Obesity risk factors in a representative group of Polish prepubertal children

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Abstract

Introduction: The study aim was to evaluate risk factors of obesity in Polish children aged 7 to 9 years.
Material and methods: A representative group of 2571 children (1268 girls and 1303 boys) was randomly selected according to the European Childhood Obesity Group protocol. Weight and height were measured and body mass index (BMI) was calculated. A questionnaire was completed by the children's parents with respect to behavioural and family-related risk factors of obesity. International Obesity Task Force criteria were used for classification of children's obesity.
Results: Obesity was found in 3.7% of girls and 3.6% of boys. There was a statistically significant association between the prevalence of obesity in girls and their mother's obesity: OR = 5.06 (1.96–13.05), $p < 0.001$, father's obesity: OR = 5.19 (1.96–13.69), $p < 0.001$, and both parents' obesity: OR = 5.43 (1.39–21.29), $p = 0.01$. Obesity in boys was significantly associated with mother's obesity: OR = 5.6 (2.6–12.02), $p < 0.001$, father's obesity: OR = 6.21 (2.89–13.37), $p < 0.001$, and both parents' obesity: OR = 7.22 (2.44–31.33), $p < 0.001$. Skipping or irregular eating of breakfast was a risk factor for obesity in girls with OR = 2.71 (1.33–5.51), $p = 0.005$. Neither family income nor parents' education level was related to their offspring's obesity. TV watching, physical activity level and eating in fast food places were not significant risk factors for obesity.
Conclusions: Eating breakfast regularly seems to protect girls from obesity development while low physical activity is not a significant obesity risk factor in this age group for either boys or girls. This finding stresses the more important role of healthy diet than physical activity promotion in obesity prevention in prepubertal children.

Key words: obesity risk factors, children, parental obesity, physical activity.

Introduction

Obesity is the most common chronic disease in highly developed countries and is one of the most important health risks of our time [1]. Its prevalence has been constantly growing worldwide since the mid 1970s, including among children and youth [2, 3]. This rapid increase implicates environmental rather than genetic factors. Several studies report increased risk of obesity in children of obese parents. A relationship between adolescent obesity and decreased physical activity and/or increased "screen" time has been found in many studies. Low family socioeconomic status

and low parents' education, together with unhealthy eating habits, may also play a role in promoting obesity in children.

Obesity is associated with an increased risk of impaired glucose metabolism and diabetes, dyslipidaemia, elevated blood pressure, cardiovascular disease, kidney disease and cancer. Paediatricians are often involved in the initial evaluation of obesity in children. Since the recognized methods of obesity treatment are hardly effective, obesity prevention through educational efforts promoting a healthy lifestyle, physical exercise and a balanced diet seems to be particularly essential. To be effective they should be introduced in young children. The study aim was to find out which of the family and social risk factors contribute to the prevalence of obesity in school children aged 7 to 9 years.

Material and methods

The study was conducted from April to July 2001. It was based on the protocol proposed by the European Childhood Obesity Group [4] and conducted in a randomly selected group of 7- to 9-year-old children. This age group was selected for medical and practical reasons. Seven to 9-year-old children are easy to recruit from schools and at this age they are prepubertal (puberty would induce a significant variation in fat content between genders). According to the protocol the country was divided into geographical areas and among them eight areas were randomly selected. For every area, a medical team composed of paediatricians and an anthropologist was ascribed. All of the teams were centrally trained before data collection to standardize the measurement techniques. A sample of primary schools in each area was randomly selected, and the number of pupils of the age group of interest on January 1, 2001 was identified for each school. Each school was split into clusters, each with fewer than 50 pupils, and the randomisation was performed according to the cluster technique described elsewhere [4]. In each school medical team members collected children's date of birth and performed anthropometric measurements. Each team was supplied with centrally purchased electronic scales (Radwag 150 OC, Poland) on which weight was measured with precision to 0.1 kg using a standardized procedure (children with underwear only, without shoes). Height was estimated on the wall-mounted measuring tapes available at schools, on a child standing up without shoes and with head, back and buttocks on the vertical plane of the height gauge. Information on parents' obesity (obesity in parents was defined on the basis of self-assessment) and social status and children's health status, lifestyle (including physical activity preferences) and eating patterns was also obtained from the questionnaires completed by the parents.

