Assessment of Obesity and Abdominal Obesity among Portuguese Children

Avaliação da Obesidade e Obesidade Abdominal em Crianças Portuguesas

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ABSTRACT

Background: Childhood obesity is a major public health issue in developed countries, and frequently proceeds into adulthood. The aim of this study was to estimate the prevalence of obesity and abdominal fat distribution in 6-12 years old children from the central region of Portugal, providing new data about trends on prevalence, epidemiology and evolution in obesity.
Methods: Weight, height and waist circumference were measured in a random representative sample of 1,433 children (747 girls and 686 boys) from public schools in 2011. International Obesity Task Force (IOTF) cut-offs were used to define overweight and obesity. Abdominal obesity was estimated using the sex and age-specific ≥ 90th waist circumference percentile and waist-to-height ratio cut-off.
Results: The prevalence of overweight and obesity among children was 33.0%; 10.7% were obese. Overweight was significantly higher in boys than in girls ($p = 0.044$), whereas no gender differences was found in obesity (10.6 % in boys and 10.7% in girls, $p = 0.571$). The prevalence of abdominal obesity based on waist circumference was similar in girls and boys (3.8% vs. 3.9% respectively; $p = 0.924$), but significantly higher in boys than in girls based on waist-to-height ratio (28.1% vs. 19.4%, respectively; $p = 0.009$). Comparison with previous studies showed a slightly increase in overweight/obesity in children of central Portugal in the last 10 years, reaching values of 40.0% prevalence in the 7-9 years old.
Conclusion: In conclusion, this study shows a very high prevalence of overweight/obesity and abdominal obesity among Portuguese children, following the trend of other southern European countries. Thus, it is of the utmost importance the development of preventive and treatment strategies.

RESUMO

Introdução: A obesidade infantil tornou-se um grave problema de saúde pública nos países desenvolvidos, que frequentemente transita para a vida adulta. Este estudo teve como objetivo avaliar a prevalência da obesidade e a distribuição da gordura abdominal em crianças Portuguesas dos 6 aos 12 anos de idade provenientes da região centro de Portugal, fornecendo novos dados acerca da epidemiologia, prevalência e tendência na evolução da obesidade.
Métodos: Numa amostra aleatória de 1.433 crianças (747 raparigas e 686 rapazes) de escolas públicas, foram medidos o peso, a altura e a circunferência da cintura em 2011. Foram utilizados os critérios do International Obesity Task Force (IOTF) para definir excesso de peso e obesidade. A obesidade abdominal foi estimada com base na circunferência da cintura utilizando o percentil ≥ 90 específico para o sexo e a idade, bem como a relação cintura/altura.
Resultados: A prevalência de excesso de peso/obesidade obtida nas crianças Portuguesas foi de 33,0%; 10,7% eram obesas. A prevalência de excesso de peso foi significativamente mais elevada nos rapazes do que nas raparigas ($p = 0,044$), não tendo sido encontradas diferenças significativas entre sexos para a obesidade (10,6% nos rapazes e 10,7% nas raparigas, $p = 0,571$). A prevalência de obesidade abdominal com base na circunferência da cintura foi semelhante nas raparigas e nos rapazes (3,8% vs. 3,9%, respetivamente; $p = 0,924$), mas significativamente maior nos rapazes do que nas raparigas com base no ratio cintura/altura (28,1% vs. 19,4%, respetivamente; $p = 0,009$). Quando comparados com estudos previamente publicados, estes dados revelam um ligeiro aumento no excesso de peso e obesidade nas crianças da região centro de Portugal nos últimos 10 anos, atingindo valores de prevalência à volta dos 40,0% na faixa etária dos 7 a 9 anos de idade.
Conclusão: Com este estudo concluímos que a prevalência de excesso de peso/obesidade e obesidade abdominal é muito elevada entre as crianças de origem Portuguesa seguindo a tendência de outros países do sul da Europa. Assim, torna-se urgente e indispensável o desenvolvimento de estratégias de prevenção e tratamento.

INTRODUCTION

The prevalence of overweight and obesity in childhood, according to the World Health Organization (WHO), is a growing problem worldwide, in many European countries as well as in developing countries.[1,2] The health consequences of overweight and obesity during childhood are strongly associated with risk factors for cardiovascular diseases, diabetes, orthopaedic problems and it is an important predictor of adult obesity.[3] In fact, it tends to develop from childhood into adult life, resulting in an elevated risk of illness and premature mortality.[3] In Portugal, the majority of obesity and overweight prevalence studies were carried in adults, although it is reported a tendency for weight increase in children along the last 30 years.[4]

The definition of obesity during childhood and adolescence is controversial due to the gender differences, and the variability in growth rate. The standard measure of adult overweight and obesity is Body Mass Index (BMI): weight (kg) / height (m)^2. It started being used for measuring chil-

dren obesity after the development of a BMI for age and sex as an international standard for the assessment of childhood overweight and obesity.[5] However, this alone could be insufficient as an obesity indicator because it is limited to give an approximation of the total adiposity in the body.[6] The use of other complementary obesity measures can overcome this problem, as it gives a better approximation of overweight and obesity in children.

