Increased prevalence of overweight and obesity among Polish children age 14-18 between 2001 and 2013 from Krakow, Poland - a cross-sectional study

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ABSTRACT

Introduction: So far, very little data on pediatric obesity has been published in Poland, although the problem seems to be growing.
Objective: To investigate present prevalence of overweight and obesity among schoolchildren using CDC (Center of Disease Control and Prevention) criteria in Krakow and to compare how it has changed between the years 2001 and 2013. Our aim was to establish the magnitude of this rising problem within the last decade.
Materials and methods: The study was conducted in two phases. In 2001, height and weight of the group of schoolchildren were obtained. Twelve years later, children in the same age, attending the same schools, were measured and weighed. Using the collected data, BMI (kg/m2) was calculated in order to acquire BMI percentile. BMI cutoffs referential for Polish population were used.
Results: Using the CDC criteria to diagnose children
as obese or overweight, the authors determined that the prevalence of overweight, including obesity was 10.8% in 2001 and changed to 15.1% in 2013 (p=0.0054). The percentage of obese children increased from 2.0% to 4.8% (p=0.0012). The occurrence of overweight and obesity has increased among girls (p=0.0025; p=0.0112 respectively) while among the group of boys, it did not change. The factors associated with excess weight were: male sex (OR=1.48; 95%CI=1.13-1.95) and second phase of the study (OR= 1.48; 95%CI=1.13-1.95).
Conclusion: Our study indicated that the prevalence of obesity and overweight among adolescents in Krakow rose within the last decade. The rising problem affected females more than males. Despite that, excess weight is still more frequent among males than females.
Key words: pediatric obesity, adiposity, overweigh

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INTRODUCTION

Obesity is being considered one of the diseases of civilization and its prevalence is constantly growing. According to WHO data 43 million children in the world are either overweight or obese. Worldwide prevalence of childhood overweight and obesity was estimated to 4.2% in 1990 and increased to the level of 6.7% in 2010 [1]. Although in some countries (USA) obesity and overweight in the pediatric population has been recognized as a problem for over forty years, in other parts of the world it became point of interest a only few years ago. As the etiology of obesity is complex and contains both genetic [2] and environmental factors [3-5] its prevalence can not be easily predicted based on HDI (Human Development Index) [6] and the affinity of the country to a specific HDI group (Table 1).

Table 1. Data on overweight and obesity among children and adolescents based on most recent researches available [7,14,32,33].

	Overweight (including obesity)	**Obesity**
Very high HDI group		
Norway	13.8%	2.3%
Switzerland	11.9%	7.1%
Great Britain	girls:29% boys: 31%	girls:14.8% boys:17.1%
Spain	26%	12.6%
USA	31.8%	16.9%
High HDI group		
Iran	10.8%	5.1%
Russia	11.8%	2.3%
Brazil	16.6%	5.5%
Romania	18.2%	7.2%
Pakistan	12%	8%
Medium HDI group		
China	15.4%	6.6%
South Africa	17%	4.2%
Bolivia	14%	5%
Low HDI group		
Yemen	6.2%	1.8%
Ghana and Uganda	girls:10.4% boys: 3.2%	girls:0.9% boys:0.5%

Moreover, at variance with common belief, that the problem of obesity among pediatric population is growing worldwide, there are several countries in which the obesity rate has either stabilized or diminished. Swiss researchers report stabilization of children obesity and overweight prevalence between 1999 and 2012 on the levels of 11.9% and 7.1%, respectively [7,8].

Similarly, both France and Sweden show no changes in obesity rates (France:1998 to 2007 in children ages 3 to 14) (Sweden: 2001 to 2007 among 16-year-old youth) [9-11].

Japan on the other hand is an example of a country with very high HDI which reports decrease in prevalence of childhood obesity after year 2000 [12] (except for the group of 17 years old boys amongst which obesity rate has increased between 1978 and 2006).

The purpose of our study was to determine the prevalence of pediatric obesity and overweight among Polish population represented by adolescents from Kraków and focus on its tendency within last decade.

