Tatjana M. Pavlica [1]

Milena A. Mikalački [2]

Biljana Đ. Srdić [3]

Darinka B. Korovljev [2]

Nebojša R. Čokorilo [2]

Sandra Đ. Vujkov [2]

Dejan B. Sakač [3]

Edita J. Stokić [3]

Authors' addresses:
[1] University of Novi Sad, Faculty of Sciences, Department for Biology and Ecology, Novi Sad Serbia.

[2] University of Novi Sad, Faculty for Sport and Physical Education, Novi Sad, Serbia.

[3] University of Novi Sad, Medical Faculty, Novi Sad, Serbia.

Correspondence:
Tatjana Pavlica
University of Novi Sad, Faculty of Sciences, Department for Biology and Ecology, Trg Dositeja Obradovica 2, 21000 Novi Sad, Serbia.
e-mail: tajana.pavlica@dbe.uns.ac.rs

Some characteristics of anthropological status of women in Novi Sad – Republic of Serbia

ABSTRACT

The aim of this study was to determine the anthropological status of adult females and the prevalence of females with potential health risk using the indices of obesity. The anthropological study was conducted from 2011 to 2013 in Novi Sad, (the north of Serbia). The tested group consisted of 310 women, with mean age 41.42±6.86, involved in the project "The impact of physical activity on the risk factors in the working population." Nutritional condition was determined using the body mass index (BMI kg/m^2), while the waist circumference and WHR were used for assessing the central obesity. According to the average BMI, the younger females are predominantly with normal weight, while higher percent of older females is characterised with pre-obesity. In total, 45.85% of females are with excessive body weight, 34.62% of them being classified as overweight and 11.23% as obese. Central obesity is more frequent in older females aged up to 40. Potential health risk increases with age, and very high health risk from abdominal and overall obesity was observed in 6.25% of younger and 13,25% of older women. The data therefore point to the necessity of continuous monitoring and a combination of existing programs with other forms of organized physical activity.

Key words: anthrolopogical status, characteristics, females, nutritional condition, health risk

Introduction

Anthropological status comprises a number of human abilities and characteristics: anthropological and morphological traits, functional abilities, motoric skills, conative function and social characteristics (Malacko, 2000). Anthropological traits include external characteristics. They are indicators of body composition, physical appearance, health condition and structure of a human population. Anthropological traits are result of a complex interaction between biological and environmental factors including numerous social, demographic and economic factors. The traits change through time and with aging, including not only the changes in specific morphological characteristics but also the changes in proportions, body constitution and body composition. With age, anthropological traits show different distribution trends.

Anthropological trait measurement can be used for assessing nutritional condition, central obesity and health risk. The height, weight and skinfold thickness are used in defining nutritional condition while the waist and hip circumference and their ratio serve as indicator of fat distribution. Assessing morphological traits in order to determine nutritional status of populations is of extreme

importance, if we bear in mind that number of overweight and obese individuals is increasing worldwide. This is a consequence of an inactive lifestyle and imbalance between calorie intake and burn. Obesity, along with other unhealthy living habits, nowadays represents one of the greatest risk factors for various diseases. According to WHO (2009) overweight and obesity have been found to be major risk factors for chronic diseases, including cardiovascular diseases, diabetes, some forms of cancer and musculosceletal disorders. Recent studies of adult population in Vojvodina (Pavlica, 2009) have pointed to a high percentage of males (66%) and females (51.35%) with a potential health risk resulting from increased central obesity, overweight or combination of both of the factors. According to the World Health Organization (WHO, 2000) overweight diagnosis is based upon the values of body mass index (BMI, kg/m^2) highly correlating with the fat mass and a number of risk factors. Health risk is not related to the weight but to the body fat, making thus the body composition analysis highly important in assessing the proportion of body fat in total weight (Wells & Victora, 2005). Apart from the body fat, fat tissue distribution is also of great importance, particularly central or abdominal distribution of fat, representing higher accumulation of intraabdominal fat. Central distribution is related to increased cardiovascular morbidity and mortality, type 2 diabetes, and lipid and lipoprotein disorders (Wajchenberg, 2000). According to the World Health Organization, waist circumference represents the best parameter in defining abdominal obesity.

The aim of this study was to determine the anthropological status of adult females in different age groups and the prevalence of those with potential health risk using the indices of obesity.