Statistical analysis

Statistical analyses were performed on children with complete information on age, gender, height and weight. Children with chronic diseases and < 7.0 and ≥ 10 years of age were excluded. Body mass index was calculated in all children by dividing weight in kilograms by height in metres squared. International references [5] published by the International Obesity Task Force (IOTF) with cut-off values based on percentiles passing through 30 kg/m^2 for obesity at the age of 18 years were used for classification of children as obese. Three classes of age were defined as follows: 7 (7.0 to 7.9 years), 8 (8.0 to 8.9) and 9 (9.0 to 9.9) years old. The cut-offs selected for each reference corresponded to the midyear value. They were 21.01, 22.18, and 23.46 for obese 7-, 8-, and 9-year old girls, respectively, and 21.09, 22.17, and 23.39 for obese 7-, 8-, and 9-year-old boys, respectively. Frequencies of obesity are given in percentages.

The odds ratio (OR) was estimated for each factor separately to examine its influence on the prevalence of obesity. A p value = 0.05 was considered statistically significant, with the confidence interval (CI) 95%. Odds ratio was estimated using a logistic regression analysis [6]. Data were analysed using the Statistica software package version 5.0.

Statement of ethics

Informed consent for participation in the study was obtained from parents and children. The study was approved by the Local Ethics Committee and supported by a grant from the Polish Ministry of Science.

Results

After excluding 57 pupils not willing to participate, a total of 3370 children (1636 girls and 1596 boys) were examined. Seven hundred and one were not included because of incomplete data or chronic disease that could impair their height or weight. Forty-one were eliminated because they were not in the age range for the protocol. The final analysis was performed in 2571 children (1268 girls and 1303 boys). Obesity was diagnosed in 47 (3.7%) girls and 47 (3.6%) boys.

The analysis of family and social obesity risk factors in girls and boys is presented in Tables I and II. There was a statistically significant association between the prevalence of obesity in girls and the mother's obesity: OR = 5.06 (1.96–13.05), $p < 0.001$, father's obesity: OR = 5.19 (1.96–13.69), $p < 0.001$, and both parents' obesity: OR = 5.43 (1.39–21.29), $p = 0.01$.

Table I. Family and social risk factors of obesity in girls (n = 1268)

Risk factors	N	OR	95% CI	Value of p
Obesity in family:				
Obese mother vs. nobody obese	175 vs. 677	5.06	1.96–13.05	< 0.001
Obese father vs. nobody obese	154 vs. 677	5.19	1.96–13.69	< 0.001
Both parents obese vs. nobody obese	49 vs. 677	5.43	1.39–21.29	0.01
Mother's education:				
Primary vs. vocational	465 vs. 129	4.85	0.63–36.99	NS
Primary vs. secondary	465 vs. 515	2.21	0.80–6.09	NS
Primary vs. university	465 vs. 159	1.48	0.71–3.11	NS
Father's education:				
Primary vs. vocational	101 vs. 692	1.37	0.40–4.64	NS
Primary vs. secondary	101 vs. 375	0.94	0.49–1.82	NS
Primary vs. university	101 vs. 100	–	–	–
Income:				
Sufficient vs. restrictions required	543 vs. 586	1.15	0.59–2.21	NS
Sufficient vs. insufficient to live on	543 vs. 139	0.82	0.44–1.53	NS

OR – odds ratio, CI – confidence interval, NS – not statistically significant

Table II. Family and social risk factors of obesity in boys (n = 1303)

Risk factors	N	OR	95% CI	Value of p
Obesity in family:				
Obese mother vs. nobody obese	166 vs. 746	5.6	2.6–12.02	< 0.001
Obese father vs. nobody obese	151 vs. 746	6.21	2.89–13.37	< 0.001
Both parents obese vs. nobody obese	44 vs. 746	7.22	2.44–21.33	< 0.001
Mother's education:				
Primary vs. vocational	126 vs. 533	1.12	0.37–3.37	NS
Primary vs. secondary	126 vs. 514	1.08	0.62–1.87	NS
Primary vs. university	126 vs. 130	1.31	0.87–1.96	NS
Father's education:				
Primary vs. vocational	121 vs. 723	1.04	0.34–3.20	NS
Primary vs. secondary	121 vs. 372	1.18	0.67–2.06	NS
Primary vs. university	121 vs. 87	1.21	0.77–1.90	NS
Income:				
Sufficient vs. restrictions required	530 vs. 593	0.60	0.32–1.12	NS
Sufficient vs. insufficient to live on	530 vs. 180	0.88	0.57–1.35	NS

Risk for obesity in boys was also significantly dependent on mother's obesity: OR = 5.6 (2.6–12.02), p < 0.001, father's obesity: OR = 6.21 (2.89–13.37), p < 0.001, and both parents' obesity: OR = 7.22 (2.44–31.33), p < 0.001.

