Nutritional status of students in Novi Sad between 1990/91 and 2010/11

Tatjana Pavlica, Rada Rakić

University of Novi Sad, Serbia

Address correspondence to: Tatjana Pavlica, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia. Ph.: +381641838887; Fax:021450-620; E-mail: tatjana.pavlica@dbe.uns.ac.rs

Abstract

Objectives. The study of nutritional status is very important in assessing the health status of populations. Underweight or overweight individuals are more susceptible to serious health problems. Due to inadequate diet and a life style lacking physical activity, an increasing number of individuals fall into the category of the overweight or obese. According to the Health Care Institute of Serbia, more than half of the adult population in Serbia (54%) have a problem with overweight: 36.7% of population are overweight, while 17.3% are obese. The highest prevalence is in North Serbia - Vojvodina, where the percentages of overweight and obese people are 35.5% and 23%, respectively. Given the high percentage of adults who have the problem of excessive weight, the aim of this study was to determine the nutritional status of students and their changes over two decades.
Material and methods. Research material was collected in two periods, among 399 female and 128 male university students in the city of Novi Sad. The first period was between 1990/91 and the second between 2010/11. For each subject, height and body weight was measured. Nutritional status was determined on the basis of BMI, according to WHO standards.
Results and conclusions. The average prevalence for both periods shows significantly higher percentage of underweight among female (8.05%) compared with male (2.92%) students, while the percentage of students with excessive weight was significantly higher in males (22.55%), than in females (11.41%). Research has shown that over two decades there has been some increase in overweight, which is particularly evident in males.

Key words: nutritional status, students, Novi Sad

Introduction

Nutritional status is very important in the assessment of physical fitness and health status of individuals and populations. Nutritional status of a person depends on the intake and consumption of nutrients. An imbalance between these two processes may disturbe nutritional status. Nutritional status of children and adolescents is a determinant of health and disease. In the last few decades, there is evidence of a positive secular trend in physical growth and body mass index (BMI kg/m^2) in most of the world over last 20 years (Zhang and Wang, 2008). There is also evidence that human constitutional features are changing, probably due to more rapid industrial development and quality of life, new habits, occupations and lifestyle (Vraneš, et al. 2012). A more common change is obesity. A recent comprehensive study in Vojvodina (northern part of Serbia) suggests that the problem of overweight and obesity is more common among men (66%) than women (49.71%), and that on average, 57.85% of both men and women have problems with overweight (Pavlica, Božić-Krstić and Rakić, 2010). According to the Health Care Institute of Serbia, more than half of the

adult population in Serbia (54%) have a problem with overweight, 36.7% of them are overweight, while 17.3% are obese. The highest prevalence is in Vojvodina, where the percentages of overweight and obese people are 35.5% and 23%, respectively. The increase in prevalence of excessive body weight and obesity is also noted in children and adolescents. According to recent research, nearly one-fifth of children and young people aged 7 to 19 years (18%) is overweight (11.6%) and obese (6.4%), while in 2000 the number of the overweight was 8.2%, and the number of the obese was 4.4%. (Institute of Public Health of Serbia, 2008). Students are a population group that is the subject of keen interest of researches, because the future and well-being of a society depends largely on the young generations to come. An analysis of students' biological condition and health is very important and allows us to detect any problems and react on time.

Considering the high percentage of adults with the problem of excessive weight, the aim of this study was to determine body height, body weight and nutritional status of students and the changes over two decades.

Material and methods

Research material was collected in two periods among 399 female and 128 male university students in the city of Novi Sad. The first period was between 1990/91 and the second between 2010/11. In the first period, 78 males and 213 females took part in the investigation, while the second period included 51 male and 186 female subjects. The students were from Medical Faculty and from Faculty of Sciences. For each subject, height and body weight was measured. Nutritional status was determined on the basis of BMI, according to WHO (2000) standards for adults. All anthropological measurements were carried out using specialist GPM Anthropological Instruments for Somatology and Osteology (Sieber Hegner Maschinen AG Zürich. Switzerland). The subjects were lightly dressed and without shoes. Height was measured with an anthropometer in the standing erect position, to the nearest 0.1 cm. Body weight was measured on electronic digital scale with an accuracy of up to 0.1 kg. The Body Mass Index (BMI), a person's weight in relation to the height (kg/m^2), was calculated from the acquired data. The values of BMI were divided in accordance with the international classification (WHO, 2000). The following categories were distinguished: underweight (BMI<18.4 kg/m^2), normal weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25-29.9 kg/m^2), obese (BMI $\geq$ 30kg/m^2). The significance of means differences was determined using t- test, the level of significance being $p<0.05$, $p<0.01$, while Chi-squared test was used to determine the differences in the prevalence of underweight, normal weight, overweight and obesity.

