

The prevalence of excess weight and obesity in Slovenian children and adolescents from 1991 to 2011

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Abstract

The proportion of overweight children and adults has been growing rapidly in recent years in many European and other countries. The survey examined excess weight and obesity in a population of Slovenian boys and girls aged seven through eighteen from 1991 to 2011 with the use of an annually repeated cross-sectional study of data from the SLOFIT fitness evaluation system. The BMI cut-off points of the International Obesity Taskforce were used to identify excess weight and obesity. During 1991–2011 period, excess weight and obesity have become clearly more prevalent in Slovenian children. The proportion of excess weight and obesity is more obvious in boys than in girls, especially among adolescents, although the increase has been similar in both sexes (overweight boys 13.3% in 1991 vs. 19.9% in 2011; overweight girls 12.0% vs. 17.2%; obese boys 2.7% vs. 7.5%; obese girls 2.1% vs. 5.5%). In recent years, the prevalence of excess weight and obesity among 9- to 13-year-old boys and 8- to 12-year-old girls is around two to three times higher than at the age of eighteen. Also notable is a high rate (around 4%) of obese girls and boys at the ages 17 and 18 in 2011, which is approximately two times higher than in previous years, while the rate of excess weight and obesity among 7-year-old children of both sexes is the same (among those overweight) and a little lower (among those obese) compared with 2006.

KEYWORDS: public health, excess weight, BMI, secular trend, epidemic, gender differences, Slovenia

Introduction

There is little doubt that the extensive change in people's lifestyles and the use of modern technology also influence the physical development of children and youth (Ferreira et al. 2007; Jurak 2006; Ortega et al. 2011; Pušnik & Starc 2008; Pušnik 2007; 2008; Rychtecký 2007; van Der Horst et al. 2007). Unsuitable eating habits and a lack of movement result in excess weight and obesity (Daniels et al. 1999; Hills, Andersen & Byrne 2011; Olds et al. 2011; Steinbeck, 2001) that are reaching epidemic proportions in the developed world (Armstrong, Lambert & Lambert 2011; Godina 2011; Garnett, Baur & Cowell 2011; Ogden et al. 2012; Sjoberg & Hulthen 2011; Starc & Strel 2010; Starc & Strel 2011; Vuorela, Saha & Salo 2011).

Obesity is a multifactorial disease with a complex aetiology (Manios & Costarelli 2011) that 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 (Hannon et al. 2005; Mihalik et al. 2012), coronary heart disease, some types of cancer, osteoarthritis and back pain (Daniels et al. 1999; Manios & Costarelli 2011; Mokdad et al. 2003). Some childhood obesity consequences – hyper-insulinaemia, poor glucose tolerance and a raised risk of Type 2 diabetes, hypertension, sleep apnoea, social exclusion and depression – begin in childhood, while other obesity-related diseases emerge in adulthood (Lobstein, Baur & Uauy 2004; Khang & Lynch 2011). Obesity also has social and psychological consequences — including stigmatisation, discrimination and prejudice. Researchers have linked obesity with a low self-image, low self-confidence and depression (Lobstein et al. 2004; Storch et al. 2007).

Overweight and obese children have a greater risk of becoming overweight or obese young adults (Ekblom et al. 2009; Angbratt et al. 2011). Starc and Strel (2010) reported that height, weight and BMI at 18-years old Slovenian were well predicted from childhood and became more predictable with age. The history of their weight shows that 40.0% of males and 48.6% of females who were obese at 18 years had already been obese at seven years of age.

Obese children under three years of age without obese parents are at a low risk of obesity in their adulthood but, among older children, obesity is an increasingly important predictor of adult obesity regardless of whether one's parents are obese (Whitaker et al. 1997). About 70% of obese adolescents grow up to become obese adults (Parsons et al. 1999). Singh et al. (2008) systematically reviewed the literature and updated evidence concerning the persistence of childhood excess weight. The majority of reviewed studies consistently reported a moderately increased risk of overweight and obese youth becoming overweight adults.

The mechanism of obesity development is not fully understood and is believed to be a disorder with multiple causes. It is confirmed that obesity occurs when energy intake exceeds energy expenditure, suggesting a proper diet and physical activity are the key strategy for controlling the current epidemic of obesity (Dehghan, Akhtar-Danesh & Merchant 2005). Genetic factors influence the susceptibility of a given child to an obesity-conducive environment. However, environmental factors, lifestyle preferences and the cultural environment also seem to play major roles in the rising prevalence of obesity worldwide (Ferreira et al. 2007; Stamatakis et al. 2005; Steinbeck 2001).

