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Overweight and Obesity in Slovenian Schoolgirls, 1991–2006

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A B S T R A C T

The proportion of overweight children and adults has been growing rapidly in the last few years in many European and other countries. Certain consequences of overweight are already manifested in youth; in adulthood they are one of the main causes of death and several diseases. The study examined the proportion of overweight and obese Slovenian girls aged 7 to 18 with the use of an annually repeated cross-sectional study. The study lasted from 1991 to 2006 and was based on the body mass index according to IOTF norms. The results show that in this period the proportion of overweight girls increased by almost 30% (from 13.5% to 18.8%), whereas the proportion of obese girls doubled (from 2.3% to 4.6%). The prevalence of overweight and obesity is highest in childhood and early adolescence where it is around two to three times higher than at the age of 18.

Key words: *body mass index, overweight, obesity, girls, Slovenia*

Introduction

Overweight and obesity are reaching epidemic proportions around the world. In 2003, the WHO reported more than 1 billion overweight adults globally, with at least 300 million of them being obese[1]. 17.6 million of them are children under the age of five. Over the last decade, the prevalence of obesity in Western and Westernising countries has more than doubled[2]. It is estimated that 400,000 extra children are becoming overweight or obese each year within the expanded European Union. In Canada, Australia and parts of Europe 1% of all children are becoming overweight every year. Twenty-five percent of children in the USA are overweight and eleven percent are obese[3].

About 70% of obese adolescents grow up to become obese adults[4]. Obese children under three years of age whose parents are not obese have a low risk of becoming obese in their adulthood. Nevertheless, with older children obesity is an increasingly important predictor of future adult obesity, regardless of whether their parents are obese or not[5].

Obesity holds many health consequences. As well as increased mortality, obesity is a risk factor in a range of chronic diseases such as Type 2 (adult-onset) diabetes, coronary heart disease, some types of cancer, osteo-arthritis and back pain. Obesity also has social and psychological consequences – including stigmatisation, discrimination and prejudice. Researches have linked obesity with a low self-image, low self-confidence and depression[3,6,7].

Some consequences of childhood obesity – hyper-insulinaemia, poor glucose tolerance and a raised risk of Type 2 diabetes, hypertension, sleep apnoea, social exclusion and depression – onset already in childhood, while other consequences of obesity pass through to adulthood[3].

The economic consequences of obesity are enormous and include the direct costs of health services, the indirect costs associated with premature death and lost economic production, and individual costs such as purchases of special clothing and so-called slimming products. The total direct and indirect costs of obesity have been estimated at up to 0.9% of GDP among countries in the EU, 1.2–1.4% in the United States and 2.1% in China[8].

The mechanism of the development of obesity is not fully understood and is believed to be a disorder with multiple causes. Genetic factors influence the susceptibility of a given child to an obesity-conducive environ-

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ment. However, environmental factors, lifestyle preferences and the cultural environment seem to play major roles in the rising prevalence of obesity worldwide. It is confirmed that obesity occurs when energy intake exceeds energy expenditure, thus suggesting that a proper diet and physical activity are the key strategies for controlling the current obesity epidemic[9].

There is a wide variety of definitions of child obesity; however, no commonly accepted standard definition has so far emerged. Although less sensitive than skin-fold thickness, the body mass index (weight/height^2) is widely used in adult populations, and a cut-off point of 25 kg/m^2 and 30 kg/m^2 is recognised internationally as a definition of adult overweight and obesity, respectively[10]. These cut-off points are only appropriate for adults as they are much lower in children and adolescents. The International Obesity Task Force (IOTF) proposed age- and sex-specific cut-off points from 2–18 years, which correspond to adult cut-off points of 25 kg/m^2 and 30 kg/m^2. They are internationally based and should help provide internationally comparable prevalence rates of overweight and obesity in children. Then norms are published in the form of centile curves, from which tables for both genders and for all ages between 2 and 18 years are derived[11]. Several studies have found BMI to be a good representative of body fat; e.g. in a recent study of Swedish schoolgirls aged 8–11 years[12], a very high linear correlation ($r=0.95$) was found between BMI and both total and abdominal fat mass.