MATERIALS AND METHODS

Population

Children that participated in the study attended five secondary and three high schools in various districts of Kraków randomized regarding wealth, ethnicity and social structure of residents. The study was divided into two phases (in 2001 and in 2013). Both phases of the study were performed in the same schools.

The group of participants during the first phase of the study (in 2001) included 466 girls and 461 boys, while during the second phase of the study (in 2013) the group was formed of 513 girls and 455 boys. There was a minor age difference between studied groups in 2001 and 2013 (15.67 ± 1.03 vs 15.93 ± 0.5 respectively, p=<0.001) (Table 2).

Table 2. Characteristic of study groups 2001 and 2013

	Females	**Males**	**Mean age**
Study group 2001	466	461	15.67 ± 1.03
Study group 2013	513	455	15.93 ± 0.5

Participation

The inclusion criteria were: age (14-18 years) and attendance of chosen school. Participation in the study was voluntary. After getting approval of the proper school authorities both the parents and the students expressed oral consent for participation in the study.

The exclusion criteria were either parent or student refusal. The research was approved by the ethical committee of the medical faculty of the Jagiellonian University of Cracow. The study complies with the Declaration of Helsinki.

Measurements

The research took place during first two quarters of 2001 and first two quarters of 2013. Children were weighed and measured without shoes and heavy clothing according to the CDC children measurement manual [13]. In both parts of the study students were measured using calibrated medical scale with the precision of 0.1 kg. Measurements were taken twice to minimize the error and final result was an average.

Data analysis

BMI was calculated by dividing weight (kg) by height squared (m2). Overweight (including obesity) and obesity were defined by the age- and sex-specific 85th and 95th BMI percentiles, according to the CDC guidelines [14]. We chose CDC (Center of Disease Control and Prevention) diagnostic criteria as previous researches proved that IOTF (International Obesity Task Force) criteria are inadequate for Polish population [15, 16]. According to the CDC criteria overweight including obesity is defined as BMI value above 85 percentile for sex and age and obesity is defined as BMI above 95 percentile for sex and age. We used national up-to-date BMI cut-offs [17] to highlight obese and overweight adolescents, as they are more suitable for the analyzed population [18,19].

Statistics.

Continuous variables were expressed using means and standard deviations. Categorical variables were described as counts and percentages. A comparison between phases of the study and counts of obesity or overweight including obesity were performed using Chi^2 test. Comparisons in the subgroups regarding sex and attendance to secondary or high school were also calculated with Chi^2 test. Logistic regression model was created in order to estimate determinants of excess weight.

RESULTS

According to the results the prevalence of overweight including obesity among adolescents in Kraków has increased from 10.8% in 2001 to 15.1% in 2013. The change in obesity index was even more dramatic- from 2.0% to 4.8% (Table 3).

Table 3. Prevalence of overweight and obesity among participants in both phases of the study

	Study group 2001 (n=927)	**Study group 2013 (n=968)**	**P value**
Overweight including obesity	10.8% (100)	15.1% (146)	0.005
Obesity	2.0% (19)	4.8% (46)	0.001

Female students were responsible for this significant increase in the whole group, amongst them the incidence of overweight rose from 7.9% to 14%, and the problem of obesity has worsen from 1.29% to 3.9% (Table 4).

Table 4. Prevalence of overweight and obesity among girls in 2001 and 2013

	Females 2001 (n=466)	**Females 2013 (n=513)**	**P value**
Overweight including obesity	7.9%(37)	14%(72)	0.0025
Obesity	1.29%(6)	3.9% (20)	0.0112

The group of boys was not affected by increase of overweight prevalence (change in overweight prevalence 13.7% to 16.2% p= 0.2704) but there was significant increase regarding obesity (from 2.8% to 5.7% p=0.0301) (Table 5).

In the logistic regression multivariate model (Table 5), male sex was associated with increased odds of excess weight rather than female sex (OR=1.48; 95%CI=1.13-1.95).

Table 5. Prevalence of overweight and obesity among boys in 2001 and 2013

	Males 2001 (n=461)	**Males 2013 (n=455)**	**P value**
Overweight including obesity	13.7% (63)	16.2% (74)	0.2707
Obesity	2.8% (13)	5.7% (26)	0.0301

Similarly, the second phase of the study was also an independent predictor of excess weight (OR=1.48;95%CI=1.13-1.95) even after standardization n for age and sex (Table 6).