Materials and Methods

The anthropological study was conducted from 2011 to 2013. The tested group consisted of 310 women. They all participated in the project entitled "The effect of physical activity on risk factors in working population". The project assessed the effect of physical activity on the health condition of women doing Pilates and was supported by Provincial Secretariat for Science and Technological Development. The present study focuses on one part of the project. The data were collected in Novi Sad, the capital city of Vojvodina, situated in the north of Serbia. The study investigated 12 anthropological characteristics: body height, body weight, relaxed upper arm circumference, contracted upper arm circumference, forearm circumference, waist circumference, hip circumference, thigh circumference, calf circumference, subscapular skinfold thickness, triceps skinfold thickness, abdominal skinfold thickness, % body fat and body fat in kg. All anthropometric measurements were carried out by the same investigator using specialist GPM Anthropological Instruments for Somatology and Osteology (Siber Hegner Maschinen AG, Zürich) The mean age of a sample was 41.42±6.86. According to decimal age, the subjects were divided in two groups: the younger group comprised females aged 20-39, their decimal age being 19.500-39.400 and the older group comprised females aged ≥ 40, with decimal age ≥ 39.500. The grouping into these two categories relied on the fact that first changes in anthropological traits appear after the age of 40. The average decrease of height between the age of 30 to 70 is 0.075 cm/year in males and 0.125 cm/year in females (Sorkin et al., 1999)

The body composition analysis was performed by bioelectrical impedance procedure, using Omron BF511 Body Composition monitor. The Body Mass Index (BMI), a person's weight in relation to the height (kg/m^2), was calculated from the obtained data. The values of BMI were categorized in accordance with the international classification. 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 ≥ 30 kg/m^2). Abdominal obesity was determined using two criteria: WHR (waist circumference / hip circumference) as well as the waist circumference. The category distinguished for prevalence of abdominal obesity was WHR ≥ 0.80 (WHO, 2000). Waist circumference of 80 cm and higher, but lower than 88 cm was considered as an increased health risk (regardless of BMI). Waist circumference of 88 cm and higher was considered as a high health risk. Body fat percentage was determined using categorization of Gallagher et al., (2000). In younger women, high body fat percentage included the values ≥ 33%, and in older women it was ≥ 34%. The values set for extremely high body fat were ≥ 39% for younger females and ≥ 40% for older ones. Potential health risk was determined on the basis of both of the traits, i.e. waist circumference and BMI, and the categorization complied with Canadian Guidelines for Body Weight Classification in Adults (HEALTH CANADA, 2003). Measurements were processed by the program SPSS for Windows version 10 using standard statistical methods. The prevalence of overweight, obesity and increased waist

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circumference were expressed in percents. Age differences in anthropological characteristics were checked by Student's t-test, with the level of significance $p<0.01$. The age differences related to the prevalence of obesity, central obesity and health risk were estimated using chi-square test.

The study was carried out pursuant to the Declaration of Helsinki. All applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.

Results

Table 1 presents mean values and standard deviation for anthropometric characteristics in different age groups of females. The average age of the subjects was 30.42 ± 5.52 and 52.42 ± 8.21, for younger and older women, respectively. As for the height, the average values ranged from 165.94 ± 5.76 cm in younger women to 163.37 ± 6.08 cm in older women. The weight considerably increased with age. The average values were 65.13 ± 13.14 kg in younger subjects while in

older ones the values were markedly higher, equaling 70.00 ± 11.90 kg. The circumference values of upper and forearm, chest, waist and hips were also significantly higher in older females. Nevertheless, the thigh and calf circumference values did not show significant differences, implying thus that these traits do not change with age. The skinfold thickness also showed greater values in older ages. The BMI values pointed to increased weight index in older subjects. The relative and absolute body fat values were also considerably higher in older females, pointing to greater fat accumulation at older age.

Body fat percentage and the prevalence of overweight, obesity and abdominal obesity in different age groups of females are presented in Table 2. The results indicate that body fat percentage increased with age. Increased body fat in total weight was recorded in 32.86% of younger and 58.43% of older females. In older age group a significantly greater prevalence of increased ($p<0.01$) and highly increased ($p<0.05$) body fat was observed.

