BODY COMPOSITION OF FEMALES OF DIFFERENT AGE

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Abstract

During the process of aging, certain changes in body composition inevitably take place. Changes that occur during life are mutual for all humans, but can also be the consequence of genetic factors, environmental factors, and individual behaviour in a sense of healthy nutrition and regular exercising. The aim of this research was to establish whether there are statistically significant differences in body composition in relation to the age between the groups of individuals that actively exercise (Heymsfield,Lohman, Wang & Going, 2005). The sample of individuals was made of 72 individuals in total, of 20-49 years of age, that were actively exercising in the fitness club „World Class", Novi Sad. Individuals were divided in three sub-samples, in accordance with their age. The first sub-sample was made of individuals of 20-29 years of age (N=23), the second one of individuals of 30-39 years of age (N=28) and the third one of individuals of 40-49 (N=21) years of age. By application of multi-variance and single-variance analysis of variance, and then t test for independent samples, we established statistically significant differences on quantitative level, between three observed groups of individuals.

Key words: body composition, individuals, aging.

Introduction

Body composition implies the composition of human body, represented with the size and grouping of the existing segments of which it is composed (Ugarković, 2001). Body composition, according to the American Health Association, physical exercising, education, recreation and dance, represent the ratio of fat, muscle and bone tissue, in the whole body mass. According to Mišigoj-Duraković (2006) non-fat body mass is made of muscles, skeleton, and internal organs, and fat mass is made of so called "important" and "unimportant" fats. Since the puberty, and all across the mature age and to the old age, women go through the number of different phases, that are mainly biologically conditioned (Mišigoj- Duraković, 2006). In a period of so called old adolescence, female body composition is being adjusted. That period, for girls, starts at the age of 16 and ends at the age of 21. (Obradović, 2008). Females have significantly higher share of fats in the total body composition versus males. The ratio of fat and non-fat parts of the body is changing during life. Research carried out up to now indicate that after 20th year of life, we can expect normal increase of body fat for 1% every ten years, all to the age of 60, which until then makes the total increase of 4%. The quantity of subcutaneous fat tissue is usually reduced after the age of 60. Normal values at mature age are 25% of body mass for men, and up to 30% for women, in relation to the total body composition. Values which are higher than presented ones indicate to obesity. Minimal limits of fat that are compatible with the idea of health are between 5% and 10% for men and between 15% and 18% for women (Wilmore and associates, 1986, according to: Mišigoj-Duraković, 2006). Morphological characteristics of women are biologically conditioned, but are also susceptible to influences of environment, lifestyle, social status, type of work, etc. Apart from the aforesaid factors, the strong contributor which influences morphological space of females is physical activity. Taking various sport and recreational activities is becoming one of the crucial factors for forming and maintaining of healthy and strong woman (Sharkey and Gaskil, 2008). Great expansion of fitness and wellness centres and other recreational offers speaks in favour of that, too. Talking about female population, we can say that females are taking physical exercising in order to achieve better mentally-physical performances (Mikalački, 2005). The aim of this research was to establish whether there are statistically significant differences in indicators of body composition in relation to the age, between groups of individuals that actively take exercises.

The sample of individuals was made of 72 individuals in total, of 20-49 years of age, that were actively exercising in the fitness club „World Class", Novi Sad. Individuals were divided in three sub-samples, following the age. The first sub-sample was made of individuals of 20-29 years of age (N=23), the second one of individuals of 30-39 years of age (N=28) and the third one of individuals of 40-49 (21) years of age. The division according to the age categories was made following the results of former research (Nasis and Gledas 2003; Heyward 2006). All individuals were exercising in accordance with the specialized standardized programs applied in the fitness centre „World Class". The sample was made of women that were practicing for a year, and that were selected from urban population, of higher socioeconomic status. World Class fitness concept can be divided into programs that are practiced with stimulators, group fitness programs and wellness activities. The area of interest included group fitness programs. World Class concept offers the whole variety of such programs, and they are all divided in three groups depending on the dominant motor ability which develops in that program of exercising. Also, their programs can be divided according to duration (length), to programs of 30, 45 and 60 minutes. Programs that last 30 minutes are called EXPRESS programs.