There is a wide variety of definitions of child obesity, and no commonly accepted standard has yet emerged. Although less sensitive than skin-fold thickness, the body mass

index (BMI; weight/height²) is widely used in adult populations and a cut-off point of 25 kg/m² and 30 kg/m² is an internationally recognised definition of adult excess weight and obesity (Malina & Katzmarzyk 1999). The International Obesity Task Force (IOTF) proposed age- and sex-specific cut-off points from 2 to 18 years that are internationally based and should help provide internationally comparable prevalence rates of excess weight and obesity in children (Cole et al. 2000; Wang & Lobstein 2006). Despite certain limitations of the BMI (Freedman et al. 2005; Matusik, Malecka-Tendera, & Klimek 2007; Starc & Strel 2011), WHO recommends it as a measure of fatness in children for public health screening (De Onis, 2004). Furthermore, in a study of Swedish schoolchildren aged 8 to 11 years (Dencker et al. 2007), a very high linear correlation was found between BMI and both total ($r=0.95$ for girls and $r=0.94$ for boys) and abdominal fat mass ($r=0.95$; $r=0.93$). The authors suggested that BMI serves as a good surrogate marker for obesity in population studies.

A number of studies on the prevalence of obesity in European children and adolescents in different years after 1990 showed (Lobstein et al. 2004) that the prevalence of overweight (including obese) children aged around 7 to 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 to 17 years, the prevalence ranged from below 10% (Slovakia, Czech Republic, Russia) to above 20% in some southern countries (Cyprus 23%, Greece 22%, Spain 21%).

There are differences in obesity prevalence between boys and girls, e.g. some studies conducted on British (Peckham et al. 1983; Stamatakis et al. 2005), Italian (Maffei, Talamini & Tato 1998), Spanish (Moreno et al. 1998), Swedish (Holmback et al. 2007) and Turkish (Yuca et al. 2010) sub-populations showing higher prevalence among girls. In contrast, the data from the Health Behaviour in School-aged Children survey (Currie et al. 2004) indicated that more boys than girls were overweight. Additionally Vuorela et al. (2011) reported on a higher rate of excess weight and obesity in Finnish boys.

In Slovenia, the percentage of overweight and obese children and adolescents has increased dramatically in recent decades, especially in younger age groups (Avbelj et al. 2005; Kovač, Leskošek & Strel 2007; Leskošek, Strel & Kovač 2010; Planinšec & Fošnarič 2009; Starc & Strel 2011). Starc and Strel (2011) reported that the changes in physical growth in the last 70 years have been substantial among 11- to 19-year-old children and adolescents from Ljubljana, the capital of Slovenia; their BMI increased on average by 32.6% among boys and 21.4%, among girls, respectively. Additionally, this data shows that, for example, 11-year-olds from 2011 are taller and heavier than 13-year-olds from 1939, which can be a proof that the maturation processes of contemporary children starts around three years earlier than 70 years ago.

The main purpose of the study was to analyse the prevalence of excess weight and obesity in children and adolescents on the basis of BMI, according to sex and age after the independence of Slovenia in 1991.

Methodology

Sample of measured subjects

The repeated cross-sectional sample (Figure 1) consists of all boys and girls who enrolled in the SLOFIT system (Strel et al. 1997) from 1991, the year of independence from the former Yugoslavia (between 150,000 and 250,000 subjects every year). Information on birth dates was obtained from schools' records. Measurements were held annually in April during physical education classes in all Slovenian schools. They were organised in school gyms between 8.00 and 14.00. Only healthy boys and 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 included. All measurements have been conducted by trained physical education teachers who had completed a 30-hour course in anthropometric measurement during their studies, according to the standard protocol. Subjects were barefoot in their shorts and T-shirts. Weight was measured with a pre-calibrated portable scale of various brands, to the nearest 0.1 kg and height with stadiometers of various brands, to the nearest 0.1 mm. Data were checked to detect coding errors.

