Original research article

THE DIFFERENCES IN THE OBESITY INDICATORS WITH THE WOMEN IN REPRODUCTIVE PHASE AND MENOPAUSE

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Abstract. *The total number of tested individuals is 158, aged from 22 to 76 years. They were distributed in the two sub-samples. 100 of the tested individuals were in the reproductive phase (33 ± 11 years), and 58 in menopause (59 ± 17 years). For the determination of the basic statistics of the tested groups, the data were treated by the treatment procedures of the descriptive and variation statistics (homogeneity). For defining the statistically significant differences, the T test for independent groups was applied, while for estimating the differences for the two sub-samples the ANOVA (analysis of variance) was used. The studies cited in this paper indicate that during menopause nearly all variables that are the obesity indicators increase, while the reason for obesity cited include aging, menopause, and estrogen reduction, as well as the sedentary way of life with reduced physical activity (Tremolliers et al., 1996; Cervellati et al., 2009; Toth et al., 2000; Tchernof & Poehlman, 1998; Gurthrie et al., 1999; Pasco et al., 2012; Pavlica asset al., 2012; Munawar et al., 2012; Martins & Marinho, 2003).*

Key words: *women, menopause, obesity.*

INTRODUCTION

The most frequently used parameters for obesity estimation are substantially different among persons of both genders still in puberty. Those differences follow them during the entire course of their lives (Kirchengast, 2010). Fat tissue in women is more abundant in relation to men, as well as its disposition. The woman's body contours are more well-rounded because they have greater amounts of subcutaneous fatty tissue (Jakonic, 1995). Unlike that of men, in the woman's constitution the fatty tissue amounts to about 18-20% of the total body mass while some authors cite higher percentages. With males this percent is remarkably lower and amounts to approximately 12%. For the increasing of the fat

reserves in the body of females the main 'culprit' is estrogen that also contributes to the fat tissue distribution, which makes the woman's body more rounded and gives it a more female appearance (Djuraskovic, 2009).

There are differences in these parameters, but also between the sexes, and the percent of fat mass, that is, the fatty and muscular tissue changes during different life ages (Zafon, 2007). The lifespan of a woman can roughly be divided into three general phases: the reproductive age, climax (passing into menopause) and menopause (Harlow, 2012).

The relevant literature includes studies which among other things also treat the problem of obesity among women in the reproductive phase as well as menopause (there are many papers treating the estimate of the different indicators of female obesity in menopause. Meanwhile the same problem connected with women in the reproductive phase were seemingly not studied as extensively, i.e. in the found studies data about the status of the tested individuals i.e. participants could not be found.

This research deals with the comparison of the indicators of obesity of women in menopause as well the ones that are still in the reproductive phase. Very few such studies exist. With BMI (Body Mass Index) increasing over 30, there is evident obesity as well the risk of obesity complications. On the other hand, a decrease under 19 brings along the risk of malnutrition. Malnutrition and obesity represent the states that can often be etiologic factors for the appearance of numerous illnesses.

THE METHOD

The sample of participants

The research was done in Novi Sad on a sample of women that participated in the project *The impact of exercise into the risk factors of the work active population*. The project was financed by the Province Secretariat for Science and Technological Development, number (114-451-2337/2011-01). Those women volunteered to participate in the above-mentioned project. All the participants (the tested women) gave their consent before the beginning of the measurement.

The total number of tested women was 158. They were aged from 22 to 76. They were divided into two subsamples. 100 participants were in the reproductive phase (33 ± 11 years), and 58 in menopause (59 ± 17 years).

The sample of measuring instruments

For the purpose of this research, that is, for the evaluation of the fat component of the body mass of the tested women, the next parameters were used:
- body height,
- body mass,
- relative fat mass (%),
- waistline,
- hips measurement,
- relation of the waistline and hips measurement,
- body mass index (BMI), that represents the relation of the body mass and body height. It can be calculated in the following way:

$$BMI = \frac{m \text{ (body mass in kilograms)}}{h^2 \text{ (body height in meters)}}$$

Table 1 The categories of individuals according to the body mass index

BMI span	weight category
19 to < 25	Normal weight
25 to < 30	Increased weight
30 to < 35	Obesity
≥ 35	Extensive obesity

Data analysis

The data were entered into the matrix and treated using the statistical program *SPSS 15.0 for Windows*.