A number of studies on the prevalence of obesity in European children and adolescents in different years after 1990 were reviewed by Lobstein, Baur & Uauy[3]. The prevalence of overweight (incl. obese) children aged around 7–11 years using the IOTF cut-off points was especially high in southern Europe (Italy 36%, Spain 34%, Greece 31%), and substantially lower in northern Europe (Holland 12%, Denmark 15%, Germany 16%). Among adolescents aged around 14–17 years the prevalence ranged from below 10% (Slovakia, Czech Republic, Russia) to above 20% in certain southern countries (Cyprus 23%, Greece 22%, Spain 21%). There are differences between boys and girls, e.g. in Great Britain the prevalence of overweight and obesity in 5- to 10-year-old children for the period 1984 to 2002-3 is much higher in girls[13].

There are also some differences between genders in terms of the psychosocial consequences of obesity. The NIHCM Foundation's Issue Brief[14] reports results of US studies where obese girls – and not boys – in kindergarten have many behavioural problems such as anxiety, loneliness, a low self-esteem, sadness, anger, arguing and fighting. Similarly, in third grade only overweight girls show depressive symptoms. This is probably a result of the views of modern society, which promotes the cult of physical appearance; this cult is widespread and tough on women and has the highest degree of moral authority. Namely, a thin body is perceived as a healthy body and a healthy body equals a good person[15].

For Slovenia, only partial results for overweight prevalence exist. According to the IOTF cut-off points, the prevalence of overweight children among five-year-olds in the period 2003-05 was 12.5% and 16.7% in boys and girls, respectively. The obesity criteria are fulfilled in 4.1% boys and 4.7% girls. Among adolescents, 18.9% boys and 16.7% girls are overweight and 3.5% boys and 3.4% girls are obese[16]. The percentage of overweight and obese girls and boys between the ages 7 and 19 grew dramatically from 1983 to 2006, especially in younger age groups[17].

The present study used data from the Sports educational chart fitness evaluation system which has been carried out in all Slovenian schools annually since 1991. Because of the huge amount of data created, only the results for girls were analysed and are presented in this article.

Materials and Methods

Sample

The repeated cross-sectional sample (Table 1) consists of all girls who participated in measurements for the Sport educational chart fitness evaluation system[18,19] from 1991 to 2006. 90% of girls aged less than 15 years were included in the measurements, whereas the proportion of older girls (16 to 19 years) was between 60–80%, depending on the type of high school[20]. Measurements of body weight and height were conducted by PE teachers annually in April during the usual physical education lessons in all Slovenian schools according to a standard protocol[18,19]. Only healthy girls who were not exempt from physical education for health reasons and whose parents had given their written consent to participate in the measurements were measured.

In the first year of school (7-year-old children) an apparent increase in the number of girls is noted between 2000 and 2004. In that period, a gradual transition to the new nine-year long compulsory education started in Slovenia, meaning that children started school earlier. The smaller number of girls is noticed in other years as a result of the birth rate decreasing by more than one-third.

Data analysis

Data were analysed with the use of the SPSS 15.0 statistical package. The prevalence of overweight (excluding obesity) and obesity were determined according to the IOTF cut-off points[11] separately for age (7- to 18-year-old girls, +/– 6 months) and the year of measurement (1991 to 2006). Confidence intervals for proportions were computed using Collett's formula[21].

Results

The prevalence of overweight and obese 7- to 18-year-old girls from 1991 to 2006 is shown in Tables 2 and 3. The 95% confidence interval width for the overweight proportion ranges from 1% to 3.1%, but is only wider than 2% for 7 years old girls. The 95% confidence interval width for the proportion of obese ranges from 0.4% to 2% and rarely exceeds 1%. The confidence interval width