Results

The average values and standard deviations of respondent characteristics and body mass index for two periods, in both sexes, are shown in Table 1. The average height of males was 180.43 cm and for females it was 166.07 cm. It can be observed that between two studied periods there were no significant differences in body height in both sexes. Male students who were tested during the 2010/11 year have significantly higher average body weight and body mass index, compared to the previously tested students, while in females there were no significant differences. Average values of body mass index, in both sexes, indicate that in both periods, most of the students were well nourished.

Table 1. Body height, body weight and BMI (kg/m^2) of students in 1990/91 and 2010/11

		Males			**Females**		
Year of investigation		**1990/91**			**1990/91**		
	Body height	**Body weight**	**BMI**		**Body height**	**Body weight**	**BMI**
N	78				213		
X	180.55	73.12	22.38		165.66	59.00	21.49
SD	7.89	11.34	2.74		5.95	7.97	2.56
Year of investigation		**Males 2010/11**			**Females 2010/11**		
	Body height	**Body weight**	**BMI**		**Body height**	**Body weight**	**BMI**
N	51				186		
X	180.32	77.15	23.75		166.49	60.65	21.86
SD	5.88	11.01	2.96		6.52	9.44	3.02
t-test	ns	2.01*	2.63**		ns	ns	ns

*p<0.05; **p<0.01; ns – non significant

Prevalence rates of underweight, normal weight, overweight and obesity among male students in 1990/91 and 2010/11 are shown in Table 2. It is noted that during the 1990/91 year, more students were in the category of normal weight compared to students measured in recent years. In today's students, slightly higher prevalence of overweight and obesity was recorded, but these differences were not significant.

Table 2. Prevalence rates of underweight, normal weight, overweight and obesity among male students in 1990/91 and 2010/11

	1990/91		2010/11	
Category	N	%	N	%
Underweight	3	3.84	1	2
Normal weight	64	82.05	34	68
Overweight	9	11.54	13	26
Obesity	2	2.56	2	4

In females (Table 3), no differences in the prevalence of underweight, normal weight and overweight were recorded. The exception is the category of obesity, which is significantly more common in today's students (χ^2=4.58; p<0.05).

Table 3. Prevalence rates of underweight, normal weight, overweight and obesity among female students in 1990/91 and 2010/11

	1990/91		2010/11	
Category	N	%	N	%
Underweight	16	7.5	16	8.60
Normal weight	177	83.09	145	77.96
Overweight	20	9.39	21	11.29
Obesity	-	-	4	2.15

Discussion

In the present work, changes in anthropological characteristics and nutritional status of students in Novi Sad during the twenty-year period were analysed. It was noted that during the last decades body height has not significantly changed in either male or female subjects. As it is well known, height of individuals is a significant index of nutrition and health of a population (Deaton, 2007). In the last century, a consistent increase in mean height and weight has been found in children and adults. This is perhaps a consequence of improvements in nutritional (Hoppa and Garlie, 1998) and socio-economic status (Li, Manor and Power, 2004). However, some recent studies have reported that the increase in height has reached a plateau in Germany (Zellner, Jaeger and Kromeyer-Hauschild, 2004) and Poland (Krawczynski, Walkowiak and Krzyzaniak, 2003). A possible cause may be the fact that the corresponding populations achieved their full genetic potential and/or that their socio-economic conditions ceased to improve (Virani, 2005). Earlier studies of the secular trend of height and body weight in children aged 3 to 11 years in Novi Sad (Božić-Krstić, Pavlica and Rakić, 2004), in the period between 1991 and 2001, recorded both positive and negative changes. The authors connected the obtained results with the changes in political and economic situation in the country. In 1990, a political and economic crisis started causing a rapid fall of living standard (Serbian Statistical Annual, 2002). The results of this study may indicate that the socio-economic situation has not significantly changed, or that acceleration reached its peak.

The average values of body weight and body mass index are significantly higher in today's students, while in female students no significant differences were recorded. Similar gender differences of the secular trend in body mass were recorded in other studies in our country. Studies of the adult population in Vojvodina (Pavlica, 2009) showed an increase in body weight during the thirty-year period, but only in males. The absence of recorded changes in women most likely reflects the increasing influence of health education and the media, as well as the fact that women tend to pay more attention to their physical appearance, as reported in researches from other countries (Wronka, Suliga and Pawlinska-Chmara, 2012).

Recent studies show (Cole, 2003) that in the last years of the 20th century the increment of height slowed down and even reached a plateau in Northern Europe, while body weight continued to show an increase, indicating the epidemic of obesity in most countries. The study of nutritional status of Novi Sad students showed that the highest percentage of respondents is well nourished. During the twenty-year period, the percentage of normal weight students shows a downward trend, but compared to the previous period, the differences are not significant. The average values for both periods show that malnutrition is more common in females (8.05%) than in males (2.92%). The young men, on average, have slightly more prevalent of overweight (18.77%) and obesity (3.28%) than girls (10.34%, 2.15%), but these differences are not significant. In the presence of certain categories of nutritional status, no significant changes over two decades were recorded, except for categories of obesity, which in girls in 1990/91 was not represented, and in new research it is present to 2.15%. However, analyzing together the category of overweight and obesity, we can observe an increase in the number of people with excessive body weight. During the twenty-year period, the percentage of overweight and obese males increased from 14.1% to 30% and among female students from 9.39% to 13.44%.

