Body Characteristics of Serbs in Vojvodina (Serbia)

Tatjana M. Pavlica, Verica S. Božić-Krstić, Rada S. Rakić

University of Novi Sad, Department for Biology and Ecology,
Novi Sad, Serbia

The aim of the paper is to determine the height, weight and BMI in adult population of Vojvodina. In males, the average height is 174 cm and the weight is 81 kg, while BMI equals 26.78 kg/m². As for females, the average height and weight is 161.73 cm and 67 kg, respectively. In comparison with males, BMI is lower, equaling 25.55 kg/m². In both of the sexes, there is a decreasing trend in height as the age is older. As for the weight and BMI, an increase in relation to the age is observed. Males are mostly overweight (40.36%), and most of the female subjects are of normal weight (48.99%). In both males and females, lower height averages are observed in subjects with compulsory education, whereas those with higher education show greater height. The lowest BMI is found in subjects with higher education while the greatest values are recorded in subjects with only compulsory education.

Key words: Body height, weight, BMI, adult population, Vojvodina.

Introduction

Height and weight are the best indicators of body size, constitution and physical status of an individual and human populations. The two traits are influenced by genetic factors, although a significant role in their formation is given to environmental factors as well as socio-cultural and ethnic characteristics of a population. Anthropological investigations of adult population of different ethnic groups [2] and their changes caused by ageing [4] have already been conducted in Vojvodina. In many studies a correlation of social factors and height was observed. Social and material difficulties during foetal life and childhood may contribute to differences in height among different social groups in a society. In Sweden, [11] a highly positive correlation between the height and level of education was observed in a large sample of the population. The lowest height in the 18-year-old Polish was recorded in the subjects with poor education background, while the greatest height was observed in the subjects with highest education [7].

The height and body weight ratio can determine body proportions and nutritional condition. The simplest way to determine nutritional condition is to use body mass index (BMI), i.e. the ratio of weight and square height (kg/m²). According to World Health Organization (WHO), BMI is useful in assessing nutritional status and living conditions, and at the same time, it can indicate obesity disease risks. Individuals with a BMI above normal weight limit can have serious health problems that may even result in premature death. BMI is influenced by the age, gender, socio-economic conditions and ethnic belong-

ing. Many studies conducted worldwide [18, 20, 8, 21, 10, 13, 23, 9, 5, 12, 3, 1, 6, 22] and in our country [14, 15, 16, 17] have confirmed the usefulness of BMI in assessing nutritional condition of adults.

According to the studies conducted by Serbian Institute of Health Protection in 2000, more than half of the adult Serbian population (54%) are above normal weight limit, i.e. 36.7% are overweight while 17.3% are obese. The prevalence (overweight and obesity) is found in Vojvodina region (58.5%).The average BMI in adult population of Serbia equals 26 ± 4.74 kg/m^2. The results of Vojvodina population investigations conducted within MONICA project [6] showed 20% obesity prevalence. The data pointed to the necessity of a permanent nutritional condition assessment in order to reduce the number of categories with potential health risk.

The present paper is a part of an investigation of adult population of Vojvodina that has been conducted since 1996. The aim of the paper is to determine the height, weight and BMI in adult population of Vojvodina, the variations of these traits caused by ageing and the influence of the level of education upon them.

Material and Methods

An anthropological investigation of height and weight in adult population of Vojvodina was conducted in rural regions of Vojvodina Province: Srem, Banat and Bačka. The paper discusses the data related to the population of Serbian nationality older than 20 years of age with ancestors born in Vojvodina. In Srem, the investigation was conducted during 1996 and included 745 subjects (433 males and 312 females). In other two regions, Banat and Bačka, the investigation was conducted in the period 2000 — 2006. In total, 611 subjects were from Banat region (276 males and 335 females), while 433 were coming from Bačka (210 males and 223 females). The average age of male and female subjects was 37.54 ± 10.26 and 37.89 ± 10.28, respectively.

The investigation was conducted in compliance with International Biological Program [24] and (WHO) [25] using the standard anthropological instrument by Martin. Data bases for each of the sexes were created using Excel. Data processing was conducted by descriptive statistical method in SPSS program [10]. The differences in means were tested by t-test and linear regression coefficient R was employed for estimating the influence of ageing and level of education upon the investigated traits and BMI.

On the basis of their height and weight measures, BMI was calculated for each of the subjects and according to the values obtained, they were classified by WHO categories of nutritional condition.