Table 1. *Mean values of anthropometric characteristics in different age groups of females*

Characteristics	Age of respondents						
	20-39			≥ 40			
	N	X	SD	N	X	SD	t-test
Age	144	30.42	5.52	168	52.42	8.21	**
Body height (cm)	144	165.94	5.76	168	163.37	6.08	**
Body weight (kg)	144	65.13	13.14	166	70.00	11.90	**
Relaxed upper arm circumference (cm)	140	26.96	3.48	163	29.17	3.42	**
Contracted upper arm circumference (cm)	58	28.06	2.95	99	30.05	4.29	**
Forearm circumference (cm)	58	23.33	1.91	99	24.96	8.60	**
Waist circumference (cm)	144	75.85	10.70	166	83.23	10.25	**
Hip circumference (cm)	144	100.45	9.13	166	104.53	8.74	**
Thigh circumference (cm)	58	55.5	6.93	99	56.56	7.03	ns
Calf circumference (cm)	58	36.29	2.92	99	36.94	2.73	ns
Subscapular skinfold thickness (mm)	144	15.77	7.58	168	19.21	7.95	**
Triceps skinfold thickness (mm)	144	19.11	6.81	168	23.39	6.72	**
Abdominal skinfold thickness (mm)	144	20.28	8.58	168	26.87	9.65	**
BMI (kg/m^2)	144	23.64	4.60	168	25.91	5.10	**
Fat mas (%)	143	30.48	9.06	166	35.17	8.32	**
Fat mas (kg)	142	20.68	11.01	166	25.35	9.75	**
WHR	144	0.75	0.05	166	0.79	0.06	**

** $p<0.01$ ns – non significant

Table 2. *Prevalence of body fat %, overweight, obesity and abdominal obesity in different age groups of females*

Characteristic	Age		Total
	20 - 39	≥ 40	
Prevalence of high values of body fat %	17.48	32.53	25.00
Prevalence of very high values of body fat %	15.38	25.90	20.64
Prevalence of overweight and obesity %			
Overweight (BMI 25 – 29.9 kg/m^2)	25.52	43.73	34.62
Obesity (BMI ≥ 30 kg/m^2)	6.20	16.26	11.23
Prevalence of abdominal obesity %			
WHR ≥ 0.80	18.75	43.37	31.06
First stage W ≥ 80 cm	12.5	22.89	17.69
Second stage W ≥ 88 cm	14.58	31.92	23.25

Table 3. *Health risk classification according to body mass index and waist circumference*

Waist circumference	BMI - Categories					
	18.5 – 24.9		25 – 29.9		30 – 34.9	
	Least risk		Increased risk		High risk	
< 88 cm	N	%	N	%	N	%
	169	54.51	62	20	5	1.61
	Increased risk		High risk		Very high risk	
≥ 88 cm	1	0.32	42	13.54	31	10

The prevalence of overweight and obesity was detected in 34.62% and 11.23% of subjects, respectively. Both categories were significantly higher in older females (p<0.01). Increased index of abdominal obesity WHR was found in 31.06% of subjects. As for the waist circumference, increased and extremely increased values were observed in 17.69% and 23.25% of women, respectively. All indicators of abdominal obesity considerably increased with age.

BMI and waist circumference point to the existence of both obesity and central obesity which further implies (Canadian guidelines for body weight classification in adults, 2003) that health risk should be assessed on the basis of both of the two indicators. Table 3 shows the health risk categories based on these two indicators referring to the total sample. It is noticeable that 54.51% of females were with lowest health risk, while 45.47% of individuals are with potential risk due to the increased waist circumference and overweight, or combination of both factors. Very high risk due to increased waist circumfrence and obesity was observed in 10% of women.

Discussion

The study of anthropological status and a potential health risk was conducted in Novi Sad, the capital city of Vojvodina Province in the North Serbia. The majority of subjects were with university education (50%), while the rest of them either had secondary school education (24.34%) or were university students, housewives and retired persons (25.65%). The average age of the sample was 41.42±6.86, ranging from 20 to 76 years. The results have shown that the subjects generally had great height, as the obtained means were within the greatest values for Europe (Cavelaars et al., 2000). Comparing the results with recently conducted studies (Pavlica, 2009) on women of similar age living in rural areas of Backa and Banat (20-39 years, X=164.25±6.35 cm; ≥ 40 years, X =159.47±6.56 cm), the present sample showed significantly higher values. The analysis of anthropological traits in women of different age groups are in line with other similar studies that pointed to the trend and dynamics of age changes (Pavlica, 2009). The difference in height between the two age groups is 2.57cm. Decrease of height after the age of 40 has been reported in other studies (Sorkin et al., 1999; Pavlica, 2009) and its cause is related to a number of biological factors and secular trend. The secular trend is observed in differences of body dimensions recorded in various age groups (Hall & Hall, 1995). If the average body dimensions are greater in young than in older population, the difference points to the positive secular trend. Populations without recorded height changes over a period of time are considered to live in good and stable socio-economic conditions which enable them to reach their maximum

genetic potentiality. The present results show that this has not been the case with the height of Vojvodina population yet.

