Overweight and obesity related to activities in Portuguese children, 7–9 years

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Background: The purpose of the study was to explore the association among the following variables: physical activity, TV, videogames, and obesity. The study included a Portuguese random nationally representative sample of 3365 children (1610 girls and 1755 boys) 7–9 year olds.

Methods: A general questionnaire was completed by the parents of participating children to provide information about the hours spent per week watching television, computer use and electronic games, and the participation in physical education. Overweight and obesity were calculated by using the body mass index (BMI) assessment and the cut-off points for overweight (25 kg/m²) and obesity (30 kg/m²).

Results: The data from the association between BMI and the independent variables (analysis of variance) were only significant for time playing electronic games for boys and girls ($P < 0.001; P < 0.029$). The association between hours of watching TV and BMI was significant only for boys ($P < 0.016$). The results from the logistic regression were only significant for electronic games both for boys and girls ($P < 0.000; P < 0.000$).

Conclusions: The results of this study suggest that the time spent playing electronic games is associated with obesity. Reducing childhood obesity calls for the reduction in sedentary behaviours, and the promotion of a more active lifestyle.

Keywords: children, obesity, overweight, physical activity, TV, videogames

Introduction

Childhood obesity is nowadays considered an epidemic of developed and industrialized countries. Obesity is not a single disease but is instead a syndrome with a multifactorial aetiology that includes metabolic, genetic, environmental, social, and cultural interactions. The rapid increase in the prevalence of obesity cannot be attributed to genetic makeup because the gene pool did not change substantially between 1980 and 1994; therefore, the main concerns of the studies should be in the changes in diet and activity that occurred simultaneously with changes in prevalence.

Obesity is the result of an imbalance of energy intake and expenditure and the main causes are linked to environment factors, mainly the factors related to sedentary lifestyles, used by children nowadays. Children’s modern lifestyles mean that activities in their spare time are mostly sedentary and unhealthy like screen watching, including television, handheld computer games, and personal computers. Time spent watching TV or computer screens and video games appear to be an important index of sedentariness, and causes obesity. The studies have found that watching TV has a considerable effect of lowering the metabolic rate which causes a displacement of physical activity, increased calorie consumption while watching or caused by effects of advertising. Among the most important variables associated with obesity are family factors, such as type of family economic unit and household contribution. A stronger association between TV viewing and obesity has been observed among children with low-income and less educated parents.

The studies that intended to verify the relationship between obesity and television most documented associations between television viewing time and obesity and indicated that the prevalence of obesity increases as the number of hours of television viewing increases.

However, this relationship has also been questioned by other researchers who found no association between BMI and television viewing and that television watching was an independent predictor of the changes in child’s BMI throughout childhood. These results may be due to the limitations in measurement and it is not clear that watching a lot of television caused obesity or whether obese children watched more television. The lower cognitive stimulation produced by types TV programmes is an additional potential confounding factor that suggests an independent risk factor for the development of child obesity. Besides energy expenditure may be reduced because less energy is required to watch television than required for activities, such as bicycle-riding or swimming.

There is an evidence that reducing the level of energy expenditure is a powerful aetiological factor for the development of obesity in children. However, there are methodological difficulties which make it difficult to measure physical activity and thus report upon its actual association with obesity. There are many methods to assess the matter and the choice depend on the expected outcomes. We can assess the type and the nature of the activity (metabolic or behavioural aspects), as well as the frequency, duration, and intensity of that activity. This variety of objectives implies also a variety of instruments to assess; that is why it is very difficult to determine how the several health aspects are related.

Besides the difficulty of the measurement of physical activity, there is evidence that reducing the level of energy expenditure is a powerful aetiological factor for the development of obesity in children.

The results of several longitudinal studies pointed out the inverse relationship between physical activity and body mass index (BMI) in a 6 year longitudinal study the investigators verified an association between physical activity level and BMI, body fat and time watching TV. They also verified an...
association between TV viewing and the participation in vigorous physical activities and higher levels of BMI.

The purpose of the study is to explore the association between: physical education, hours of television viewing, use of computer, hours of playing electronic games, and obesity in Portuguese children.