Hence, the study provided evidence that time lapse of one decade increased odds ratio for excess weight among adolescents by 48%. In 2013 the group of students with excess weight included 146 adolescents, 49% of which were females. 46 adolescents were considered obese also with predominance of boys (56%) (Table 7).

Table 6. Multivariate logistic regression model with overweight as dependent variable. Overall model significance level: p=0.025

Variable	**OR**	**CI**	**P value**
Male sex	1.48	1.13-1.95	0.01
Age	1.00	0.9-1.11	0.92
Study phase	1.48	1.13-1.95	0.005

Table 7. Characteristic of overweight and obese adolescents from study group 2013

	Females (513)	**Males (455)**	**Overall (968)**
Overweight including obesity	72	74	146
Obesity	20	26	46
Mean age	16.15±1.51	15.67±1.45	15.93 ± 0.5

DISCUSSION

The fact that the mean age of the population was different (difference 0.5 year) may be considered as a limitation of our study. However in pediatrics weight, height as well as BMI are being analyzed age-adjusted, so the age difference does not affect objectivity of judging obesity and overweight prevalence.

The strength of our study is the fact that no data about the tendency in obesity and overweight prevalence among adolescent population in this time period, was published. According to the study published in 2012 [20] overweight affected 27.31% Krakow boys and 16.09% girls, while 7.78% boys and 3.44% girls were suffering from obesity. The difference between our study and the results of the authors' maybe the consequence using of different criteria (IOTF) of overweight and obesity. Also, the fact that the age groups from the study mentioned above were younger than in our study (6-13 years) suggests that the problem may escalate in the future. Another research regarding trends of childhood obesity problem in Krakow [21] shows that the percentage of overweight and obese children and adolescents doubled between 1971 and 2000, and at the same time presents much more alarming data: in 2000 overweight including obesity was on the level of 15.2% among boys and 11.8% among girls. Nevertheless, the population of the study was younger (7-18 years) and different criteria were used to determine overweight and obesity.

A study conducted in 2010 [22] for which children from 400 random Polish towns were recruited shows results less alarming than ours, regarding the prevalence of the diseases- 9.0% adolescents age 14-18 were overweight and 5.1% were obese, girls were more affected by this problem than boys. On the other hand, the current Polish data show overweight or obesity index equivalent to 18.7% and 14.1% in school-aged boys and girls, respectively [19].

The differences between particular Polish data, on the issue of obesity and overweight at childhood and adolescence might result from disparity of age groups as well as of different criteria accepted by the researches. Our decision to choose CDC criteria, which causes difficulty in comparing the studies was imposed by the desire to achieve the most accurate diagnosis. Undoubtedly, the matter requires further analysis and monitoring.

Moreover, our results throw light on the problem of obesity among girls. Most of the previous Polish researches show that the obesity problem is more frequent among boys and male adolescents, while this correlation is not that clear in other parts of Europe. In England [23] according to the national health survey female students were much more obese than male students. Similar results were presented by Irish researchers [24]. In France where stabilization of the obesity problem is observed, there was no significant difference in the prevalence of overweight and obesity between boys and girls [25]. Overweight and obesity rates were equal among boys and girls in Lithuania [26] where one of the lowest prevalence among girls was also observed. Worldwide data show that girls are more obese than boys in Saudi Arabia [27], Libya [28], Algeria [28], South Africa [29], Nigeria [30], Mexico [31], Bolivia [32], Pakistan [33], Australia [34] and New Zealand [35]. The dramatic growth of obesity among Polish girls compared to boys, may result from girls' unhealthy eating habits [36] although, according to some Polish authors, boys' daily dietary habits are worse than girls [37]. Girls' lower physical activity level [38] can also be responsible for their excess weight. The matter certainly requires further research.

CONCLUSION

In conclusion, the authors proved that the prevalence of both obesity and overweight increased among Krakow children. The girls were more affected by the increase than boys, however excess weight was still more frequent among boys.

Conflicts of interest

The authors do not report any conflict of interest.

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