Waist circumference (WC) can be defined as an excessive accumulation fat around the organs inside the abdominal cavity and it is calculated between the lowest rib and the superior border of the iliac crest.[7] It can also be a good indicator of abdominal fat reported in the development of cardiovascular risk factors.[7] Recently, waist-to-height ratio (WHtR) emerged as a good predictor for abdominal obesity and cardiovascular risk factors.[8] This measure is very simple to use, and it can be applied to both genders and ages with a cut-off of WHtR ≥ 0.50 defining those with excess abdominal fatness.[8]

This study aimed to estimate the prevalence of overweight, obesity and abdominal fat distribution among 6-12 years old Portuguese children from the central region of Portugal, providing new data based on different obesity measures from a recent sampling in 2011.

MATERIAL AND METHODS
Study subjects
Subjects were selected in 2011 from several public schools in the central region of Portugal (25% of Portuguese population), and all volunteer children aged 6-12 years old were chosen. From a total of 4,028 initially selected, 1,468 parents gave their written informed consent, and 1,433 children were included in this study: 747 girls and 686 boys (35 children were excluded from the analyses because they had African (*n* = 8), Asian (*n* = 2), or other European origins (*n* = 15)).

The study protocol was approved by *Direção-Geral de Inovação e de Desenvolvimento Curricular*, the ethical Committee of the *Ministério da Educação* (nº 0151100001), and was conducted in accordance with the institutional guidelines of the University of Coimbra.

Anthropometric measurements and analyses
Height (cm) and weight (kg) were measured with participants dressed in lightweight clothing and without shoes. Waist circumference (cm) was measured midway between the lowest rib and the iliac crest to the nearest 0.1 cm after inhalation and exhalation. Hip circumference (cm) was measured at the point over the buttocks yielding the maximum circumference. The BMI was calculated as the weight in kilograms divided by the square of height in meters (kg/m^2). The definition of overweight and obesity were defined using the International Obesity Task Force (IOTF) cut-offs,[5] derived from the BMI in adults cut-points of 25 kg/m^2 and 30 kg/m^2 respectively. Abdominal obesity was defined using the sex and age-specific ≥ 90th waist circumference percentile[9] and waist-to-height ratio was calculated as the ratio of waist and height using the cut-off value of ≥ 0.5.[10] All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, for windows version 18.0; Chicago, IL).

RESULTS
The children characteristics are shown in Table 1. Significant statistical differences were found between boys and girls regarding height (*p* = 0.002), weight (*p* = 0.033), hip circumference (*p* = 0.006) and waist-to-hip ratio (*p* = 0.003). The prevalence of overweight and obesity found in the sample ranged 33.0% (36.5% in boys and 29.7% in girls), with 22.3% children classified as overweighed and 10.7% as obese (Table 2).

Boys presented higher prevalence of overweight than girls (25.9% for boys and 19.0% for girls, *p* ≤ 0.05), but obe-

Table 1 - Characteristics of the sampled Portuguese children.

Characteristics	Overall (*n*=1.433)	Boys (*n*=686)	Girls (*n*=747)	*p*-value
Age (years)	9.3 ± 1.77	9.2 ± 1.77	9.4 ± 1.76	0.952
Height (cm)	136.6 ± 11.90	136.3 ± 11.30	136.9 ± 12.43	**0.002**
Weight (kg)	34.3 ± 10.00	34.1 ± 9.59	34.6 ± 10.38	**0.033**
BMI (kg/m^2)	18.1 ± 3.08	18.0 ± 3.04	18.1 ± 3.12	0.370
BMI Z-score	0.40 ± 1.02	0.45 ± 1.05	0.35 ± 0.99	0.080
WC (cm)	63.9 ± 7.20	64.7 ± 7.21	63.1 ± 7.11	0.619
HC (cm)	76.0 ± 9.41	75.4 ± 8.86	76.5 ± 9.84	**0.006**
WHR	0.84 ± 0.06	0.86 ± 0.05	0.83 ± 0.06	**0.003**
WHtR	0.47 ± 0.05	0.48 ± 0.05	0.46 ± 0.05	0.953

Data are presented as mean ± standard deviation.
Abbreviations: BMI, body mass index; BMI Z-score, body mass index standard deviation score; WC, waist circumference; HC, hip circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio.
p-value significant (*p* ≤0.05) in bold.

sity prevalence was statistically similar between genders. Regarding the prevalence of abdominal obesity it was found that 7.8% of the children had a waist circumference ≥ 90th, and 23.6% had a waist-to-height ratio (WHtR) ≥ 0.50 (Table 2). The WHtR was significantly higher among boys (28.1%) than in girls (19.4%) (*p* = 0.009). The prevalence of overweight and obesity increased with age until the 10 years-old in boys, while in girls no trend was detected across different ages (Fig. 1).