On the basis of the date of the investigation and their date of birth, the decimal age of all of the subjects was calculated. In relation to this value, the population was divided into 5 age groups, the youngest including the subjects aged 20-29 (19.5-29.499), and the oldest including those over 60 years of age (more than 59.5).

According to the level of their education, the population was divided into 3 categories: those with compulsory education (8 years), further education (12 years) and higher education (14 or 16 years of education).

Results

The results of descriptive statistical analysis of height, weight and BMI of Vojvodina population are given in Table 1.

T a b l e 1. Means (SD) of body height, body weight and BMI in males and females

	Age		Body height		Body weight		BMI	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Males	37.54	10.26	174.20	7.25	81.31	14.17	26.78	4.25
Females	37.89	10.28	161.73	6.33	66.76	12.23	25.55	4.61

The average age of the subjects of both sexes is approximately 37 years. In males, the average height is 174 cm and the weight is 81 kg, while BMI equals 26.78 kg/m². As for females, the average height and weight is 161.73 cm and 67 kg, respectively. In comparison with males, BMI is lower, equaling 25.55 kg/m².

T a b l e 2. Distribution of height, weight and BMI in population of different age

	20-29			30-39			40-49			50-59			>60		
	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD
Males															
Body height	237	176.73	7.22	319	174.89	7.00	264	172.50	6.94	103	171.52	6.31	16	168.11	7.71
Body weight	237	77.59	11.71	319	82.88	14.96	264	82.51	14.92	103	82.26	13.56	16	79.25	13.94
BMI	237	24.82	3.31	319	27.06	4.33	264	27.67	4.44	103	27.93	4.13	16	27.93	3.87
Females															
Body height	220	163.27	6.30	280	163.07	6.34	262	160.52	5.72	113	159.06	5.84	13	154.17	5.54
Body weight	220	61.89	10.39	280	66.38	11.50	262	69.61	13.06	113	70.26	12.18	13	69.54	13.07
BMI	220	23.20	3.57	280	24.98	4.25	262	27.00	4.76	113	27.76	4.53	13	29.13	4.38

Table 2 shows the distribution of height, weight and BMI in population of different age. In both of the sexes, there is a decreasing trend in height as the age is older. The males of the youngest age group (20-29) show the greatest height (176.73cm). With age, the height gradually decreases, the lowest value being recorded in oldest subjects (168.11cm). The decrease approximately equals 9 cm.

As for the weight and BMI, an increase in relation to the age is observed. The lowest weight is recorded in youngest subjects (77.59 kg), in the following 3 groups it increases equaling approximately 82 kg. After the age of 60, however, there is a certain decrease (79 kg). The BMI values indicate a rather regular increasing trend. In youngest subjects it equals 24.82 kg/m², thus pointing to normal nutritional condition of males, while in all other groups it is greater than 27 kg/m², indicating the overweight in older age.

A similar trend is observed in female subjects. The height shows a negative trend, decreasing from 163.27 cm (20-29 years of age) to 154.17 cm (>60 years of age). As it is the case with males, this decrease approximately equals 9 cm. The weight increases from 61.89 kg (20-29 years of age) to 70 kg (>60 years of age). The average BMI indicates that females are characterized by normal weight till the age of 40, after which an increase of overweight subjects is recorded.

T a b l e 3. Averages and standard deviation of the height, weight and BMI in males and females with different level of education

	Age			Body height		Body weight		BMI	
Males	n	X	SD	X	SD	X	SD	X	SD
Compulsory education	214	36.86	10.16	171.97	6.99	79.96	15.31	26.99	4.67
Further education	589	37.01	9.98	174.93	7.18	81.66	14.09	26.67	4.19
Higher education	116	41.00	10.98	174.40	7.37	80.76	11.82	26.57	3.79
Females	n	X	SD	X	SD	X	SD	X	SD
Compulsory education	213	40.07	11.05	158.67	6.71	67.14	13.41	26.68	5.15
Further education	509	36.69	9.89	162.29	5.73	66.65	11.97	25.32	4.48
Higher education	148	38.61	9.81	164.29	5.90	66.81	11.28	24.76	3.95