After 1996, when new education legislation was accepted, only students having the written consent of their parents have been included. As a result of the birth rate having decreased after independence of Slovenia to 2003 (Statistical Office of the Republic of Slovenia, 2008, 55) a smaller number of students was measured until 2008. Between 1996 and 2011, slightly less than 95% of primary school boys and girls below the age of 15 were measured, whereas the proportion of high-school boys and girls (16 to 18 years) was between 60 and 84%, depending on the type of high school (Starč, Strel & Kovač 2010).

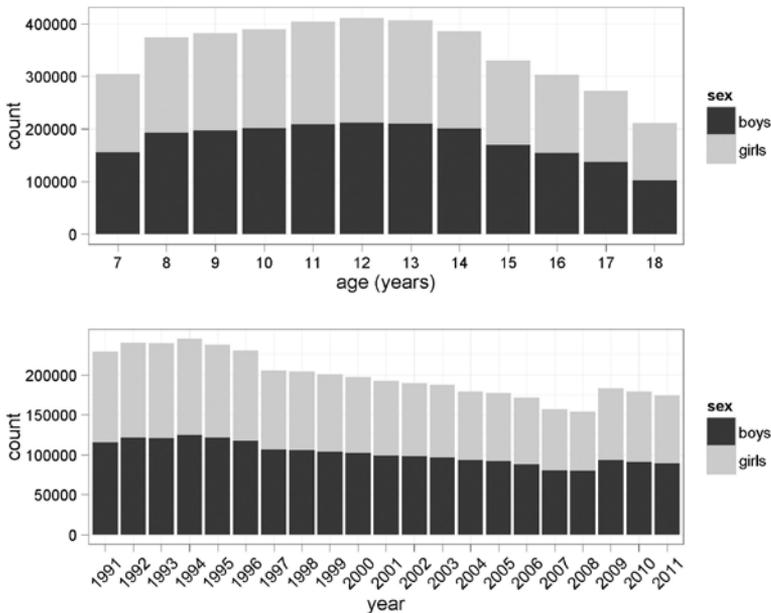


Figure 1: Sample structure by age of subjects (above) and year of observation (below)

Data analysis

Data were analysed with the use of the SPSS 18.0 statistical package. The prevalence of excess weight and obesity were determined according to the IOTF cut-off points (Cole et al. 2000) separately for age (7- to 18-years old), sex and the year of measurement (1991 to 2011). Confidence intervals (CI) for the proportions were computed using the Collett formula (1991).

Results

When the entire sample is considered, irrespective of the boys' and girls' ages, the proportions of overweight and obese children and adolescents are almost steadily growing from 1991 to 2011 (Figure 2). In the observed period, the proportion of overweight boys grew from 13.3% in 1991 to 19.9% in 2011, whereas the proportion of overweight girls increased from 12.0% to 17.2%. The percentage of obese boys increased from 2.7% in 1991 to 7.5% in 2011, whereas the percentage of obese girls increased from 2.1% to 5.5%.

Between 1991 and 2011, a 95% CI width for the overweight proportion ranges from 1.1% to 2.9% in boys, and 1.1% to 2.8% in girls, but in most cases do not exceed 2%. A 95% CI width for the obese proportion ranges from 0.5% to 1.7% in boys and 0.4% to 1.4% in girls, but it only exceeds 1.3% in two out of 504 cases (year/age combinations).