For defining the basic statistics of the groups of participants, the data were processed by the procedures of descriptive and variation statistics (homogeneity). For defining the statistically significant differences, the T-test for independent groups was applied, while for the assessment of differences between the two subsamples the ANOVA (Univariate Analysis of Variance) was used.

RESULTS

The research results are shown in the tables, with a text interpretation. In the beginning, the results of the descriptive statistical analysis are shown, obtained by the application of adequate statistic procedures for the variables *Body height, Body mass, body mass index (BMI), fat mass in %, waistline hips measurements, relation of the waistline and hips measurement (RWHM) and abdominal skinfolds* of the women who are in the reproductive phase and in menopause.

Table 2 shows the elementary descriptive statistics regarding body mass, BMI, the relative (%) indicator of the fat mass, waistline, hips measurement, RWHM and abdominal skinfolds of the participants (tested women) on the basis of the menopause status.

On the basic of the value of the arithmetical means (AM), one can see that the average scores of the participants of the both groups for the variable *Body height* do not differ very much, i.e. that the participants (the tested women) are of nearly the same values (AM=162,34 and AM=164,85). The arithmetical means of the variable *Body mass* differ among the women in menopause AM=70,75, and the ones still in their reproductive phase AM=64,60. The results of the women in menopause in the variable *BMI, Body Mass Index* (AM=26,83) are grouped in the category 'increased body mass', while the average scores of the participants in their reproductive phase (AM=23,79) are grouped in the category 'normal body weight'. On the other hand, the average result of the *Fat mass* in percentages was determined for the participants in menopause substantially above the limits of the reference values (AM=37,01), and for the participants that are not in menopause the average values were within the frame of limits (AM=28,70). The variable *Waistline* presents the significant difference between the women that are in menopause (AM=85,25) and the ones that are not (AM=76,07). In the case of the variable *Hips*

measurement there is no great difference between the groups, neither with the variable *relation of the waistline and hips measurement* (*RWHM*), but therefore on the basis of the recommendation of the World Health Organization, the group of women which are in menopause have somewhat increased values of RWHM (AM=0,81). The average values of the variable *abdominal skinfolds* for the women in menopause was (AM=28,32), while with the women in their reproductive phase it was (AM=23,65).

Table 2 Body height, Body mass, BMI, Fat mass in %, Waistline, Hip measurement, Relation of the waistline and hips measurement (RWHM) and Abdominal skinfolds.
$\sum$ N = 158; subsamples: N = 58 menopause, N = 100 reproductive phase

		Min	Max	AM	SD
Body height	Women in menopause	148,70	175,50	162,34	6,03
	Women in reproductive phase	153,00	177,00	164,85	5,43
Body mass	Women in menopause	54,00	100,00	70,75	11,49
	Women in reproductive phase	45,00	99,00	64,60	9,71
BMI	Women in menopause	19,46	37,02	26,83	3,96
	Women in reproductive phase	17,86	37,58	23,79	3,59
Fat mass in %	Women in menopause	21,50	61,00	37,01	8,09
	Women in reproductive phase	9,10	47,80	28,71	7,68
	Women in menopause	67,50	111,00	85,25	11,33
Waistline	Women in reproductive phase	59,50	108,00	76,07	9,08
Hip measurement	Women in menopause	92,00	132,00	104,60	8,05
	Women in reproductive phase	83,50	128,50	100,37	7,37
RWHM	Women in menopause	0,69	1,01	0,81	0,08
	Women in reproductive phase	0,65	0,91	0,76	0,06
Abdominal skinfolds	Women in menopause	10,73	43,00	28,32	8,13
	Women in reproductive phase	7,13	40,00	23,65	8,90

Legend: Min-minimal value; Max-maximal value; AM-arithmetical mean; SD-standard deviation

In Table 3, we can find the data of the test of homogeneity (Leven's coefficient) and statistical significance (p) for both groups of participants.