Table 3 shows the averages and standard deviation of the height, weight and BMI in males and females with different level of education. In both of the sexes, the largest number of subjects are with further education (64.09% of males and 58.50% of females). About 24% of the subjects of both sexes are registered with only compulsory education, while the number of subjects with higher education is greater in females (17.01%) than in males (12.62%). As for the height, it ranges from 171.97 cm in males with compulsory education to 174.93 cm in subjects with further education. The average height of males with further and higher education is approximately the same (174 cm), while significantly lower values of height are recorded in males with compulsory education ($p<0.01$). A similar trend is observed in the weight value, ranging from 79.96 kg (males with compulsory education) to 81.66 kg (males with further education). However, these variations are not statistically significant. The BMI averages are approximate, equaling more than 26 kg/m² in all three groups. The lowest value is recorded in males with higher education (26.57 kg/m²) while the highest is found in males with only compulsory education (26.99 kg/m²). These variations, however, are not statistically significant.

In females, a similar trend of the average height and weight distribution is observed. The greatest height is recorded in females with higher and further education (164.29 cm and 162.29 cm respectively), while the lowest values are observed in subjects with compulsory education (158.67 cm). Statistical differences are recorded among all three groups ($p<0.01$). A similar trend is observed in weight, although the values are more uniform, equaling about 67 kg for all three groups, with no statistically significant differences recorded. The smallest BMI is found in females with higher education (24.76 kg/m²), while the greatest values are recorded in females with compulsory education (26.68 kg/m²). In comparison with two other groups, females with compulsory education show significantly higher BMI ($p<0.01$). As for the females with further and higher education qualifications, no significant differences in BMI averages are observed.

Table 4 and 5 presents the results of regressive analysis of height, weight and BMI in relation to the age and level of education in males and females. It also points to the significance of differences among the investigated traits in relation to both of the independent variables. With ageing, a significant decrease in height and an increase in weight and BMI are observed in both of the sexes. The level of education highly influences the height of both males and females as well as the BMI of females. As for the weight, no significant correlation is observed with the level of education.

T a b l e 4. Results of linear regression analyses for variables related to body height, body weight and BMI in males

Independent variable	Body height			Body weight			BMI		
	β	F	p	β	F	p	β	F	p
Age	−0.267	70.375	.000	0.113	11.872	0.001	0.260	66.385	0.000
Education	0.127	14.948	.000	0.027	0.694	0.405	−0.032	0.946	0.331

T a b l e 5. Results of linear regression analyses for variables related to body height, body weight and BMI in females

Independent variable	Body height			Body weight			BMI		
	β	F	p	β	F	p	β	F	p
Age	−0.279	73.309	0.000	0.258	62.051	0.000	0.383	149.66	0.000
Education	0.294	82.41	0.000	−0.010	0.095	0.759	−0.139	17.136	0.000

T a b l e 6. Categorization of BMI in males and females

Category		Males		Females	
		n	%	n	%
Severe underweight	< 16				
Medial underweight	16 — 16.9	1	0.11	1	0.11
Moderate Underweight	17 — 18.4	2	0.21	21	2.36
Normal weight	18.5 — 24.9	356	37.91	435	48.99
Overweight	25 — 29.9	379	40.36	290	32.66
Obesity	30 — 39.9	196	20.87	134	15.09
Pathological obesity	> 40	5	0.53	6	0.68

Table 6 shows the categories of BMI in both males and females. Males are mostly overweight (40.36%), normal weight is found in 37.91% and obesity is present in 20.87% of the cases. The underweight and pathological obesity categories are recorded in a very small per cent.

Most of the female subjects are of normal weight (48.99%), the number of the overweight equals 32.66% and obesity is lower than it is the case with males (15%). Underweight category is present in a rather small per cent (0.11%), while pathological obesity is recorded in 6 cases (0.68%).

Discussion

The paper analyzes the height, weight and nutritional condition of adult population of Vojvodina. The investigation includes the population of rural areas that cover almost the entire territory of Vojvodina. The subjects are of Serbian nationality with the average age 37 ± 10.27. The paper determines the changes of morphological characteristics in relation to the age, as well as the influence of the level of education upon these characteristics.

According to Martin classification, the population of both sexes are characterised by great height. The average height in males and females equals 174 cm and 162 cm, respectively. When compared with previous investigations of Vojvodina population [2], the obtained values are significantly higher, thus indicating acceleration. The rural population of Vojvodina has approximate height with the population of the city of Novi Sad (males 175 cm and females 162 cm - the results of a project focusing on cardiovascular diseases) [6]. The investigation points to a decrease in height in relation to ageing, the difference between the youngest and oldest category being significant — 9 cm in both of the sexes. The differences observed in previous investigations are somewhat smaller, equaling 6 cm [4].