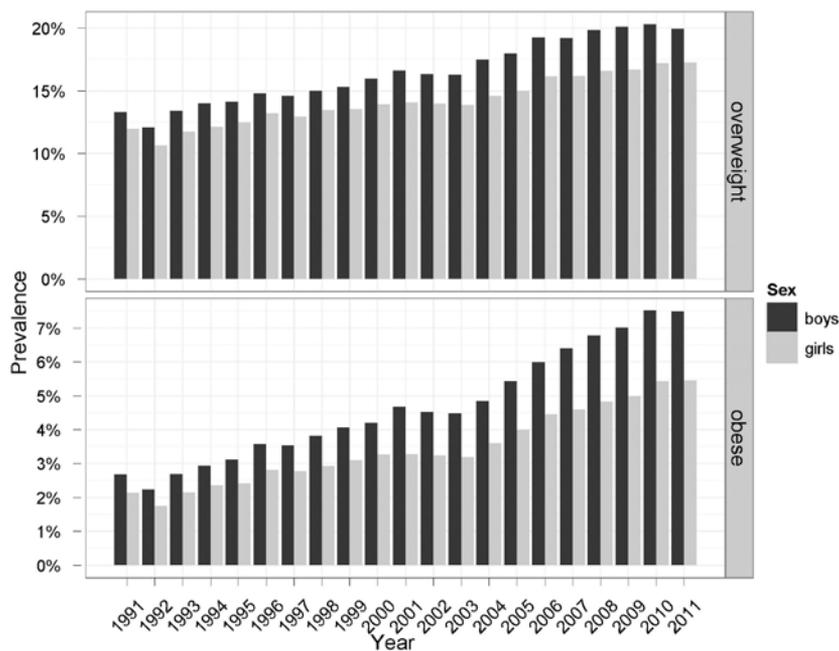


Figure 2: Prevalence of excess weight and obesity in Slovenian youth from 1991 to 2011 by sex

In all observed years, the percentages of overweight and obese boys were higher than the percentage of girls. In most recent decade (Figure 2), we observed an especially higher rate among obese boys compared with obese girls (2001: 4.7% boys vs. 3.3% girls; 2011: 7.5% vs. 5.5%). During the observed period, the main differences among sexes are seen among overweight adolescents aged 14 to 18 (Figure 3).

The prevalence of excess weight and obesity among girls is highest in childhood and early adolescence, where it is around two to three times higher than at the age of eighteen. The same pattern is seen among obese boys, while among overweight boys the lowest percentage is seen at ages 7 to 9 (Figure 3).

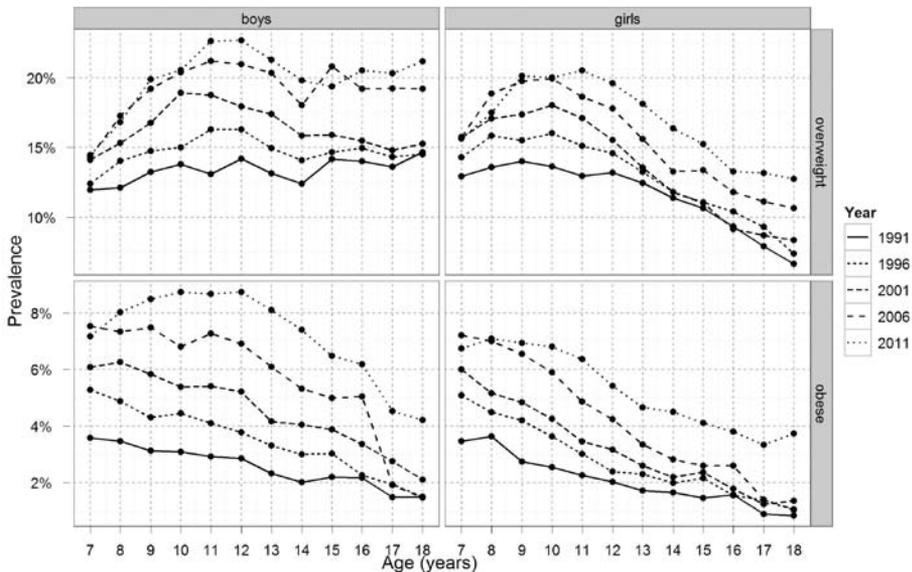


Figure 3: Secular trends of excess weight and obesity by different ages and sexes (years 1991, 1996, 2001, 2006 and 2011)

In recent years, it has been observed that the 9- to 13-year age group represents the largest proportion of overweight and obese boys (28.4% to 31.4%), whereas among girls the highest proportions of the overweight and obese are observed among the 8- to 12-year age group (25.0% to 27.1%). The proportion of overweight young people starts to decrease after the age of 11 until 18 in girls and 12 until 15 in boys. The percentage of obese girls decreases from the age of eight; the same pattern was seen among obese boys between 1991 and 2006, while in 2011 the percentage increases from seven to twelve and then decreases. Until the age of 18, in both sexes the percentage of obese children decreases to less than half of its maximal value.

The comparison of five-year periods (1991–1996–2001–2006–2011) shows that the highest increase of proportion of overweight girls and obese boys and girls is observed between 2006 and 2011, while among overweight boys the highest increase was seen between 2001 and 2006.