The weight reflects the body and health condition of an individual. This trait is highly variable and dependent upon non-genetic or environmental factors. The values considerably vary in different periods of an individual's life. The weight is reported to increase for 250 g per year, regardless of the sex and menstrual status. The average weight of the young group of subjects approximately equals 65.13±13.14 kg, while in older females the values are higher equaling about 70.00±11.90 kg. In comparison with similar studies conducted in Backa and Banat, the obtained results show no significant differences, equaling 63.66±10.67 kg and 71.40±11.95 kg, in young and older-age women, respectively.

The present results indicate that the circumference traits also increase with age. Most of the obtained values show significant differences in two age groups. This, however, does not refer to the thigh and calf circumference, implying that the two dimensions do not change with age. As for the skinfold thickness, this trait indicates the quantity of subcatenous fat and as such indirectly points to the body composition. The study results suggest that all of the skinfold thickness values are significantly higher in older group. The literature data point to inconsistent values regarding pre- and postmenopausal females. Some studies (Hwu et al., 2003) report that skinfold thickness values are markedly higher in postmenopausal women. Other studies (Strenfeld et al., 2004), however, report the opposite trend. The total body fat shows greater values in postmenopausal women (Nassis & Geladas, 2003).

Referring to the average BMI values, the largest number of younger age women are with normal weight, while most of the females in other group are overweight. The obtained values equal 23.64±4.60 kg/m^2 and 25.91±5.10 kg/m^2 respectively. The recorded nutritional status is generally in accordance with the reported results for overall Serbian population (Grujić et al., 2005), with 42.42% of females having excessive weight, 10.02% of them being obese and 32.39% preobese. The overall prevalence of obesity in this study is detected in 45.85% of women, 34.62% with preobesity and 11.23% with obesity. As obesity is defined as increased body fat, its diagnostics includes the analysis of body composition in order to determine the total body fat (Stokić & Srdić, 2007). The results of body fat in total body mass point to the identical prevalence of obesity recorded by BMI criterium.

The results of our and other studies confirm the increase of BMI, WHR and waist circumference with age (Skrzypczak & Szwed, 2005). Aging is associated with low demand for energy caused by the decrease of basic metabolism and lack of physical activity. On the basis of distribution of WHR categories and waist circumference, a considerable number of subjects are determined to have central obesity. The results referring to central obesity based on the waist circumference indicate that 40.94% of females are with excessive waist circumference. In the case of 14.58% younger females and 31.92% older females, the excessiveness of this trait indicates a very high health risk (W ≥ 88 cm). The prevalence of central obesity increases with age. In women, the age of 50 and above is crucial for body composition changes since this is the age of menopause. After the menopause, insufficiencies of estrogens play a significant role in the change of body composition and changes of adipose tissue (Grujić et al., 2009).

In compliance with Canadian Guidelines for Body Weight Classification in Adults, health risk categorization has been determined on the basis of waist circumference and BMI, since these two traits are indicators of both obesity and central obesity. As this study used the above classification, it restricted only to obese individuals whose BMI ranged from 30 to 34.9 kg/m^2. However, it should be emphasized that individuals with BMI of 35-39.9 are with very high risk and those with BMI 40+ have extremely high risk, regardless of their WC.

The analysis of health risk indicates that, according to the anthropometric indices of obesity, a considerable percentage of women are with potential health risk. Previously reported data (http://www.ehn-heart.org/publications/annual-reports) showed gender differences in the distribution of health risk categories. Thus the usual age when women suffer from cardiovascular diseases is ten years later than in men. During the reproductive period they are partially protected, but the risk increases after the menopause, partly because of ovarian hormone deficiency that favours central obesity, hypertension, diabetes, hyperlipidemia, and the metabolic syndrome.

Although restricted to a relatively small number of females, this study offers an insight into the anthropological status and potential health risk among females in Vojvodina today. It is important to note that the health risk of each individual is influenced by a unique combination of factors which must be considered in addition to BMI and/or WC (National Institutes of Health, National Heart, Lung and

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Blood Institute, 1998). Accordingly, cardiovascular diseases may also be a result of certain biological factors, such as inheritance, age or sex, and the effects of these factors cannot be changed. There are other factors as well, such as insufficient physical activity, stress, smoking, and their effect can be modified by a change of lifestyle.

The results of anthropometric status in a sample of females in Novi Sad, demonstrate that considerable number of females are with a potential health risk. Since the average age of the subjects is 41.42 years, these results seem to be rather alarming. This implies a constant need of assessing body traits and the index of obesity in order to offer the official public information on the number of individuals with real and potential health problems.

Acknowledgement

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