The weight values are influenced by various endogenous and exogenous factors, thus they can show great variations in human populations. The average weight in males and females equals 81 kg and 67 kg, respectively. The regressive analysis points to a significant correlation between the weight and age, in both males and females. In males, the lowest average is recorded in the age group 20-29. In older age groups, the average is higher (82 kg), although after the age of 60 the weight values decrease. In females, however, increasing weight is still observed in older age. A similar trend was also recorded in previous investigations [4].

The average BMI in males is 26.78 kg/m², while in females it is lower, equaling 25.55 kg/m². Similar BMI averages for identical age are reported to be found in England, Scotland and Whales [9]. American population measured in the period 1988-1994 [8] shows similar averages for ages 30-59 (males 27.1 kg/m², females 27.0 kg/m²). The same refers to American white females of the average age 47.7 [10]. In Hungary [22], the females of the average age 45.44 ± 4.45 are characterized by somewhat higher BMI (26.32 kg/m²). Vojvodina population shows higher BMI values in relation to Italian imigrants to USA of the

same age [3]. The same holds good in relation to France [18], developing countries [20], Denmark [13], Brazil [23] and Japan [5].

BMI categorization indicates that the greatest number of males are overweight (40.36%), followed by those of normal weight (37.91%) and finally those classified as obese (21%). In females, the situation is as follows: 48.99% are with normal weight, 32.66% are over-weighted, and 15% are obese. Similar distribution has already been recorded in Vojvodina region [14, 15, 16, 17], as well as in Bulgaria, regarding male subjects [1]. The values obtained for different age groups in both males and females point to an increase of BMI with ageing, a trend already observed in previous investigations in Serbia [6] and world-wide [8, 5]. The averages of males indicate that they are with overweight in all age groups. As for females, up to the age of 40 they are mostly of normal weight, while in older age they are overweight.

In both males and females, lower height averages are observed in subjects with com-pulsory education, whereas those with higher education show greater height. The same, positive influence of education upon the height has recently been reported [11, 7]. Regard-ing the weight, no significant influence is observed, while in BMI, certain variations are recorded among the subjects. The lowest BMI is found in subjects with higher education while the greatest values are recorded in subjects with only compulsory education. The variations are more observable in females, the fact also observed in some European coun-tries [21] and in America [12]. This draws a conclusion that educated women are probably more aware of their appearance and pay more attention to fashion trends and their looks.

References

1. A n d r e e n k o , E. Variations in the body mass index (BMI) of middle-aged men: Effects of the occupation, age and social class. – Acta morphol. anthropol., **10**, 2005, 203-206.
2. B o ž i ć, V. Neke fizičke osobine stanovništva SAP Vojvodine. MSc thesis, Novi Sad University, 1976. 105p.
3. D a n u b i o , M. E., E. A m i c o n e , R. V a r g i u . Height and BMI of Italian immigrants to the USA, 1908-1970. – Economics & Human biology, **3**, 2005, 33-43.
4. G a v r i l o v i ć, Ž., V. B o ž i ć - K r s t i ć. Morfofiziološke i biotipološke karakteristike odraslih i starih osoba. – Glasnik ADJ, **18**, 1981, 33-80.
5. I s h i z a k i , M., Y. M o r i k a w a , H. N a k a g a w a , R. H o n d a , N. K a w a k a m i , T. H a r a t a n i , F. K o b a y a s h i . The influene of work characteristics on body mass index and waist to hip ratio in Japanese employees. – Industrial Health, **42**, 2004, 41-49.
6. J a k o v l j e v i ć, Đ., M. P l a n o j e v i ć, N. R a d o v a n o v i ć, D. B e n c , V. P e t r o v i ć. Twenty years of MONICA project in Novi Sad (Eds. Đ.Jakovljević, M. Planojević). Novi Sad, 2005. 157 p.
7. K r z y z a n o w s k a , M. Inter-generational educational advancement and body height. – J. Biosoc. Sci., doi: 10.1017/S002193006001672, Cambridge University Press, 2006.
8. K u c z m a r s k i , R. J., M. D. C a t r o l l , K. M. F l e g a l , R. P. T r o i a n o . Varying body mass index cutoff points to describe overweight prevalence among U. S. adults: NHANES III (1988-1994). – Obesity Res., **5**, 1997, No 6, 542-548.
9. L a n g e n b e r g , C., R. H a r d y , D. K u h , E. B r u n n e r , M. W a d s w o r t h . Central and total obesity in middle aged man and women in relation to lifetime socioeconomic status: evidence from a national birth cohort. – J. Epidemiol. Community Health, **57**, 2003, 816-822.
10. L o v e j o y , J., S. S m i t h , J. R o o d . Comparison of regional fat distribution and health risk factors in middle - aged white and African American women: The healthy transitions study. – Obesity Res., **9**, 2001, 10-16.
11. M a g n u s s o n , P. K., F. R a s m u s s e n , F, U. G y l l e n s t e n . Height at age 18 years is a strong predictor of attained education later in life: cohort study of over 950 000 swedish men. – Int. J. Epidemiol., doi:10.1093/ije/dyl011, Oxford University Press, 2006.