Materials and methods

Sample and procedures

The study was carried out from October 2002 to June 2003 and was performed in a random sample of 7–9-year-old Portuguese children. This age range was chosen for practical and physiological reasons. By age 6 the adiposity rebound occurs, following the nadir of the BMI curve.23

Schools were randomly selected in each District of the country, and from each of them the participating children were selected using stratified randomization for age, with the aid of a table of random numbers. The sample was composed of 4,511 (2,237 girls and 2,273 boys) Portuguese speaking individuals, however, only 3,365 were considered for the present study. For different reasons 1,146 subjects were excluded and the exclusion criteria were: (n = 336) because they were from Asian countries, (n = 16) African countries (114), other European countries (n = 4), South America (n = 10), three had Down syndrome, one had diabetes, and one had nanism. Finally, 187 were less than 6 years or more than 9 years old. The response rate was 81%. A total of 3365 were included, comprising 1610 girls and 1755 boys, ranging from 7 to 9 years old.

The number of children included was determined according to the formula: \[ n = \frac{N^2 pq}{d^2(N - 1) + z^2 pq}, \] where, \( n \) = sample, \( N \) = population size, \( Z = 1.96 \) for an error of 0.05, \( P = \) prevalence estimated, \( q = 1 - p \), \( d = \) precision.24

The study protocol was approved by Direcção Regional de Educação (Portuguese institution in the Ministry of Education), and informed consent was previously obtained from all the children’s parents.

Measures

In each school two trained persons measured height and weight using a standardized procedure.25 Height was measured with a stadiometer, with the head in the Frankfort horizontal plane; weight was measured with an electronic scale with a precision of 0.1 g. The BMI was calculated, weight/height (kg/m²). Cut-offs were used to classify children as normal weight, overweight, or obese.26 These cut-off points are linked to the widely accepted standard of clinical reasoning.23

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS/PC+, version 11.0, 2003). The associations between variables were assessed separately by gender. Analysis of variance was fitted to estimate the association between BMI and the independent variables and the logistic regression was used to estimate the magnitude of association between obesity and independent variables.

Results

Descriptive data

The data about the activities for boys and girls are presented in table 1. As regards physical activity a very large percentage of boys and girls (32.9%; 34.2%), respectively, do not have the opportunity to practice physical education at school, because physical education is not a compulsory subject in Portuguese curriculum primary schools system. Only 67.1% of boys and 65.4% of the girls have physical education at school. The results show that the difference is not very high. Boys that have opportunity to practice physical education at school present higher average BMI values (18.0), than those that do not have physical education (17.8); and the same is true for girls (18.0 and 17.9), respectively (x = 1).

With regards to sedentary behaviours, we can see that most of the boys and girls do not use computer and boys use for a longer period and most girls do not use computer at all. Boys play electronic games for a longer period than girls. With respect to TV, most girls and boys spend 4–6 h in a day watching it. The average mean values for BMI are higher for the children (boys and girls) that do not practise physical education. The mean values for BMI get higher as the hours that both boys and girls spend watching TV, playing electronic games increase and play computer use.

Relationship between BMI and variables

In what concerns the relationship among BMI, physical education, computer, electronic games and TV, only found an association between electronic games and BMI for boys and girls and an association between BMI and time spent watching TV for boys (table 1).

In the table 2 it is suggested that the prevalence of obesity is higher for children that had physical education at school, both in boys (68.0%) and girls (65.8%). When we looked at the other variables it is suggested that the prevalence of obesity is higher for children that use computer for shorter periods, both for boys (45.7%) and girls (59.3%). With regards to TV viewing we can see that the prevalence of obesity gets higher as the hours of watching TV increase and has the highest prevalence for boys (32.5%) and girls (32.5%) that watched TV for 4-6 h a day, and then decreases. The prevalence of obesity is higher for boys that spend more time playing electronic games, and for girls that spend less time.

