7-year-old (Table 2).

**DISCUSSION**

The present study attempted to provide current information for the prevalence of overweight and obesity among young children in Athens, the capital of Greece. The selected age group was spread into four successive years (4- to 8-year-old) and covered pre-school and first years of schooling periods. These particular periods in children’s life have not been, adequately, investigated in Greece, even though a dramatic upraise of pre-school obesity since 1990, with the prediction to climb higher during the current decade, has been indicated at an international level.<sup>58</sup>

As it has been highlighted by earlier studies, the younger part of Greek society has been underwent a consistent increase in overweight/obesity prevalence during the previous

decades.<sup>59,60</sup> According to the present results, a relatively high overall percentage for overweight (18.2%) and obesity (7.4%) is evident, especially in comparison to the considerably lower obesity rate of 3.6% found as early as 1990-1991 in the age group of 6- to 17-year-old Greek youths.<sup>61</sup> This finding comes to reaffirm the trend of increase, in relation to children’s obesity, in Greece.

However, in order to evaluate the results of this study and draw conclusions on the current situation on overweight/obesity, a comparison with recent national and international findings would be informative. It is useful to note, at this point, that such comparisons should be carefully made, as often lead to misconceptions caused by discrepancies in methodology between different studies.<sup>14</sup> A common difference observed is the criteria used for BMI classification to overweight/obesity categories (e.g., IOTF, World Health Organization/WHO, US Centers for Disease Control and Prevention/CDC or other national standards), which usually result in different estimations for the relevant overweight/obesity rates.<sup>7,10</sup> As IOTF cut-off criteria have been adopted by this study, comparisons will only be made with works that followed the same procedure.

Comparing the present results with those of previous studies conducted in Greece, it was revealed that the current obesity rate of 7.4% was almost identical to that of 7.3% indicated by Kyriazis et al<sup>47</sup> and within the range of prevalence (5.8%-11.7%), reported in other studies.<sup>45,48,49,51,52,60</sup> Considering overweight and obesity prevalence as a whole, the present findings regarding pre-school aged children (24%) are slightly higher than those of previous studies.<sup>23,45,46</sup> Concerning older children (6-8-year-old), in the present study, an overweight/obesity prev-

**Table 2:** *p*-Values for the Differences in Overweight (Including Obesity) Prevalence between Age Groups in Boys and Girls.

	4 vs. 5 years	5 vs. 6 years	6 vs. 7 years	7 vs. 8 years
<b>Boys</b>	0.70	0.11	0.03	0.96
<b>Girls</b>	0.48	0.52	0.46	0.29

alence of 29.7% was found. This is similar to the percentage found by Kollias et al<sup>48,49</sup> in children of 9 years of age (30%) and Kyriazis et al<sup>47</sup> in children 6- to 12-year-old (31.2%); however, it is much higher than the prevalence revealed in the study of Georgiadis and Nassis<sup>61</sup> (20.9%) that was conducted in early 1990s. It seems that childhood obesity remains a public health issue for Greece.

In addition, it would be of great interest to understand the differences that are supposed to occur in respect to gender, as well as, how adiposity develops within different age groups. In relation to gender, no significant differences observed in this study (overall percentage: overweight, 18.1% for boys and 18.3% for girls; obesity, 5.6% for boys and 8.8% for girls), a finding that is in accordance with other studies.<sup>6,23,46,62</sup> Nevertheless, gender is a complex factor, controversially associated with overweight/obesity trends.<sup>13,16,20,45,63</sup> In reference to that, and since both genders present high risk to obesity pathogenesis, boys and girls should be equally protected by its adverse outcomes.

Furthermore, in order to get additional information on overweight/obesity development, it seems challenging to study smaller age groups and observe potential trends between them. In the present study, four age groups were identified (4-5, 5-6, 6-7 and 7-8-year-old) and individually analyzed. According to the results, there was only one statistically significant difference in overweight prevalence (including obesity) among age groups; that was between 6- and 7- year old boys, with the 7-year-old surpassing the 6-year-old. Unfortunately, there is no data to directly compare and further support this finding, because of the different, usually broader age groups other studies utilized. The acknowledgement that the first years of schooling are an important crossover in child's life is valuable. Special attention should be given at this period on the dietary and physical activity patterns of children, since these two factors are proposed as anti-obesity measures.<sup>16,48,52,64</sup> Taken together the fact, that obesity early in life possibly results in obesity later in life,<sup>32</sup> children should be encouraged to eliminate screen time<sup>19,47</sup> and establish a healthier lifestyle.<sup>47</sup>

As it is the case for Greece, increases in children adiposity have been also demonstrated in many regions worldwide, during the past decades.<sup>7,12,13,16,43</sup> Surprisingly, this is already true for both developed<sup>22</sup> and developing countries.<sup>58,65</sup> Howbeit the obscure situation, there is considerable research to manifest stabilization in the prevalence of obesity in certain parts of the global<sup>14,41</sup> including Greece.<sup>50</sup> Many explanations have been put forward to analyze the background of this progression, e.g., changes in dietary and physical activity habits, a more supportive family and community environment, mainly due to intense initiatives/interventions have been taken to adverse this unhealthy condition during the recent years.<sup>42</sup> The present study reported somehow similar obesity rates with studies published at the beginning of this decade<sup>48,51,52,62</sup>; however, it is arbitrary to claim that childhood obesity in Greece is levelling off. Likewise, it seems unfound to make any inference in relation to socio-economic recession and whether the latter has provoked greater

obesity expansion. More research needs to be done to facilitate claims like that.

There are some limitations that should be taken into account when interpreting the findings of this study. A first limitation is that data collection included one single measurement of each child; a longitudinal design would provide valuable information. Furthermore, additional measurements or other personal details that would be critical to determine physical condition, family or social background of the subjects, though useful, did not comply with the objectives of this study. Finally, the overweight/obesity rates found in this study can be generalized only to urbanized populations that likely share similar lifestyles.

Despite its limitations, this study provides an insight into overweight/obesity prevalence in an age group less investigated, so far. The findings revealed an overweight/obesity problem that is evident even before children enter primary school and unfortunately persists or occasionally increases during the first years in school. Since obesity is directly associated with metabolic abnormalities and major health issues,<sup>11,48</sup> national and local authorities ought to embrace policies and interventions, also, targeting at very young children. Examining the obesity prevalence is only the first, but not the only step in the battle against childhood obesity. Carefully designed policy interventions are needed in order to improve eating and physical activity habits in young children.

#### CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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