12. M u j a h i d , M. S., A. V. D i e z   R o u x , L. N. B o r r e l l , F. J. N i e t o . Cross-sectional and longitudinal associations of BMI with socioeconomic characteristics. – Obesity Res., **13**, 2004, No 8, 1412-1421.

13. N y s o m , K., C. M o l g a a r d , B. H u t c h i n g s , F. M i c h a e l s e n . Body mass index of 0 to 45-y-old Danes: reference values and comparison with published European reference values. –Int. J. Obesity, **25**, 2001, 177-184.

14. P a v l i c a , T. Bioantropološke karakteristike odraslih stanovnika Srema. MSc thesis, Novi Sad University, 1996. 110p.

15. P a v l i c a , T., V. B o ž i ć - K r s t i ć , R. R a k i ć . Antropološke karakteristike odraslih Rumuna iz nekih delova srednjeg i južnog Banata. – Zb. rad. PMF, **33**, 2004, 45-53.

16. P a v l i c a , T., V. B o ž i ć - K r s t i ć , R. R a k i ć . Body height and weight and nutritional status in adult population of northwest Bačka and central Banat (Serbia, Vojvodina). 2007, (in press).

17. P a v l i c a , T., V. B o ž i ć - K r s t i ć , R. R a k i ć . Some anthropological characteristics of adult population of the Northwest Bačka. Balcan Scientific Conference of Biology. Plovdiv University „Paisii Hilendarski", Faculty of Biology, 2005.

18. R o l l a n d - C a c h e r a , M. F., T. J. C o l e , M. Sempe, I. Tichet, C. Rossignol, A. Charraud. Body mass index variations: centiles from birth to 87 years. – Eur. J. Clin. Nutr., **45**, 1991, 13-21.

19. Sektor za Socijalnu medicinu i organizaciju zdravstvene slu•be, Sektor za Epidemiologiju, Sektor za higijenu i zaštitu životne sredine Institut za zaštitu zdravlja Novi Sad, 2005. 72 p.

20. S h e t t y , P. S., W. P. T. J a m e s . Body mass index- A measure of chronic energy deficiency in adults. FAO FOOD and NUTRITION PAPER 56, 1994.

21. S u n d q u i s t , J., S. E. J o h a n s s o n . The influence of socioeconomic status, ethnicity and lifestyle on body mass index in a longitudinal study. – Int. J. Epidemiology, **27**, 1998, No 1, 57-63.

22. T ó t h , G. A., B. L. B u d a . Differences in BMI and body fat values of pre – and postmenopausal Hungarian women. – Glasnik ADJ, **42**, 2007, 411–418.

23. V e l a s q u e z - M e l e n d e z , G., G. K a c, G. L. V a l e n t e , R. T a v a r e s , Q. C. d a S i l v a , E. S. G a r c i a . Evaluation of waist circumference to predict general obesity and arterial hypertension in women in Greater Metropolitan Belo Horizonte. – Brazil. Cad.Saude Publica, Rio de Janeiro, **18**, 2002, No 3, 765-771.

24. W e i n e r , J. S., J. A. L o u r i e . Human biology; a guide to field methods, International biological programme. Oxford and Edinburgh: Blackwell scientific publications, 1969, 621 p.

25. World Health Organisation. Obesity: preventing and managing the global epidemic. Geneva: WHO technical report series no 894, 2000.