DISCUSSION

We found that overweight and obesity are common among Portuguese children. Comparing our data with a study of 2002,[4] we observe a slightly higher prevalence (1.5%) in overweight and obesity, but a decrease in children classified as obese (10.7% in this study and 11.3% in the

2002 study). However, if we consider only the children with 7-9 years old (like in the 2002 study) the prevalence of overweight and obesity increased during the last 10 years (overweight and obesity was estimated 40.7%, and 12.6% were classified as obese), which represents an increase of 10% in overweight and obesity comparing to 2002 study. These values revealed a high prevalence of overweight and obesity in this Portuguese region, mainly in the 7-9 years old age category, being these values similar to those reported for Spain, Greece and Italy.[11,12] This data indicates that, in Europe, 31.8% of children are estimated to be overweight and of these 7-9% are obese.[11] Our recent data (collected in 2011) reveals an increase in prevalence for overweight and obesity in central region of Portugal during this last 10 years,[13] with values particularly dramatic for 7-9 years old children, as observed in Greek children.[12] This study pro-

Table 2 - Prevalence of overweight, obesity and abdominal obesity among Portuguese children by gender according to the International Obesity Task Force (IOTF) cut-offs of BMI.

		Body mass index[*], % (*n*)			Abdominal obesity, % (*n*)	
	n	Overweight and Obese	Overweight	Obese	WC ≥ 90th	WHtR ≥ 0.50
Overall	1.433	33.0 (473)	22.3 (320)	10.7 (153)	7.8 (111)	23.6 (338)
Boys	686	36.5 (250)	25.9 (179)	10.6 (71)	3.9 (52)	28.1 (193)
Girls	747	29.7 (223)	19.0 (141)	10.7 (82)	3.8 (59)	19.4 (145)
p-value		**0.002**	**0.044**	0.571	0.924	**0.009**

[*] According to the International Obesity Task Force (IOTF) cut-offs of BMI.
Abbreviations: WC, waist circumference; WHtR, waist-to-height ratio.
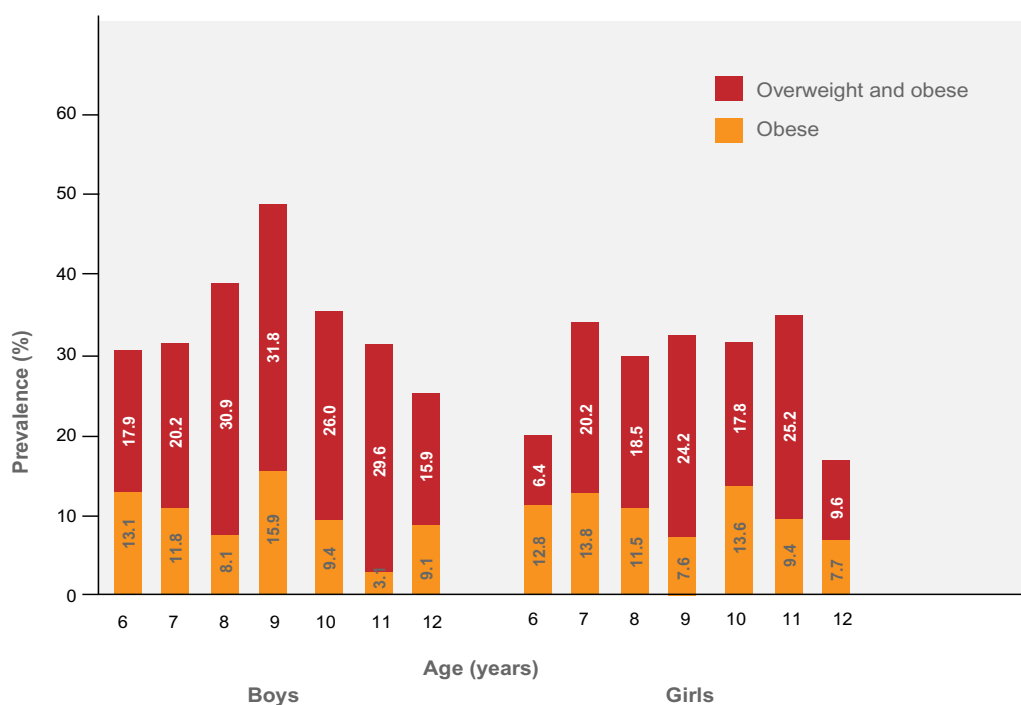*p*-value significant (*p* ≤ 0.05) in bold.

