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Original research article

THE INFLUENCE OF BODY COMPOSITION AND AGE ON THE BLOOD PRESSURE OF FEMALES OF DIFFERENT AGES

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Abstract. *Genetic factors play an important role, but most important of all is their interaction with metabolical syndromes, specifically obesity. So far it has been confirmed in certain studies that blood pressure value is connected to age and obesity. The aim of his study was to determine whether or not there is a relation between body composition and age that affects systolic and diastolic blood pressure. Material and methods: The data from the current research have been collected within the scientific research project titled "Anthropological status and physical activity of the population in Vojvodina", which was realized by the Faculty of Sports and Physical Education in Novi Sad, financed by the Provincial Secretariat for Science and Technological Development. Based on 102 female participants, aged 20 to 49, from the city of Novi Sad, an assessment of blood pressure and body composition parameterswas conductedusing a digital camera OMRON M4-1 and bioelectric impedance Maltron 920. The relations between the studied variables were examined using Pierson's correlation analysis and a regression analysis. Results: Based on the gathered multiple correlation coefficients (R) and other parameters (F tests and statistical significance P), it can be concluded that there in fact is a certain correlation between the prediction system of variables, body composition and the criteria, blood pressure assessment variables. By analyzing the coefficients of regression, individual influences of the variables of the prediction system on the criteria variables were noted. Conclusion: The results of this study suggest that an obvious influence of body composition onsystolic and diastolic pressure exists. This study also suggests that the percentage of fat in the body is a better indicator of blood pressure than age.*

Key words: *body composition, blood pressure, females.*

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INTRODUCTION

One of the risk factors for the occurrence of arteriosclerosis and coronary heart disease is physical inactivity. Together with hypokinesia, overeating, age and other factors, they are referred to as the multifactorial causes of cardiovascular disease, because most of the diseases are caused by these factors. The positive effects of physical activityhave been provenat the primary, secondary and tertiary level of prevention of coronary heart disease. It has also been accepted that physical activity is a significant factor in the preservation of normal physical and mental health. Meyer et al., (2000) showed that individuals who are in good shape havefifty percent less chance of suffering from cardiovascular disease, even in the presence of main risk factors such as hypertension, diabetes, smoking, etc. There has been a significant decrease in people's physical activity in the modern world. The trend of sedentary lifestyle was conditioned by the occurrence and improvement of technological developments. The necessity to use physical force while performing various tasks is disappearing very quickly, and human work is being replaced by machines and new technological achievements, so people's energy loss during a working day has been reduced to its minimum. Such an inactive lifestyle has contributed to the development of a range of related diseases which mostly include chronic diseases of the locomotor system and the deterioration of general body resistance, especially of the cardio-respiratory system. One of the leading diseases of such an inactive lifestyle is increased blood pressure. High blood pressure or hypertension increases the pressure on the circulatory and excretion organs, simultaneously increasing the risk of a heart attack, stroke and kidney diseases (Petrović, Obrenović, Poskurica & Stojimirović, 2002). In some instances high blood pressure causes headaches, ear tingling, dizziness, feelings of tension in the chest and shortness of breath, nausea, sight obstructions. However, the largest number people with hypertension have no symptoms and do not know that they have high blood pressure since they do not have regular medical check-ups. The role of the genetic factors is great, but the most factor is the connection tometabolical syndromes, primarily obesity (Reaven, 1999). So far, it has been confirmed in certain studies that the value of blood pressure usually increases with age and weight gain (Lee & Oh, 2010; Fagard, 2002). In this study, we are going to evaluate in more detail the relative contribution of age and obesity to the regulation of blood pressure in a healthy population of women.

Table 1 Categorization of patients according to the values of their blood pressure (based on the European Society for Hypertension and European Association of Cardiologists, 2007).

Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	< 120	< 80
Normal	120 – 129	80 – 84
Increased	130 – 139	85 – 89
Level 1 hypertension	140 – 159	90 – 99
Level 2 hypertension	160 – 179	100 – 109
Level 3 hypertension	≥ 180	≥ 110

Cardiovascular disease is the leading cause of premature deaths in Serbia. In 2008, heart and blood vessel diseases accounted for over half of all the causes of death (55.8%); 57.343 people died, and this group of diseases occurred more often in the case of women

(54.9%) than men (45.1%). Between 2002 and 2008, the death rates for this disease increased by 5.5% for women and 0.2% for men. The risk factors for the occurrence of this disease are present in a high percentage for all citizens of Serbia. Also, increased blood pressure is present in 46.5% of adults (Table 1). In addition, the fact that 67.7% of the citizens of Serbia are inactive is very disturbing(Radojčić, 2010).

THE METHOD

The sample of participants

The sample consisted of women from Novi Sad, aged 22-49. There were 102 participants in the total study. Out of the 102 respondents, 25 were between the ages of 22 and 30, 37 between 30 and 39 and 40 between 40 and 49. In terms of education, 80 of the respondents had finished high school, 19 had a college education and three respondents completed their postgraduate studies (master or doctorate). Basically, the majority of the respondents were employed, and 67 of the 102 respondents had had one or more childbirths. The data collected were used for the scientific research project "The anthropological status and physical activity of the citizens of Vojvodina" which was carried out by the Faculty of Sport and Physical Education in Novi Sad and financed by the Regional Secretariat for Science and Technological Development.