Relationship between obesity and variables

When we examined the relationship between obesity and the variables, we found only a moderate relationship between obesity and the time that children (boys and girls) played electronic games. Increased rate of obesity occurred among boys and girls who played electronic games more than 1 h per day. The odds ratio of being obese were 0.45 (95% CI 0.26–0.64) times more for boys and 0.57 (95% CI 1.22–0.08) times more for girls that played more than 1 h of electronic games per day compared to those who played only 1 h per day (table 2).

Discussion

The sedentary activities of screen watching are those that are associated with higher BMI average values and obesity. These results are consistent with recent investigation research that found the same kind of relationship.2–10

The average mean values get higher as the time increases for playing electronic games and watching TV; obesity is also higher as the time is longer. Those results are consistent with those2–9 who pointed out that the obesity increases as the number of hours of television viewing also increases.2–10 These results are consistent with the arguments of those who defend that watching TV can reduce activity levels in children3 and promote energy intake.

With regards to the time that children use computer we found no association with BMI or obesity. Most of the studies tried to
find an association between obesity and TV watching, not including time spent on the computer. Eating while watching TV is a common practice among Portuguese families; computer use requires a more centered focus of attention and the use of both hands. Eating snacks, while playing in the computer takes place during small breaks between the different games or change of level of difficulty. The results from the effects of television viewing on obesity in a cross-sectional and prospective survey persisted after controlling for some of the recognized family variables that affect the prevalence of obesity.2

Like most studies we found no association between physical activity and BMI and obesity, and surprisingly the higher mean values for BMI and for obesity are for those children that practise physical education at school. We know that it is difficult to measure physical activity through reports, so we cannot rule out the possibility that error was associated with these measures, therefore influencing our ability to detect stronger effects. There are different approaches for assessing children’s activity, but no specific method can be identified as the best option for all studies.28 The instrument to accurately assess physical activity must be sensitive enough to detect code or record both the intensity and the duration of a sporadic and intermittent activity.28 We only asked the frequency of physical activity. The greatest resource for promoting physical activity is physical education in schools,29 but the results from the studies carried out about the engagement levels of children in physical education classes is low, with only 36.2% children participating in moderate-to-vigorous physical activity (MPVA), a number far below the values recommended.30–31

With regards to intensity, possibly the instrument used is not able to assess the energy dispended by the children during the class. It is hard for children to quantify and to recall accurately how much exercise they took part in.6 On the other hand, obtaining energy expenditure requires information about metabolic costs, and that requires more precise instruments like calorimetry and doubly labelled water techniques. Even so, the results from several studies found no differences in the amount of physical activity between obese and non obese children, assessed by accelerometers.32–33 But this kind of assessment tools also has limitations when we studied very large samples.

Therefore, the hypothesis is that the frequency and the intensity of physical activity of Portuguese children is not enough to counterbalance the energy intake. On the other hand, the time spent watching TV and playing electronic games is enough to increase calorie consumption and to reduce metabolic rate. The relationship between sedentary behaviour and physical activity is related to the limited number of hours in the day that they spent playing.

Another aspect that must be taken into consideration is the existence of facilities in schools, such as playgrounds that encourage more active play. The results of recent studies demonstrated that the quality resources are significantly associated with higher levels of MVPA.34 The time spent in recess accounts for about a third of daily recommendations for physical activity in primary schools and therefore represents a significant context for promotion of physical activity among children.29

Our findings show that girls report engaging in less physical activity than boys, spend less time playing electronic games, computer, and watching TV than boys.

The BMI average mean values increase with more time spent by the children (boys and girls) watching TV, playing electronic games, and computer. On the other hand, children (boys and
The criteria of SES. Lower SES may be related to increased risks due to the differences in the ages of the children and associated with high SES. The differences among the studies socioeconomic status (SES) and others increased obesity is demonstrated increased level of obesity associated with low socioeconomic factors also remains controversial; some studies environmental. The importance of education. Nevertheless, the results of several studies, obesity is independent of socioeconomic factors, race, maternal marital status, or maternal BMI. The importance of socioeconomic factors also remains controversial; some studies demonstrated increased level of obesity associated with low socioeconomic status (SES) and others increased obesity is associated with high SES. The differences among the studies may be due to the differences in the ages of the children and the criteria of SES. Lower SES may be related to increased risks of obesity because of less healthy eating patterns, its relation-ship to decreased physical activity and also poorest home environment.