TABLE 1
SAMPLE SIZES ACCORDING TO THE AGE OF THE GIRLS AND THE YEAR OF MEASUREMENT

	Age											
Year	7	8	9	10	11	12	13	14	15	16	17	18
1991	2903	11528	12066	12349	12760	13137	12789	12598	12125	10686	9305	8038
1992	2845	11541	11836	12212	12663	13283	13258	12876	12549	11903	10866	8788
1993	2648	11334	11695	12000	12428	13035	13444	13334	12788	12007	11583	9725
1994	3010	10869	11765	11880	12239	12784	13177	13420	13165	12260	11837	10346
1995	2999	11309	10891	11715	11861	12435	12754	12981	13007	12089	11579	10161
1996	2681	11482	11532	11038	11924	12173	12491	12748	12542	11271	10782	9461
1997	2341	9862	11100	11143	10704	11443	11450	11545	10626	8082	8161	7285
1998	2429	9651	10050	11142	11267	10871	11472	11330	10859	9060	8530	7920
1999	2205	9446	9831	10084	11200	11406	10793	11205	10778	9362	8537	7396
2000	2792	8704	9671	9953	10197	11370	11303	10547	10435	8925	8452	7443
2001	3251	8790	8878	9622	10001	10227	11254	11006	9864	8832	8364	7437
2002	4158	8677	8866	8890	9704	10040	10113	10912	10247	8149	7932	7385
2003	5479	8535	8804	8925	8942	9769	9931	10059	10415	9004	8057	7268
2004	8125	8415	8564	8749	8988	8960	9681	9794	9300	8529	8318	7187
2005	7928	8296	8497	8607	8826	9043	8880	9613	9117	7482	7853	7373
2006	7368	7817	8089	8292	8418	8734	8814	8674	8265	5997	6690	6619

for the proportion of overweight and obese girls is never higher than 18.7% and 38.9%, respectively, of its point estimate. As the sample used in this study is not a probability sample, the above confidence intervals should only be used for descriptive purposes.

When the entire sample is considered, irrespective of the girls' ages, the proportion of overweight and obese girls is almost steadily growing from 1991 to 2006. In the observed period the percentage of obese girls doubled – from 2.3% in 1991 to 4.6% in 2006 – whereas the percentage of overweight (excl. obese) girls rose from 12.3% in 1991 to 15.8% in 2006.

Although the overall prevalence of overweight and obese girls is continuously growing from 1991 to 2006,

TABLE 2
PREVALENCE OF OVERWEIGHT (EXCL. OBESITY) IN SLOVENIAN GIRLS (IN %) FROM 1991 TO 2006

	Age											
Year	7	8	9	10	11	12	13	14	15	16	17	18
1991	13.2	13.1	14.2	14.3	13.7	13.2	13.4	12.2	11.3	10.7	8.3	8.0
1992	13.8	12.2	12.7	12.8	12.5	11.7	11.6	11.0	9.9	9.6	7.9	7.0
1993	13.5	13.9	14.3	14.4	14.3	13.6	12.5	11.6	11.1	10.2	9.3	7.6
1994	13.6	13.8	15.5	15.3	14.9	14.3	13.0	12.0	10.8	10.8	9.0	8.1
1995	14.7	14.1	15.5	16.1	15.4	14.7	13.6	12.3	11.0	11.2	9.8	8.2
1996	14.9	14.9	16.4	16.0	16.3	15.0	14.2	13.1	11.9	11.6	9.9	9.1
1997	14.2	14.7	15.9	16.2	15.0	15.0	13.9	12.6	11.7	11.0	9.2	8.6
1998	14.7	15.3	16.6	16.8	16.4	14.6	14.4	13.6	11.6	11.0	9.8	8.3
1999	15.4	15.1	17.2	17.3	17.0	15.8	14.0	12.6	12.0	10.9	9.6	8.7
2000	14.8	15.7	17.2	18.4	17.4	16.6	15.4	12.9	11.7	10.7	9.6	9.0
2001	15.4	15.9	17.9	17.9	18.2	17.0	14.9	13.2	11.8	10.7	9.3	8.7
2002	15.3	16.1	17.7	17.5	16.8	17.0	15.1	13.2	12.1	11.0	9.5	8.9
2003	14.3	15.9	17.3	17.9	17.2	15.8	15.4	13.7	12.1	11.6	9.3	8.9
2004	14.8	15.7	18.8	18.9	18.1	17.0	15.0	13.7	13.0	11.8	10.8	8.9
2005	14.3	17.0	18.6	19.2	17.8	17.5	16.0	13.9	12.8	12.3	10.7	10.5
2006	14.0	17.2	19.9	19.8	19.5	17.9	16.7	14.6	12.9	12.8	11.3	10.1