There was no significant association between the prevalence of obesity in children and the education of the mother, father, or both parents. Socioeconomic status of the family did not affect the development of obesity either.

The analysis of risk factors for obesity associated with lifestyle in girls is presented in Table III, and in boys in Table IV. TV-watching time did not constitute a risk factor for obesity. Physical activity level was not significantly associated with obesity in both genders, but a tendency for significance was noted in boys. In those active 2-3 times per week as compared to those who were active every day: OR = 1.94 (0.92–4.1), p = 0.08, and in boys active once a week as compared to those who were active

Table III. Lifestyle-related risk factors of obesity in girls

Risk factors	*N*	OR	95% CI	Value of *p*
Watching television:				
< 2 h vs. 2-4 h per day	755 vs. 479	1.60	0.85–3.01	NS
< 2 h vs. > 4 h per day	755 vs. 33	1.07	0.38–3.02	NS
Physical activity:				
Daily vs. 2-3 times a week	1079 vs. 168	1.33	0.58–3.06	NS
Daily vs. once a week	1079 vs. 19	–	–	–
Daily vs. none	1079 vs. 1	–	–	–
Extra eating out:				
None vs. once a week	831 vs. 357	1.03	0.49–2.18	NS
None vs. 2-3 times a week	831 vs. 59	1.02	0.20–5.06	NS
None vs. > 3 times a week	831 vs. 21	–	–	–
Having breakfast:				
Always vs. usually	823 vs. 277	2.71	1.33–5.51	0.005
Always vs. never	823 vs. 168	1.63	1.08–2.47	0.01

Table IV. Lifestyle-related risk factors of obesity in boys

Risk factors	*N*	OR	95% CI	Value of *p*
Watching television:				
< 2 h vs. 2-4 h per day	681 vs. 577	1.18	0.67–2.10	NS
< 2 h vs. > 4 h per day	681 vs. 45	0.77	0.28–2.12	NS
Physical activity:				
Daily vs. 2-3 times a week	1143 vs. 141	1.94	0.92–4.10	0.08 (NS)
Daily vs. once a week	1143 vs. 17	2.37	1.25–4.51	0.07 (NS)
Daily vs. none	1143 vs. 2	–	–	–
Extra eating out:				
None vs. once a week	845 vs. 374	0.95	0.50–1.79	NS
None vs. 2-3 times a week	845 vs. 51	0.70	0.25–1.91	NS
None vs. > 3 times a week	845 vs. 32	1.36	0.90–2.06	NS
Having breakfast:				
Always vs. usually	868 vs. 290	1.35	0.69–2.64	NS
Always vs. never	868 vs. 145	1.38	0.94–2.03	0.09 (NS)

every day: OR = 2.37 (1.25–4.51), $p = 0.07$. There was no significant association between eating out and prevalence of obesity in both genders.

Risk for obesity was greater in girls who eat breakfast irregularly as compared to those who always have breakfast: OR = 2.71 (1.33–5.51), $p = 0.005$. Odds ratio for girls who never eat breakfast as compared to those who always eat breakfast was statistically significant: OR = 1.63 (1.08–2.47), $p = 0.01$.

There was no statistically significant association between eating breakfast and prevalence of obesity in boys, but a tendency to significance in boys who never eat breakfast as compared to those who always eat breakfast ($p = 0.09$) was noted.

Discussion

Parental obesity is considered to be the most significant risk factor contributing to the development of obesity in children [7]. Our study confirmed this fact as we found a statistically significant association between the prevalence of obesity in girls and boys and the obesity of the mother, father, or both parents. This risk was higher in boys than girls, particularly in those with both obese parents

(OR = 7.22). Among other authors Strauss and Knight [8] demonstrated that children develop obesity when one or both parents are obese, the mother's obesity being the most contributing factor in this study. Similar results were obtained by Lake *et al.* [9], although the obesity of both parents was most critical. Perez-Pastor *et al.* reported recently that obesity in offspring seems to be confined to those whose same-sex parents are obese [10, 11]. In our study maternal and paternal obesity constituted the same risk of their sons' or daughters' obesity but we did not follow our subjects longitudinally.