The program according to which the individuals were exercising consisted of combination of different fitness programs, and according to the following line-up:

Table 1. Program of Exercising

GROUP FITNESS PROGRAMS			
TRAINING 1 PUMP 60'	TRAINING 2 STEP EXPRESS 30'	TRAINING 3 PUMP 60'	TRAINING 4 PILATES 60'
SPININIG EXPRESS 30'	CORE EXPRESS 30'	SPINING EXPRESS 30'	

Testing of the body composition was performed by means of bioelectrical impendance MALTRON 920– 2. Bioelectrical impendence or bio-impendance Maltron Bioscan 920 – 2 is a quick non-invading method which functions in the following way: safe dose of electricity (50 kHz) is emitted through the body structure. Maltron bio-impendance is one among the latest devices of this type. Measuring and testing was carried out during the forenoon. In order to get the most accurate results for evaluation of the body composition, measuring was performed according to the protocol ACSM from 2005 (Heymsfield and associates, 2006).

- Measuring was realized during the morning, every day at the same time,
- Empty bladder of individuals,
- 48 hours prior to measuring, individuals did not consume alcohol,
- Normal level of hydration,
- 12 hours prior to measuring individuals did not take any physical activity,
- Measuring was performed while individuals were in a reclining position

Body height (cm), as a represent of longitudinal dimensionality of skeleton was measured by standard anthropometer according to Martin (according to IBP).

Body weight (kg), as a represent of body volume and body mass, was measured by means of digital scales, prior to beginning of testing of the body composition (according to IBP).

Estimation of body composition gave results with the following indicators:

1. BH (cm) – body height,
2. BW (kg) – body weight,
3. FFM (kg) – *Fat free mass* or share of the non-fat mass in body composition, and which represents the total mass of muscle, connective and bone tissue,
4. FM (kg) – Represents the share of fat mass in body composition,
5. MM (kg) – Represents the share of muscle mass in body composition, and
6. BMI – *Body mass index* represents the value which is used for evaluation of normal body mass in relation to the height of the measured person. It is obtained as a quotient of the body mass (kg) and the square of the body height (m^2).

In order to establish the basic statistics of the groups of individuals, we calculated the basic descriptive statistics. Testing of significance of differences in indicators of the body composition for groups of individuals of different age was carried out by application of multi-variant analysis of variance. After that, in order to test the significance of differences for pairs of groups, different age, we applied ttest for independent samples. The processing of data was carried out by means of statistic package SPSS 16.0.

Results

With the purpose of establishing the significance on quantitative level, for indicators of body composition between the groups of individuals of different age, the following tables will show the results obtained by application of multi-variant and single-variant analysis of variance and t test for independent samples.

Table 2. The results of multi-variant analysis of variance for indicators of the body composition

VARIABLE	GROUP	AS	S	f	p
Body height (cm)	20-29	169,18	4,97	0,43	0,65
	30-39	167,83	5,68		
	40-49	168,76	5,15		
Body weight (kg)	20-29	58,25	5,50	8,27	**0,00**
	30-39	61,63	7,23		
	40-49	67,85	10,59		
Non-fat mass (kg)	20-29	45,98	3,03	0,59	0,55
	30-39	46,10	3,88		
	40-49	47,02	3,23		
Fat mass (kg)	20-29	12,50	3,22	14,01	**0,00**
	30-39	14,94	5,29		
	40-49	21,37	7,99		
Body mass index (kg/m^2)	20-29	20,38	1,70	9,93	**0,00**
	30-39	21,75	2,82		
	40-49	24,18	3,76		
Muscle mass (kg)	20-29	19,93	1,32	0,48	0,62
	30-39	21,91	12,22		
	40-49	20,27	1,71		
		F= 3.25	**P=0.00**		

Legend: AS – arithmetic mean, f – value of univariate F test, p – level of significance of univariate F test, Fvalue of multivarite F test, P- level of significance of multivariate F test

Multi-variant analysis of variance established statistically significant differences in total space of variables, where F = 3,25 is on the level of significance P=0,00. Analysis of quantitative differences by single-variant analysis of variance for some indicators of body composition established statistically significant differences for variables Body weight, Body mass and Body mass index.