In summary, our results show that obesity is higher among children who spend more time playing electronic games, and the time that children played electronic games is significantly associated with the incidence of obesity and BMI. Obese children were found to be less likely to have participated in physical activity. Reducing television watching and time spent playing videogames may be a way to reduce and to prevent obesity. Intervention strategies designed to promote healthy lifestyles represent a major public health challenge and priority. The prevention of childhood obesity requires the involvement and collaboration of health professionals, parents and educators to encourage children to be active.

Table 2 Unadjusted odds ratios and 95% confidence intervals (CI) for obesity children by amount of television viewed (TV), playing electronic games (electronic games) and computer use and practice of physical education, by gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Activities</th>
<th>Grades</th>
<th>No. of subjects</th>
<th>% Overweight + obesity</th>
<th>Odds ratios (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>Physical</td>
<td>Yes</td>
<td>577</td>
<td>68.0</td>
<td>1.125 (2.009–0.547)</td>
<td>0.404</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>1163</td>
<td>32.0</td>
<td>1 (...)</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>Physical</td>
<td>Yes</td>
<td>547</td>
<td>65.8</td>
<td>1.156 (1.817–0.495)</td>
<td>0.322</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>1047</td>
<td>34.2</td>
<td>1 (...)</td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>Electronic games</td>
<td>1–2 h</td>
<td>512</td>
<td>25.3</td>
<td>0.262 (0.389–1.35)</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2 h</td>
<td>1066</td>
<td>74.5</td>
<td>0.448 (0.255–0.643)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Girls</td>
<td>Electronic games</td>
<td>1–2 h</td>
<td>952</td>
<td>62.8</td>
<td>0.399 (0.755–0.037)</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2 h</td>
<td>450</td>
<td>34.2</td>
<td>0.570 (1.220–0.08)</td>
<td>0.043*</td>
</tr>
<tr>
<td>Boys</td>
<td>TV</td>
<td>1–2 h</td>
<td>492</td>
<td>25.3</td>
<td>0.686 (1.754–0.372)</td>
<td>0.095</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2–4 h</td>
<td>491</td>
<td>25.1</td>
<td>0.728 (1.386–0.007)</td>
<td>0.155</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;4–6 h</td>
<td>515</td>
<td>32.5</td>
<td>1.089 (2.372–0.952)</td>
<td>0.695</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;6 h</td>
<td>243</td>
<td>1670</td>
<td>1 (...)</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>TV</td>
<td>1–2 h</td>
<td>515</td>
<td>28.7</td>
<td>0.940 (1.865–0.015)</td>
<td>0.798</td>
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<tr>
<td></td>
<td></td>
<td>&gt;2–4 h</td>
<td>403</td>
<td>27.0</td>
<td>1.362 (2.720–0.04)</td>
<td>0.207</td>
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<tr>
<td></td>
<td></td>
<td>&gt;4–6 h</td>
<td>457</td>
<td>32.5</td>
<td>1.269 (2.608–0.070)</td>
<td>0.320</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;6 h</td>
<td>197</td>
<td>11.8</td>
<td>1 (...)</td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>Computer use</td>
<td>0 h</td>
<td>810</td>
<td>659</td>
<td>1.278 (2.636–2.00)</td>
<td>0.085</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;1 h</td>
<td>469</td>
<td>34.1</td>
<td>1 (...)</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>Computer use</td>
<td>0 h</td>
<td>919</td>
<td>83.6</td>
<td>0.923 (1.628–0.218)</td>
<td>0.672</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;1 h</td>
<td>177</td>
<td>16.4</td>
<td>1 (...)</td>
<td></td>
</tr>
</tbody>
</table>

* = P < 0.05

Acknowledgement


Key points

- Reductions on sedentary behaviour may help prevent further increases in prevalence of obesity.
- Interventions strategies that promote health lifestyles represent a major public health challenge and priority.
- The prevention of childhood obesity requires the involvement and collaboration of health professionals, parents and educators to encourage children to be active.

References