Table 3 Tests of variance homogeneity

	Leven's coefficient	p
Body height	0,67	0,41
Body weight	2,62	0,11
BMI	0,72	0,40
Fat mass in %	0,01	0,93
Waistline	7,24	0,01
Hips measurement	0,11	0,75
RWHM	8,45	0,00
Abdominal skinfolds	0,50	0,48

Leven's coefficient value is statistically significant for the variables *waistline* and *RWHM* (p=0,01 and p=0,00), which means that these two analyzed groups are statistically substantially different in terms of variability. On the other hand, Leven's coefficient value is not statistically significant for the other variables (p=0,41; p=0,11; p=0,40; p=0,93; p=0,75 and p=0,48). So, one can conclude that these two groups are not statistically different in relation to the variability in these six variables.

Table 4 shows the data on the analysis of the variance: F-relation (F) and its significance (p). These data illustrate the analysis of the arithmetic means in the variables of *body height, body mass, BMI, feat mass in %, waistline, hips measurement, RWHM and abdominal skinfolds* for these two groups of women.

Table 4 The variance analysis (ANOVA)

		F	p
Body height	Inter groups	7,28	0,01
	Intra groups		
Body mass	Inter groups	12,86	0,00
	Intra groups		
BMI	Inter groups	24,48	0,00
	Intra groups		
Fat mass in %	Inter groups	41,34	0,00
	Intra groups		
Waistline	Inter groups	31,20	0,00
	Intra groups		
Hips measurement	Inter groups	11,31	0,00
	Intra groups		
RWHM	Inter groups	26,54	0,00
	Intra groups		
Abdominal skinfolds	Inter groups	10,75	0,00
	Intra groups		

The F-relation value is high and statistically significant at the p=0,00 and p=0,01 level, so one can conclude from it that these two analyzed groups are statistically different in relation to the results in the variables *Body height, Body mass, Body mass index, Fat mass in percentages and Waistline, Hips measurement, RWHM and Abdominal skinfolds*. On the basis of the F-relation it was determined that the groups are statistically significantly different (p=0,00 and p=0,01), and that the group of women in menopause realized more values in all the variables.

In table number 5 we find the results of the T-test for the two independent groups. Considering that it is defined by the test of homogeneity, Leven's coefficient is not statistically significant for six variables (*Body height, Body mass, Body mass index, Fat mass in percentages, Hip measurement and Abdominal skinfolds*), the values from the first line are accepted while for the variables *Waistline and RWHM* the values from the second line were taken. For all the variables, the T-test demonstrated that there is a statistically remarkable difference at the p=0,00 and p=0,01 level.

Table 5 T-test results for the two independent groups

	t	p
Body height	-2,69	0,01
	-2,62	0,01
Body mass	3,59	0,00
	3,43	0,00
BMI	4,95	0,00
	4,82	0,00
Fat mass in %	6,43	0,00
	6,34	0,00
Waistline	5,59	0,00
	5,27	0,00
Hips measurement	3,36	0,00
	3,28	0,00
RWHM	5,15	0,00
	4,76	0,00
Abdominal skinfold	3,28	0,00
	3,36	0,00

Legend: t = value of T-test; p = statistical significance of T-test

For all the variables except for the variable *Body height*, there is a statistically significant difference in favor of the first group, that is, women in menopause. The differences in the values of the variable *Body height* are also statistically significant, but this time in favor of the women that are not in menopause.

DISCUSSION

On the basis of the obtained results, one can conclude that in this sample of participants in menopause the average value of the Body mass index was obtained, *BMI*=26,83. It groups them into the category of the 'increased body mass', which has limit reference values of 25-30. On the other hand, for this sample of the women that are still in their reproductive phase, the obtained average score *BMI*=23,79, groups them into the category of 'normal body mass', whose limit reference values are in the range of 19-25.

Regarding the variable *Fat mass* in percentages, the women in menopause are substantially above the limits of the reference values, because their score amounts to 37,01% of the fat mass, while among the women that are not in menopause an average value of 28,70% was obtained. It presents the result in the limits of reference values. On the basis of these data, one can ascertain that there are the differences in these variables on this sample of participants.