Table 3 – Testing of the significance of differences between pairs of groups according to variables

VARIABLE	AS	Pairs	t	p
Body height (cm)	169,18	20-29 - 30-39	0,89	0,37
	167.83	20-29 - 40-49	0,27	0,78
	168,76	30-39 - 40-49	-0,58	0,56
Body weight (kg)	58,25	20-29 - 30-39	-1,84	0,07
	61,63	20-29 - 40-49	-3,82	**0,00**
	67,85	30-39 - 40-49	-2,44	**0,01**
Non-fat mass (kg)	45,98	20-29 - 30-39	-0,11	0,90
	46,10	20-29 - 40-49	-1,09	0,28
	47,02	30-39 - 40-49	-0,87	0,38
Fat mass (kg)	12,50	20-29 - 30-39	-1,93	**0,05**
	14,94	20-29 - 40-49	-4,90	**0,00**
	21,37	30-39 - 40-49	-3,38	**0,00**
Body mass index (kg/m	20,38	20-29 - 30-39	-2,04	**0,04**
	21,75	20-29 - 40-49	-4,37	**0,00** 2)
	24,18	30-39 - 40-49	-2,58	**0,01**
Muscle mass (kg)	19,93	20-29 - 30-39	-0,77	0,44
	21,91	20-29 - 40-49	-0,73	0,46
	20,27	30-39 - 40-49	0,61	0,54

Legend: AS – arithmetic mean, t – value of t test, p – level of significance of t test

Application of t test for independent samples established statistically significant differences between all pairs in groups of variables Fat mass and Body mass index ($p<0,05$). Variable Body weight showed statistically significant difference between groups of individuals of 20-29 and 40-49 years of age and 30-39 and 40-49 years of age.

Discussion

If we analyse obtained descriptive statistics for indicators of body composition of the observed groups of individuals, we can say that all three analysed age categories, compared to referent values (Heyward, 2006; Pavlica, Božić-Krstić and Rakić 2010), fall within normal category in accordance with age. This represents special advantage for older individuals, because normal Body mass index (BMI) positively correlates with reduction of risks of occurrence of cardio-vascular disorders and other diseases related to excessive body mass (Srdić & Stokić, 2008). Multi-variant analysis of variance established statistically significant, in total space of variables for evaluation of body composition. Single-variant analysis established statistically significant differences between the groups on quantitative level. Statistically significant differences were also stated for variables Body weight, Fat mass and Body mass index. The significance of differences between groups of individuals of different age was tested by means of application of t test for independent samples. The results of test showed the significance of differences between the youngest (20-29) and middle (30-39)

individuals, between middle (30-39) and oldest (40-49) individuals and the youngest and (20-29) and oldest (40-49) individuals in variables Body weight, Fat mass and Body mass index. Statistical significance of variable Body weight was only missing between the groups of individuals of 20-29 and 30-39 years of age. Higher values of stated indicators of body compositions were in favour of older individuals. The biggest difference in obtained values of analysed indicators of body composition was between the youngest (20-29) and the oldest (40-49) individuals.

During the period of adolescence females have double proportional increase of fat mass, compared to men, whereas men have double proportional increase of non-fat body mass (Malina and Bouchard, 1991, according to: Mišigoj-Duraković, 2006). Changes in body composition which occur with ages, at females and observed from the aspect of biological theory of aging, and especially neuro-endocrine theories, among the others, relate to occurrence of sarcopenia – gradual decay of muscle tissue (Coggan, Spina, King, Rogers, Brown, Nemeth and Holloszy, 1992). At physically active females, the level of such decline is lower, and/or the degree of maintenance of muscle mass is on the same level (Kylie, Melzer, Kayser, Picard-Kossovsky, Gremion and Pichard 2006). In this research, among the individuals of different age, there was no statistically significant difference in share of muscle mass in body composition, which can be attributed to active, systematic exercising which contributes to loss of differences between age categories of the observed sample. As for the muscle tissue, there is not much information on average, and/or desired values for general population. There is an increased percent of share of muscle tissue in total body composition, since it is a starter of locomotive apparatus and cannot be an obstacle in practice, versus increase of fat tissue (Cvetković, 2006). The results which indicate that aging causes significant decline in non-fat mass (FFM) and body height, and significant increase of total body fat (FM), weight and body mass index (Guo, Zeller, Chumlea and Siervogel, 1999) are also significant. Individuals of the third group (40-49) in this research are characterized with significantly higher values versus younger individuals (20-29 and 30-39) in share of Fat tissue in body composition, increased value of Body mass index and higher Body weight. At older individuals, the increase of observed indicators of body composition is also conditioned for individuals older than 42 years of age (Sternfeld, Wang, Quesenberry, Abrams, Everson-Rose, Greendale, Matthews, Torrens and Sowers, 2004).

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