The sample of measuring instruments and variables

Systolic and diastolic blood pressure was measured by the digital blood pressure measuring device with a cuff OMRON M4-1 (Omron Healthcare Europe BV, The Netherlands). The cuff was placed firmly on the upper arm 2-3 cm above the elbow. While the measurement took place, the participants were seated for 15 minutes. Their blood pressure was taken three times. During each measurement the values of blood pressure varied, and it should be noted that the highest value was measured during the first measurement, and the lowest during the third. On account that the measured values did not differ for more than 4.5mmHg for the diastolic pressure, the mean value was the average of all three measurements, not the average of the second and third measurement, as recommended by the World Health Organization (WHO, 2000), all with the purpose of increasing the level of freedom for the mean values. The results are given in mmHg. Bioelectrical impedance Maltron 920 was used for the evaluation of body composition. The sample consisted of the following tests:

1) BM (kg) – body mass,
2) FM (%) –the proportion of fat mass in body composition,
3) MM (%) –the proportion of muscular mass in body composition.
4) BMI (kg/m^2) – index of body mass, the value used for the evaluation of normal body mass in accordance with the height of the person involved. It is obtained as a quotient of the body mass (kg) and the body mass squared (m^2).

Description of conditions and measurement protocols

The evaluation of body composition and blood pressure was performed at the Faculty of Sport and Physical Education in Novi Sad. During the process of testing, all rules were obeyed. Transversal measurement also took place.

Data analysis

To determine the basic statistics of the participants, the basic descriptive statistics for all the variables were calculated. By using Pearson's correlation coefficient and aregression analysis, the correlation between the predictor variables and the effect of system variables on the criterion were determined. For all the statistical analyses, the level of statistical significance was 0.05. The data processing was done by the statistical package IBM SPSS 20.0.

RESULTS

Table 2 The basic descriptive statistical variables.

Variable	N	Mean	Std. Deviation
Age	102	42,27	10,53
Body mass (kg)	102	66,46	12,22
BMI (kg/m^2)	102	24,58	4,47
Fat mass (%)	102	31,93	9,15
Muscule mass (%)	102	21,92	9,87
Syistolic BP(mmHg)	102	110,00	13,67
Diastolic BP (mmHg)	102	71,37	9,15

Legend: Mean – arithmetic mean, SD – standard deviation.

Table 3 The intercorrelation matrix of the body composition and age for the evaluation of blood pressure.

	1	2	3	4	5	6	7
1. Age	1						
2. Body mass	0,38	1					
	0,00						
3. BMI	0,46	0,91	1				
	0,00	0,00					
4. Fat mass	0,50	0,66	0,71	1			
	0,00	0,00	0,00				
5. Muscle mass	0,48	0,76	0,78	0,91	1		
	0,00	0,00	0,00	0,00			
6. Systolic BP	0,17	0,43	0,43	0,30	0,41	1	
	0,07	0,00	0,00	0,00	0,00		
7. Diastolic BP	0,16	0,41	0,37	0,28	0,39	0,75	1
	0,10	0,00	0,00	0,00	0,00	0,00	

Based on the results obtained in table 3, a positive correlation between body composition variables and systolic blood pressure were noted, but not between body composition and age. The determined statistically significant relations presented a basis for a regression analysis which is shown in table 4.

Table 4 The regression coefficient and the multiple correlation coefficient of the body composition variables for the evaluation of systolic and diastolic blood pressure

Variable	Systolic BP		Diastolic BP	
	ß	p	ß	p
Body mass	0,07	0,72	0,26	0,25
BMI	0,22	0,32	-0,03	0,89
Fat mass	-0,45	0,04	-0,40	0,08
Muscle mass	0,59	0,02	0,58	0,02
F	7,71		6,45	
R	0,49		0,45	
P	0,00		0,00	

Legend: ß – regression coefficient; p – the statistical significance of the regression coefficient; F – F-test; R – the multiple correlation coefficient; P – the statistical significance of the F-test.

Based on the resulting co s of multiple correlation (R) and other parameters (F-test and statistical significance P), it can be concluded that there is a connection between the prediction system of variables, body composition on the one hand and criteria, variables for assessment of systolic and diastolic blood pressure on the other. By analyzing the regression coefficients, individual influences of the prediction system on the criteria variables were noted. A statistically significant influence was notedfor the variables: fat mass (p=0.04), muscle mass (p=0.02) to systolic blood pressure, and muscle mass (p=0.02) to diastolic blood pressure. A further interpretation of the regression coefficients has shown that certain mathematical relations are negative; this means that increasing the value of the variables of the prediction system decreases the value of the criteria variables.