We did not find any relationship between the prevalence of obesity in children and the education of the mother, father, or both parents. The impact of parents' education on the development of obesity in children was recently investigated by Van Lenthe *et al.* in the GLOBE research project [12]. Significantly higher BMIs among individuals with lower education were observed in that study. However, de Vito *et al.* [13] found no statistically significant relationship between the mother's education and the prevalence of obesity in children. A more detailed assessment is certainly required to understand the discrepancy of the results achieved by various authors. To some extent it can be explained by the financial situation of the family, which may be another risk factor contributing to the development of obesity. Although such a correlation has been proven by de Spiegelaere *et al.* [14], we did not find the family's financial situation to have any substantial impact on the development of obesity in both genders.

No statistically significant association between eating out and the development of obesity in boys and girls was found. It is, however, questionable whether the parents who were aware of the reasons for their child's excessive body weight and their own contribution to his or her health condition gave true answers. Consumption of fast food among children in the US seems to have an adverse effect on dietary quality and increases the risk of obesity [15]. However, dietary factors were not associated with BMI in the study conducted by Jago *et al.* [16]. Some authors suggest that dietary fat consumption is associated with increased BMI in children [17, 18], but other studies reported no relationship between dietary fat intake and preschool children's BMI [19].

Analysis of eating habits showed that avoiding breakfast was a substantial risk factor contributing to the development of obesity in girls ($p = 0.01$). In boys, this factor had no statistical significance, but a trend towards significance could be observed ($p = 0.09$). The results achieved for a group of girls were in agreement with those of Rampersand *et al.* [20], who have also demonstrated that avoiding breakfast is a risk factor of obesity. Interestingly, in girls who most often had breakfast the odds ratio for the risk of developing obesity was statistically significantly higher than in those who always had breakfast. It implies that the lack of established eating habits may contribute to the development of obesity.

Television watching time did not constitute in our study a risk factor that might contribute to the development of obesity in either of the sexes. Our findings are different from the results of some other authors [16, 21, 22]. Jago *et al.* [16] found that physical activity and TV viewing were the only significant predictors of BMI of children aged 3 to 6 years. Other authors, in concordance with our study results, have not found such a relationship [23, 24]. The discrepancy of the results obtained by various research teams is probably due to the use of different study protocols, as well as to different age of the children examined.

Interesting results were also provided by an analysis of how much of their time children spend doing exercise. Physical exercises did not affect the development of obesity among girls, which, in turn, would suggest a more prominent role of dietary factors in this gender. It was impossible to calculate the odds ratio for girls engaging in physical exercise once a week as compared to those doing so on a daily basis; nor was it possible for those who did not exercise at all, because there were no obese girls in such groups. In a group of boys, however, a tendency to significance (OR = 1.94, $p = 0.08$) was identified for boys taking exercise only 2–3 times a week as compared to those who did so on a daily basis. It was impossible to calculate OR for boys who did not engage in physical exercise at all, as there were no obese boys in that group.

The present study is the first attempt to analyse the family and socioeconomic risk factors of simple obesity conducted on a large randomly selected group representative of the Polish population of school children aged 7 to 9 years. It is a part of the research on prevalence and risk factors of obesity in children aged 7 to 9 years conducted according to the protocol developed by ECOG [4]. Its first results were published in 2005 [25] and 2007 [26]. A comparison of the results compiled by Polish researchers with those obtained for the same age population of French children and using the same research methodology [27] showed that the prevalence of obesity in children of this age group is similar. The conclusions arising from our study indicate that the risk of obesity in children of both genders aged 7 to 9 years was significantly higher if the mother, father, or both parents were also obese. The risk of obesity in girls increased if they did not eat breakfast. Physical activity did not affect the development of obesity in either boys or girls.

It was rather surprising that low physical activity did not contribute to obesity development in

these young children. It could be due to the study limitation, which was the reporting of activity by the parents and not recording through a direct technique. However, it may also reflect the fact that small children are naturally quite active, regardless of being overweight, and diet may play a more important role than activity in obesity promotion. Our findings are to some extent supported by the study of Collins *et al.* [28]. They have recently demonstrated a greater reduction in BMI *z*-score in overweight prepubertal children by treatment with a dietary programme compared to a physical activity programme. They are also in accordance with recently published results of the Early Bird 45 study [29] investigating the factors that lead to obesity in 7 to 10 year old children. Based on the longitudinal observations, its authors conclude that physical inactivity is the result rather than the cause of fatness in children.

In conclusion, the implementation of focused preventive strategies for parents and children could stop further increase in the number of obese children and adults. Extensive efforts encouraging healthy living and eating are the most effective way of preventing obesity and adverse health conditions. The findings of our study may help identify families that are most vulnerable to obesity and develop health promotion programmes for them.

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