For the variable *waistline* there were also very remarkable differences, because the arithmetic means of the measured women in menopause amounts to 85,25cm and for the women that are not in menopause 76,07 cm. *Hip measurement*, in contrast to the previously tested variable, demonstrates little difference between these two groups, because the arithmetic mean of the women in menopause amounted to 104,60 cm, and those in the reproductive phase was 100,37 cm.

The *RWHM* variable in the case of women that are in menopause had a means of 0,81. It was a somewhat higher value than the one calculated with the women in the reproductive phase, 0,76. However the value of 0,76 is considered in the reference limit (<80), while the value calculated with the women in menopause was 0,81, slightly above that limit.

According to this, the women in menopause are on average different from the other women in terms of their results, as well as in this obesity indicator, which exceeds the abovementioned limit.

The abdominal skinfolds do not manifest great differences between these two groups. For the women in menopause the calculated average value was 28,32 mm, and for the other group was 23,65 mm.

These two analyzed groups are remarkably different in all the variables in favor of the first group, that is, ahead of the women in menopause. Taking into consideration that all the variables except *Body weight* are inverse, that is, that higher values effectively reflect worse results, from this point of view the women still in their reproductive phase, showed remarkably better results in relation to the women in menopause.

The studies quoted in this paper indicate the fact that in menopause nearly all the variables that are obesity indicators increase. The cited reasons are aging, menopause and an estrogen decrease, as well as a sedentary lifestyle with reduced physical activity (Trémollieres et al., 1996; Cervellati et al., 2009; Toth et al., 2000; Tchernof & Poehlman, 1998; Guthrie et al., 1999; Pasco et al., 2012; Pavlica et al., 2012; Munawar et al., 2012; Martins & Marinho, 2003).

Namely, in numerous papers in which a group of women in their reproductive phase and women group in menopause were compared, the results show that the results in the variables *Body mass, Fat mass, Body mass index (BMI), Waist line and RWHM* are higher and substantially higher in relation to the group that are not yet in menopause (Toth et al., 2000; Wang et al., 1994; Ley et al., 1992; Poehlman et al., 1995; Guo et al., 1999; Donato et al., 2006; Kosková et al., 2007; Björkelund et al., 1996, Srdic et al, 2005).

The results obtained on this sample of participants (tested women) confirm the facts from former studies cited in this paper. The values of these examined variables are remarkably higher in the case of women in menopause. Moreover, the results obtained for the variables, that is, the calculated arithmetic means of the results for fat mass in percents, BMI and RWHM, exceed the reference limit values, and classify this group of women in menopause as belonging to the obesity group.

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RAZLIKE U INDIKATORIMA GOJAZNOSTI KOD ŽENA U REPRODUKTIVNOJ FAZI ŽIVOTA I ŽENA U MENOPAUZI

Ukupan broj ispitanica bio je 158, starosti od 22 do 76 godina. Podeljene su u dve pod-grupe. 100 ispitanica bile su u reproduktivnoj fazi (33 ± 11 godina), a 58 u menopauzi (59 ± 17 godina). Radi utvrđivanja osnovnih statističkih parametara testiranih grupa, podaci su podvrgnuti testovima deskriptivnog i varijacijskog tipa (ujednačenosti). Kako bi se definisale statistički značajne razlike, t-test za nezavisne uzorke je korišćen, dok se za procenu razlika između pod-grupa koristila ANOVA. Istraživanja citirana u ovom radu pokazala su da, tokom menopauze, skoro sve varijable koje su indikatori gojaznosti pokazuju veće vrednosti, dok se kao razlog za razvoj gojaznosti navode godine starosti, smanjenje estrogena, kao i neaktivan način života uz smanjenu fizičku aktivnost (Tremolliers et al., 1996; Cervellati et al., 2009; Toth et al., 2000; Tchernof & Poehlman, 1998; Gurthrie et al., 1999; Pasco et al., 2012; Pavlica et al., 2012; Munawar et al., 2012; Martins & Marinho, 2003).

Ključne reči: *žene, menopauza, gojaznost.*