While in the 1991–2006 period the proportion of the obese population of both sexes had been decreasing from around 7-year-old to 18-year-old, in 2011 we observed the high increasing rate from 7- to 12-years old boys, followed by the decrease until the age of 18. In 2011, the proportion of obese girls had been decreasing with two exceptions: slightly increasing rates have been observed between ages 7 and 8, and 17 and 18. Also notable is a high rate (around 4%) of obese girls and boys at the ages 17 and 18 in 2011, which is around two times higher than in previous years. In 2011, the rate of excess weight and obesity among 7-year-old children of both sexes is the same (among the overweight) and a little lower (among the obese) compared with 2006.

Discussion

The percentage of overweight and obese boys and girls in Slovenia has been rising almost constantly every year from 1991 to 2011, with the only real exception at the beginning of the studied period (in 1992), which is probably due to establishment of the new state of Slovenia in 1991. In that year, a significant migration of the population occurred, accompanied by the introduction of a new currency, the loss of important markets in parts of former Yugoslavia and the transition from a socialist to a capitalist economic system, resulting in economic instability (Pušnik & Starc 2008). Between 2010 and 2011, the prevalence of excess weight and obesity may have reached a plateau as in other countries (Ogden et al. 2010; Stamatakis et al. 2010).

The prevalence of excess weight 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, with some exceptions. Between 1991 and 2011, the most prominent change took place in 9- to 13-year-old Slovenian boys and 8- to 12-year-old girls. Holmback et al. (2007) reported that in 2002 more 10-year-old Swedish girls and boys were overweight/obese compared with 1982, although the increase was larger in girls; but no difference was seen in the 16-year-old sample. In Slovenia, the increase was larger in boys at all age groups. In the USA, trend analyses over a 12-year period (Ogden et al. 2012) indicated a significant increase in obesity prevalence between 1999 and 2000 and 2009 and 2010 in males aged 2 through 19 years (odds ratio, 1.05; 95% CI, 1.01–1.10) but not in females (odds ratio, 1.02; 95% CI, 0.98–1.07) per two-year survey cycle. There was a significant increase in BMI among adolescent males aged 12 to 19 years ($P = .04$) but not among any other age group or among females. In Slovenia, the increase between 1991 and 2011 was observed in both sexes and all measured age groups (7 through 18).

In Slovenia, obesity is rising at higher rates than excess weight as it has around three times higher in just 20 years. Also worrying is the status of the population older than 15 years (high-school students); namely, in the 2006–2011 period, a considerable increase in the proportion of obese young people was observed in comparison to previous periods. In 2007, a reduction in the hours for physical education lessons occurred in high school programmes; moreover, because of ill-conceived solutions (for example, inadequate provision of financial resources for extra-curricular sport programmes), the proportion of physically

active young people in these extra-curricular sport programmes has decreased (Kovač et al. 2011). At the same time, high school had to ensure hot meals for their students.

The proportion of children with excessive weight is high particularly in the period between the ages of 11 and 13, when young people have the best conditions available for sports activities in schools (physical education is taught by specialised physical education teachers in good working conditions with a smaller number of children in a group; lessons are carried out in sports halls and other specialised places, i.e. dance and fitness studios etc.) and still show an interest in free-time sports participation in sports clubs (Kovač et al. 2011). It can be concluded that the excessive weight seen in this period is connected with the transition to puberty, where an accelerated increase of height is still not observed although the body mass is already increasing (Manios & Costarelli 2011; Starc & Strel 2011). It can be concluded that excessive weight in the pre-pubertal period is more a result of the physical development and less of external conditions; in other words, the reference values of the IOTF for a specific age group are not particularly suitable. This anomaly of the BMI distribution found on the studied population is also characteristic of other populations (Rolland-Cachera et al. 1991). For this reason, Starc and Strel (2011) suggested that the nationally specific BMI cut-off points, based on more recent data than international references, would be appropriate for defining being underweight, being overweight and obesity in Slovenian school-aged population.

The increase in the proportion of both (excess weight and obese) groups in developed countries is a result of the different ways young people spend their free time; their characteristics are mainly physical inactivity (Riddoch et al. 2004; Hills et al. 2011; Olds et al. 2011) and inappropriate diets with energy-rich food and unsuitable eating habits (Helms 2007; Alexy, Sichert-Hellert & Kersting 2002). Also in Slovenia the volume of free-time physical activities gradually decreases with age (Jurak 2006; Strel et al. 2007) and the food intake pattern of Slovenian adolescents deviates markedly from a healthy eating pattern (Kobe et al. 2012). Although we cannot infer causality from this study, our results may indicate that changes in the environment have not similarly affected all age groups.