TABLE 3
PREVALENCE OF OBESITY IN SLOVENIAN GIRLS (IN %) FROM 1991 TO 2006

	Age											
Year	7	8	9	10	11	12	13	14	15	16	17	18
1991	3.7	3.7	3.2	3.0	2.5	2.2	2.0	2.0	1.8	1.7	1.3	1.0
1992	4.0	3.0	2.8	2.3	2.0	1.8	1.5	1.5	1.4	1.4	1.1	0.8
1993	4.8	4.3	3.4	2.9	2.4	2.4	2.0	1.7	1.6	1.4	1.3	1.2
1994	5.5	4.4	4.1	3.2	2.6	2.5	2.4	2.1	1.9	1.7	1.4	1.3
1995	5.5	4.9	4.4	3.9	3.1	2.6	2.7	2.4	2.0	1.7	1.6	1.3
1996	5.6	4.9	4.6	4.0	3.6	2.9	2.7	2.3	2.3	2.3	1.7	1.5
1997	5.8	5.0	4.5	4.0	3.3	2.8	2.3	2.1	1.8	2.0	1.8	1.3
1998	5.2	5.2	4.9	4.1	3.6	3.2	2.8	2.2	2.4	2.0	1.7	1.5
1999	5.1	5.5	5.3	4.5	3.7	3.3	2.9	2.7	2.2	2.2	1.8	1.5
2000	6.3	5.3	5.5	4.7	4.2	3.7	3.0	2.6	2.4	2.4	1.9	1.8
2001	6.3	6.1	5.1	5.0	3.8	3.6	3.3	2.6	2.5	2.5	1.8	1.7
2002	6.3	5.7	5.4	4.4	4.1	3.1	3.0	2.7	2.3	2.1	2.0	1.3
2003	5.9	6.1	5.5	4.5	3.5	3.2	2.7	2.4	2.4	2.2	2.2	1.9
2004	6.5	6.4	6.3	5.1	4.4	3.4	3.3	2.6	2.5	2.4	2.1	2.2
2005	6.1	6.9	6.2	6.2	4.8	4.0	3.3	3.2	2.8	2.3	2.6	2.1
2006	6.5	7.0	7.0	6.0	5.7	4.5	3.6	3.1	2.9	3.0	2.5	2.5

the pattern of changes (Figures 1 and 2) remains almost the same. The percentage of overweight children has the highest values between the ages of 9 and 11 and then gradually decreases until the age of 18, whereas the percentage of obese children only rises from the age of 7 to 8 and up until the age of 18 it decreases to less than half its maximum value.

Discussion

There are some limitations of the study. Although the sample is large, it is not a probability sample of all girls aged 7–18 years in Slovenia. Namely, after 1996 (when new educational legislation was accepted) only healthy girls wishing to participate and having the written consent of their parents are included. Nevertheless, the same limitations apply even to probability sampling; further, the sampling procedure was the same throughout the study. Therefore, there is no reason for the described trends not to apply to the entire population. However, there is some reason to believe that the prevalence of overweight and especially obesity are in fact a little higher in the population than as described in this study since obese pupils are probably less likely to participate.

Undoubtedly the prevalence of overweight and obesity is taking on epidemic proportions. The percentage of overweight and obese girls in Slovenia has been rising almost constantly every year from 1991 to 2006, with the only real exception at the beginning of the period (in 1992), which is probably due to the establishment of the new country of Slovenia in 1991. In that year the migration of the population was not monitored and some nov-