DISCUSSION

Nowadays it is not an easy task to find a sample of a healthy population for this kind of research. This sample, however, included female participants who were engaged in regular physical activity, who agreed to take part in the scientific research project on the anthropological status of physical activity of population in Vojvodina (including participants that have already been treated for hypertension and cardiac disease), and it represents a typical sample of healthy females aged 20-50. Hypertension is a disease with increased risk among the older and obese population (Cornoni-Huntley et al., 1989; Redon et al., 2009).However, the results of this research have only partially confirmed such previous conclusions. Firstly, a correlation between blood pressure and obesity has been noticed. Other than that, our results show that blood pressure is under the great influence of obesity, and more so the systolic rather than diastolic values of the blood pressure.

In a study carried out by Czech authors (Boledovicova et al., 2013), on a sample of middle-aged men and women, result were obtained that there is a relationship between blood pressure and obesity and age. Also, they came to the conclusion that obesity may

be a better parameter that influencesblood pressure with age, which to some extent can be identified with this study, in which we came to the same conclusion.

In the introduction to this paper, we notedthe large number of countries in the world, including Serbia, that have a high rate of cardiovascular diseases, one of most frequent being hypertension. In developed countries, prevention programs and control over cardiovascular diseases are mainly aimed at decreasing the influence of risk factors, as well as the improvement of the diagnostics and therapy of cardiovascular diseases. It has been established that 46.5% of adults have increased blood pressure (Radojčić, 2010).The prevention of cardiovascular disease includes the education of people, aimed at increasing the level of education and knowledge about risk factors and diseases related to the heart and blood vessels, systematic medical check-ups for the people above the age of 40, early detection of cardiovascular disease and risk factors, implementation of contemporary diagnostic methods, therapy and control of cardiovascular diseases, etc.The prevention programs and control of cardiovascular disease ought to decrease the influence of risk factors and improve the diagnostics and therapy of cardiovascular diseases.

Elkhalifa, Kinsara & Almadani (2011) determined that three factors influence hypertension on a similar sample in a healthy population: diabetes, age and obesity. The influence of social-economical factors and stress on hypertension may be important for the elderly population (Moulin, Labbe, Sass, Gerbaud, 2009). It is well known that arterial hypertension is more frequent among people with diabetes type 2, and systolic hypertension is especially singled out. For people with diabetes, higher values of blood pressure are more frequent in women, and among female diabetics there is a greater correlation between age and blood pressure (Pinto, 2007). Among postmenopausal women, blood pressure is more dependent on the duration of menopause rather than on age (Izumi, et al. 2007). Many factors can influence the sociological prevention of hypertension, such as the low level of education and alcoholism (Wagner, et al. 2011). The risk of hypertension among obese people is twice as great as with non-obese people (Sit, et al. 2009).

CONCLUSION

The results of this research show that there is a statistically significant effect of body composition on systolic and diastolic blood pressure. This study suggests that the percentage of fat in the body is a better predictor of blood pressure than age. Also, the authors of this paper wish to point out the seriousness of the problem of obesity and its harmful effects on the healthy functioning of the human body (in this case blood pressure) and its prevention.

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UTICAJ TELESNE KOMPOZICIJE I STAROSTI NA KRVNI PRITISAK ŽENA RAZLIČITE STAROSNE DOBI

Uloga genetskih faktora je veoma velika, ali najvažniji je odnos prema metaboličkim sindromima, prvenstveno uključujući gojaznost. Do sada je u nekim radovima potvrđeno da se vrednost krvnog pritiska obično povećava sa porastom starosnom dobi i gojaznosti. Cilj istraživanja bio je da se utvrdi da li postoje relacije izmedu telesne kompozicije i godina na sistolni i dijastolni krvni pritisak. Material i Metode: Podaci aktuelnog istraživanja prikupljeni su u okviru naučno-istraživackog projekta pod nazivom „Antropološki status i fizička aktivnost stanovništva Vojvodine", koji je realizovan od strane Fakulteta za sport i fizičko vaspitanje u Novom Sadu, finansiran od strane Pokrajinskog sekretarijata za nauku i tehnološki razvoj. Na uzorku od 102 ispitanica, uzrasta od 20 do 49 godina, iz grada Novog Sada, izvršena je procena parametara krvnog pritiska i telesne kompozicije pomoću digitalnog aparata OMRON M4-1 i bioelektrične impedanse Maltron 920. Relacije između posmatranih varijabli ispitivane su pomoću Pirson-ove analize korelacije i regresione analize. Rezultati: Bazirajući se na rezultate koeficijenata multiple korelacije (R) i drugih parametara (F-testa i statističke značajnosti P) može se zaključiti da postoji povezanost između prediktorskog sistema varijabli, telesne kompozicije i kriterija, varijabli za procenu krvnog pritiska. Posmatrajući regresione koeficijente uočeni su pojedinačni uticaji varijabli prediktorskog sistema na kriterijske varijable. Zaključak: Rezultati ovog istraživanja ukazuju da postoji jasno izražen uticaj telesne kompozicije na sistolni i dijastolni krvni pritisak. Ova studija sugeriše da je procenat masti u telu bolji prediktor krvnog pritiska nego što je starost.

Ključne reči: *telesna kompozicija/ krvni pritisak/ žene.*.