It is difficult to make international comparisons of BMI and obesity, because of differences in sampling and design of investigation. However, the results of this study show a significantly lower prevalence of overweight and obesity in relation to recent research of the American

population (US Department of Health and Human Services, 2012), while studies in subjects of the same age in neighboring countries (Radu, et al. 2006-2007), report on similar percentages of certain categories in both sexes. Compared to a recent survey of female students in Poland (Wronka, Suliga and Pawlinska-Chmara, 2012), female students in Novi Sad show a lower prevalence of malnutrition and higher prevalence of overweight, suggesting that in our country exceeded weight can present a serious problem in student population.

Conclusions

The present results indicate that during the last two decades, body height has not significantly changed in either males or females. The average values of body weight and body mass index are significantly higher in today's students, which is particularly evident in males. Obesity prevalence shows a change over the past 20 years, and the data are consistent with the possibility of slight increases. During the twenty-year period, the combined prevalence of overweight and obesity has increased from 14.1% to 30% in males, and from 9.39% to 13.44% among female students. The data point to the need for further continual monitoring of biological and health condition of this part of our population.

Bibliography

1. Božić-Krstić,V., Pavlica, T., and Rakić, R., 2004. Body height and weight of children in Novi Sad. *Ann Hum Biol,* 31(3), pp. 356-363.
2. Cole, T.J., 2003. The secular trend in human physical growth: a biological view. *Econ Hum Biol,* 1, pp. 161-168.
3. Deaton, A., 2007. Height, health, and development. *Proc Natl Acad Sci USA,* 104, pp. 13232-7.
4. Hoppa, R.D., Garlie, T.N., 1998. Secular changes in the growth of Toronto children during the last century. *Ann Hum Biol,* 25, pp. 553-561.
5. Institute of Public Health of Serbia. 2008. *Institut za javno zdravlje Srbije. Zdravlje stanovnika Srbije-analitička studija 1997-2007*, pp. 45-51.
6. Krawczynski, M., Walkowiak, J., and Krzyzaniak, A., 2003. Secular changes in body height and weight in children and adolescents in Poznan, Poland between 1880 and 2000. *Acta Paediatr,* 92, pp. 277-282.
7. Li, L., Manor, O., and Power, C., 2004. Are inequalities in height narrowing? Comparing effects of social class on height in two generations. *Arch Dis Child,* 89, pp. 1018-1023.
8. Pavlica, T., 2009. Antropološke karakteristike odraslog stanovništva Bačke i Banata. Doktorska disertacija. Univerzitet u Novom Sadu, Prirodno-matematički fakultet, Departman za biologiju i ekologiju. pp. 198.
9. Pavlica, T., Božić-Krstić, V., and Rakić, R., 2010. Body mass index, waist-to-hip ratio and waist/height in adult population from Backa and Banat – the Republic of Sebia. *Ann Hum Biol,* 20, pp. 25-33.
10. Radu, E., Ciotaru, L.O., Glavce, C., Macovei, A., and Sandru, C., 2006-2007. Body mass in Transylvanian urban population. *Ann Roum Anthropol,* 43-44, pp. 31-53.
11. Serbian Statistical Annual, 2002. *Republika Srbija, Republički Zavod za statistiku, Beograd, Opštine u Srbiji, Društveni proizvod i narodni dohodak*. pp. 467, 122-123.

12. Virani, N., 2005. Growth patterns and secular trends over four decades in the dynamics of height growth of Indian boys and girls in Sri Aurobindo Ashram: a cohort study. *Ann Hum Biol,* 32 (3), pp. 259-282.
13. Vraneš, H.S., Gall, V., Jukić, M., and Vraneš, Z., 2012. Secular Changes in Growth and Obesity in Perinatal Population. *Coll.Antropol,* 36 (2), pp. 549-554.
14. World Health Organization (WHO). 2000 *Obesity: Preventing and Managing the Global Epidemic*. Report of a WHO Consultation on Obesity.
15. Wronka, I., Suliga, E., and Pawlinska-Chmara, R., 2012. Socioeconomic determinants of underweight and overweight in female Polish students in 2009. *Anthrop Anz,* 69 (1), pp. 85-96.
16. Zellner, K., Jaeger, U., and Kromeyer-Hauschild, K., 2004. Height, weight and BMI of schoolchildren in Jena, Germany- are the secular changes levelling off? *Econ Hum Biol,* 2, pp. 281-294.
17. Zhang, Y.X., Wang, S.R., 2008. Distribution of body mass index and the prevalence changes of overweight and obesity among adolescents in Shandong, China from 1985 to 2005. *Ann Hum Biol,* 35(5), pp. 547-555.
18. ***United States. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. 2013. Health United States, 2012 with Special Feature on Emergency Care. Hyattsville: MD.