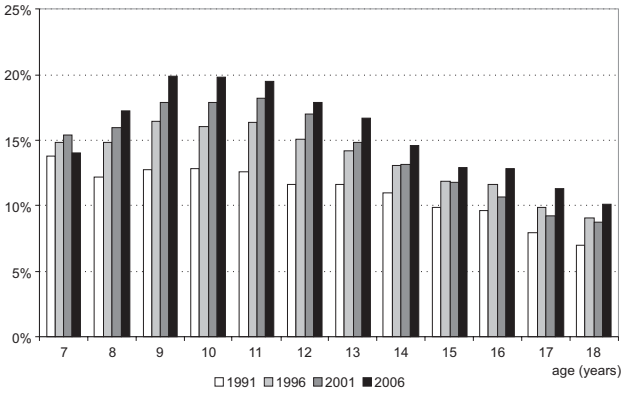

Fig. 1. Proportion of overweight girls at different ages in Slovenia from 1991 to 2006.

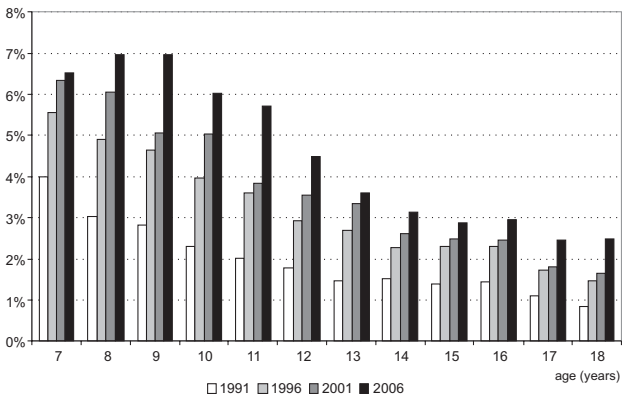

Fig. 2. Proportion of obese girls at different ages in Slovenia from 1991 to 2006.

elties were introduced into the education system. Obesity is rising at higher rates than overweight, as it has more than doubled in just 15 years.

The proportion of overweight and especially obese girls is rapidly falling from around 11-year-old to 18--year-old girls. This might seem promising as it should lead to the conclusion that the proportion of obesity in adulthood, when it becomes a real health problem, is falling. In contrast, the WHO (infobase.who.int) estimates that the percentage of adult (15+ years) obese (BMI>30 kg/m^2) females in Slovenia exceeds 25% and is twice as high as for males.

The age period between 11 and 18 years is marked in the Slovenian education system by the introduction of specialised physical education teachers; the results of motor tests significantly improve[22] due to the greater systematic work, better working conditions for this age group (a smaller number of children *per* group) and better knowledge of sports teachers about the selection of suitable contents and the work load.

The prevalence of overweight and obesity, its secular trends and pattern of changes from childhood to adolescence in Slovenia are similar to those in many other countries in Europe and the rest of the world. Although data are not directly comparable with recent studies in other European countries, as reviewed by Lobstein & Frelut[23], due to methodological and other differences it seems that the prevalence of overweight children in Slovenia is in conformity with its geographical position in Europe. As an example, in 2000 the prevalence of overweight (including obese) 7-9-year-old girls in Slovenia was 21.8%, while the prevalence of overweight children (Lobstein & Frelut did not report the results separately for boys and girls) of the same age and in a similar period (most studies were done in 1997–2001) was around 30–35% in Mediterranean countries and around 20% in the other countries. With 14- to 17-year-old girls, the equivalent prevalence in Slovenia was 13.7%, while it ranged around Europe from 8–23%.

The increase in the proportion of both (overweight and obese) groups in developed countries is probably a result of several factors, although their relative impact in the epidemiology of obesity is somewhat controversial. It seems that one of the key factors is the change in dietary and physical activity patterns of young people[23]. The way young people spend their free time has changed in recent years. Most studies show that girls are less physically active than boys in their free time and that the volume of free-time physical activities gradually decreases with age[25–27]. In a review of several European studies, Brettschneider and Naul[25] show that physical activity significantly decreases with age – 3% *per* annum for boys and a staggering 7% for girls. Only every third Slovenian girl is moderately to intensively active at the age of eleven; this information is also valid for every fourth 13-year-old and every fifth 15-year-old girl[28].