The findings about differences between boys and girls in obesity rates as defined by body mass index are generally inconsistent (Holmback et al. 2007; Maffei et al. 1998; Moreno et al. 1998; Peckham et al. 1983; Stamatakis et al. 2005; Vuorela et al. 2011; Yuca et al. 2010). However, in all observed years the percentages of overweight and obese Slovenian boys were higher than the percentage of girls, which is similar with to data from the Health Behaviour in School-aged Children survey (Currie et al. 2004). These may result from differences in biology (sex differences) or those assumed to be due to society or culture (gender differences), or a combination of the two (Krieger 2003).

There are some limitations of the study. Although the sample is large, it is not a probability sample of all boys and girls aged 7 to 18 years in Slovenia. Specifically, after 1996 (when new education legislation was accepted) only healthy students wishing to participate and having the written consent of their parents are included. Nevertheless, the same limitations apply even with 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 excess weight and especially obesity are in fact even a little higher in the population than as described in this study, since obese pupils are probably less likely to participate (Andersen et al. 2007).

Conclusion

Clearly the prevalence of excess weight and obesity is also taking on epidemic proportions in Slovenia. Obesity is growing at higher rates than excess weight, as it is almost three times higher among both sexes than just 20 years before. The introduction of television and the telephone decades ago has undoubtedly influenced the everyday practices of physical activity of the entire Slovenian population (Pušnik & Starc 2008; Pušnik 2007; 2008). Warnings about these negative trends have been issued for a significant period; unfortunately without success. Particularly in 2007 a reduction in the hours for physical education lessons occurred in high school programmes. Therefore, sports teachers and health workers are calling for an increase and not a decrease in the number of physical education lessons and improved access to free extracurricular sports programmes (Kovač et al. 2011). However, it is also vital that parents ensure healthy eating habits and limit children's time spent in front of TV and computer screens.

Further, certain measures that could contribute to a better status are also being suggested: the removal of vending machines offering unhealthy snacks from high 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 physical 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 (Jurak et al. 2011).

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POVZETEK

Delež otrok in odraslih s prekomerno telesno težo se je v zadnjih letih v številnih evropskih in drugih državah hitro povečeval. Raziskava je na podlagi presečnih študij preučila prekomerno telesno težo in debelost v populaciji slovenskih fantov in deklet, starih med sedem in osemnajst let, od leta 1991 do leta 2011 s pomočjo podatkovnega sistema SLO-FIT - športnovzgojni karton. Za ugotavljanje prekomerne telesne teže in debelosti so bili uporabljeni kriteriji International Obesity Taskforce. V obdobju med 1991 in 2011 so narasli deleži prekomerno težkih in debelih slovenskih otrok. Ta trend je bil bolj izražen pri dečkih kot pri dekletih, zlasti med mladostniki, čeprav je naraščanje podobno pri obeh spolih (delež prekomerno težkih fantov 13,3% v letu 1991 v primerjavi z 19,9% v letu 2011; delež prekomerno težkih deklet 12,0% v primerjavi s 17,2 %, delež debelih fantov 2,7% v primerjavi s 7,5%; delež debelih deklet 2,1% v primerjavi s 5,5%). V zadnjih letih je razširjenost prekomerne telesne teže in debelosti med 9- do 13-letnimi dečki in 8- do 12-letnimi dekleti približno dva-do trikrat večja kot v starosti osemnajst let. V letu 2011 je opazen tudi visok delež (okoli 4%) debelih deklet in fantov v starosti 17 in 18 let, kar je približno dvakrat več kot v preteklih letih, medtem ko je stopnja prekomerne telesne teže in debelosti med 7-letnimi otroki obeh spolov ostala enaka (med prekomerno telesno težkimi) ali se celo rahlo znižala (med debelimi) v primerjavi z letom 2006.

KLJUČNE BESEDE: javno zdravje, prekomerna teža, ITM, sekularni trend, epidemija, razlike med spoloma, Slovenija

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