Fig. 1 - Prevalence of overweight and obesity among Portuguese children by age and gender.

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vides further evidence that there were strong increases in BMI among Portuguese children between 2002 and 2011.

The changes in the social and economic structures in Portugal in the last three decades led to a global improvement of the living conditions.[4] These changes also had some negative effects leading to higher percentages of sedentary lifestyle for adults.[4] Several studies shown that the prevalence of obesity is common in families with low socio-economic status.[14,15] Different studies have proved that healthier diets are more expensive than low quality diets, and could affect the acquisition of healthy foods both for parents and schools with lower budgets.[15]

The prevalence of overweight and obesity was particularly high in boys (36.5%) when compared to girls (29.7%) (p = 0.002). These differences remain significant when comparing the prevalence of overweight (p = 0.04). However the same cannot be said about obesity, where prevalence values are similar in both genders (p = 0.571). This trend is also observed across different age children, with a higher prevalence of overweight and obesity in boys comparing with girls. This prevalence is reverse when compared to the 2002 study,[4] where prevalence of overweight and obesity was higher in girls. This fact could be due to the lack of physical activities in detriment of spending more time playing electronic games/computer, which is more typical in boys than in girls. It was previously shown a relation between Portuguese children who spend more time playing electronic games/computer with higher values of BMI.[16] It is possible that Portuguese children especially boys display also a highly sedentary behaviour, contributing to their increase in overweight/obesity. If we compare this results to other southern European countries, Portugal follows the trend found in Spain and Greece[17,18] and the frequency of obesity in the last decade has increased more in boys than in girls.[17] A trend study from 1997-2007 in 8-9 years old Greek children, showed an increase of overweight and obesity in boys (26.5% and 12.2%, respectively), and in girls (26.7% and 11.2%, respectively).[12] In that study, the prevalence obtained in 2007 for overweight/obesity was estimated in 38.3%, and from these 11.7% were obese.[12] In our study, the prevalence of obesity is similar in boys and in girls, but overweight is higher in boys than in girls. We also analysed abdominal obesity in the children, as it could be a better predictor for cardiovascular disease risk in children than BMI,[7] and also important in weigh management.[19] Furthermore according to our data, BMI seems a better tool than WC for discriminating obesity prevalence. We also looked to WHtR as it might be a useful index to identify metabolic risk in overweight children.[20] This index showed a similar trend to BMI in both gender, and these could indicate that WHtR is a good tool for discriminating the prevalence of abdominal obesity, and also a possible measure of total obesity prevalence. All these measures are useful in measuring overweight and obesity prevalence, but they all have limitations and the use of all depicts a more accurate picture of the prevalence in a sample. Traditionally, BMI has been used to predict body composition whereas WC is a measure of adipose tissue, but both are important in prediction of health risks in children.[7,8] Recently, WHtR also emerged has a good tool for evaluating obesity prevalence and health risk in children.[20] Our data are in agreement with this, as we detected a higher prevalence (WHtR above ≥ 0.50) in boys and girls using this index, than using BMI or WC. The higher value for WHtR than for WC could be due to the fact that WHtR takes into account differences in body height. Curiously, the trend of adults in European countries such as Spain shows that abdominal obesity is more frequent in women than in men.[21] We found that abdominal obesity in Portuguese children has a similar frequency in boys and girls using waist circumference percentile, but it is more frequent in boys than in girls using waist-to-heigh ratio cutoff. Nevertheless, data on secular trends in WC and WHtR are scarce in Portuguese children, thus it is impossible to compare these results with previous studies. Future studies concerning overweight and obesity trends in children should also consider WC and WHtR as screening tools.

CONCLUSION

Children obesity and overweight is a major public health issue, not only in developed but also in emerging countries. Our data in central Portugal showed a prevalence of childhood overweight and obesity similar to other southern European countries. However, our data also shown an increase in overweight and obesity prevalence in the last decade in the Portuguese children, indicating that the rate of prevalence could be increasing. It seems important to reverse this scenario, making prevention since childhood, and by that helping to reduce the higher incidence of cardiovascular diseases, that are the major cause of death in Portugal.

CONFLICT OF INTERESTS

None stated.

FUNDING SOURCES

None stated.

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