Although it can be expected that a smaller amount of motor activity will result in a larger proportion of overweight and obese children, particularly girls, the influence of fashion and the media ever praising a thin body means that girls in the period of their adolescence look after their external appearance significantly more[15]. It has also been noted[29] that this smaller proportion of overweight and obese girls in adolescence is a result of unhealthy eating habits (girls skipping breakfast and dinner and often having uncontrolled diets) rather than the sportingly active spending of free time. In the Slovenian part of the Health Behaviour in School-aged Children (HBSC) study[28], 8% of boys and 20% of girls were found to follow some kind of diet; at the same time 64% of boys and only 41% of girls were happy with their body weight. The proportion of people dieting with the intent of losing weight is increasing with age. 8% of girls thought that they are extremely overweight and 44% of girls thought that they are slightly overweight. The proportion of people who consider their body as being in shape is decreasing with age, while the proportion of people who think of themselves as overweight is rising.

Eating disorders have been noticed in numerous young people. It is estimated that about 5% to 10% of teenage girls have eating disorders[30]; similar values can also be noticed for Slovenian high school girls[20].

The health consequences of overweight during childhood are less clear, but a systematic review shows that childhood obesity is strongly associated with risk factors of cardiovascular disease (CVD) and diabetes, orthopaedic problems and mental disorders[31,32]. The number of children with health problems is also on the rise in Slovenia, particularly among the youngest children[33]. A growing trend is noted for diseases of the muscular-skeletal system and mental and behavioural disorders.

Conclusion

Undoubtedly the prevalence of overweight and obesity is also taking on epidemic proportions in Slovenia. The percentage of overweight and obese girls in Slovenia was rising almost constantly every year from 1991 to 2006, with the only real exception at the beginning of the period (in 1992). Obesity is going up at higher rates than overweight, as it has doubled in just 15 years.

The proportion of overweight and especially obese girls is decreasing for girls between the ages of 11 and 18, which is probably a result of the quality physical education in schools and fashion trends that demand young girls to be thin[34]. Nevertheless, data on the adult population show that the proportion of obese (BMI>30 kg/m^2) females in Slovenia exceeds 25% and is twice as high as with males.

Warnings on these negative trends have already been issued for some time now; unfortunately, the government does not listen to the opinions of health and sports experts. Particularly in the last years a reduction in the hours of physical education lessons has occurred in high school programmes[35], with this being one of the biggest mistakes of educational policy-makers. Therefore, sports pedagogues and health workers are calling for an increase and not a decrease in the number of physical edu-

cation lessons. Further, certain measures that could contribute to a better status are also being suggested: the removal of vending machines offering unhealthy snacks from school premises, safeguarding the school neighbourhood so that children can walk or cycle to and from school, maintenance of playgrounds near the school thus allowing for spontaneous sports activity, an improvement of educational norms (a smaller number of children *per* teacher) and an improvement in the quality of physical education in the first few years of education involving the combined teaching of form teachers and PE teachers[17].

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PREKOMJERNA DEBLJINA I PRETILOST KOD SLOVENSKIH UČENICA, 1991–2006

SAŽETAK

Udio prekomjerno debele djece i odraslih na području mnogih Europskih ali i drugih zemalja, u zadnjih nekoliko godina, u ubrzanom su porastu. Određene posljedice pretilosti već su vidljive kod mladih; u odrasloj dobi jedan su od vodećih uzroka smrti i ozbiljnih bolesti. Ova studija istražuje razmjere prekomjerne debljine i pretilosti kod slovenskih učenica između 7 i 18 godina s godišnje ponovljenim transverzalnim istraživanjem. Istraživanje je trajalo od 1991. do 2006. godine i bilo je bazirano na indeksu tjelesne mase po IOTF normama. Rezultati pokazuju da se u ovom periodu povećao udio prekomjerno debelih učenica za gotovo 30% (od 13,5% na 18,8%), dok se udio pretilih udvostručio (od 2,3% na 4,6%). Prevalencija prekomjerne debljine i pretilosti najviša je u razdoblju djetinjstva i rane adolescencije gdje je oko dva do tri puta viša nego u dobi od 18 godina.