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BIOCHEMICAL AND ANTHROPOMETRICAL PARAMETERS AND PHYSICAL ACTIVITY OF WOMEN – A SHORT REPORT

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Key words: women, physical activity, body mass, biochemical indices

An appropriate level of physical activity is an important element of a strategy for achieving and maintaining the correct body mass, which is a key factor related to reducing health-related risks. This study was aimed at evaluating body mass and body composition as well as selected biochemical indexes in women in relation to their physical activity in the context of health risks.

The study included 368 women aged 39 to 60. Depending on the physical activity, significant differences in the body mass, fat and fat free body mass, the BMI and waist and hip circumferences were found. Women with low physical activity had a body mass higher by about 5 kg on average than the active women, and for women with no physical activity the difference amounted to about 9 kg. Women with no physical activity were found to have waist circumferences greater by about 8 cm on average than the active women. The average BMI for active women was significantly lower than for those with no physical activity (25.5 *vs*. 28.9 kg/m^2). The total cholesterol level in the entire group of women included in the study was found to be elevated, regardless of the level of physical activity. The serum levels of glucose, triglycerides and HDL-cholesterol consistent with reference ranges were found in women with no physical activity.

The anthropometric parameters in women with low physical activity were likely to increase the risk of developing diet-related diseases.

INTRODUCTION

Hypertension, smoking, dyslipidemia, diabetes, body mass index, a low level of physical activity and metabolic syndrome are strong predictors of cardiovascular incidents [European guidelines…, 2007; Jakicic *et al.,* 2005; Shaper *et al.,* 1997; Kushner *et al.,* 2003]. Among women in Europe, the cardiovascular diseases cause a total of 55% deaths (43% among men), whereas coronary arterial disease – 23% (21%), strokes – 18% (11%), other circulatory diseases – 15% (11%), all malignant tumours in total – 17%, including breast cancer – 3% [European guidelines…, 2007; Jakicic *et al.,* 2005]. The cardiovascular risk linked with hypertension, hypertriglyceridemia and diabetes among women increases with aging [Collins *et al*., 2007; Mozaffarian *et al*., 2004; Manson *et al*., 1995; Grundy, 2000; Poehlman *et al*., 1995].

Employment of strategies to prevent atherosclerotic cardiovascular diseases is aimed at evaluating and controlling the cardiovascular risks and minimizing the symptoms in vessels by modifying the lifestyle, including diet, and increasing physical activity in each age group of women [Macdonald *et al*., 2004; Hu *et al*., 2000].

A beneficial influence of physical activity on reducing the occurrence of metabolic diseases has been confirmed in many studies [Baranowski, 2004; Haskell *et al*., 2003; Skoumas *et al.,* 2003]. An active lifestyle may have a crucial role in keeping a proper body mass, in decreasing the body mass of an obese person and also in preventing its increase. Physical activity, along with modifications of energy intake is a very important behavioural prevention factor claimed to be effective in fighting the obesity epidemic and other metabolic diseases [Baranowski *et al*., 2004; Despres & Krauss, 1998; Haskell *et al*., 2003; Skoumas *et al.,* 2003; Hu *et al*., 2000].

The aim of the study was to evaluate body mass and body composition as well as selected biochemical parameters of women in relation to their physical activity in the context of health hazards.

MATERIALS AND METHODS

The study was carried out on 368 women aged 39-60 years from the Province of Warmia-Mazury. The sample choice was open without strict clinical data. The women's body compositions were evaluated on the basis of anthropometric measurements, *i.e.* body mass (kg), body height (cm), four skinfold thicknesses (mm), waist circumference (cm), hip circumferences (cm) and indices calculated on their basis: BMI (kg/m^2), fat mass in the body (%FM,%) and waist to hip ratio (WHR). The biochemical examinations included determination of the fasting total cholesterol level, its HDL and LDL fractions, triglycerides and glucose concentration in the serum [Poehleman *et al*, 1995].

The physical activity was self-assessed by the subjects as: (1) active, *i.e.* daily intensive physical activity, (2) quite active, *i.e.* 2-3 times/week intensive physical activity, (3) low activity level, *i.e.* intensive physical activity once a week, (4) spo-

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radic, *i.e.* an answer: "I'm sporadically physically active", and (5) passive, *i.e.* sedentary lifestyle, no exercise at all. The consent for the study was issued by the Bioethical Committee at the Warmia-Mazury Chamber of Physicians in Olsztyn by a resolution No. 14/2003/II.

The comparison of the mean values of the analysed parameters in relation to physical activity was made using the variance analysis. A statistical analysis was carried out at a significance level of $p \leq 0.05$ [Stanisz, 1998]. All calculations were made using the Statistica PL v.8.0 computer program.

RESULTS AND DISCUSSION

Depending on physical activity, significant differences were found in body mass, fat mass and fat free body mass, the BMI and waist and hip circumference (Table 1). Higher values of the analysed parameters were determined for the women with limited physical activity. The women with a low level of physical activity had a body mass higher by about 5 kg on average than the active women, while the mean difference between active women and those with no physical activity amounted to about 9 kg (Table 1). The observed mean BMI value for physically-active women (BMI=25.47 kg/m^2) was consistent with the BMI values for the body mass recommended by The American Institute of Nutrition [Manson *et al*., 1995] as the BMI=22-27 kg/m^2, while the women with a sedentary lifestyle (BMI=28.89 kg/m^2) considerably exceeded the recommended BMI range (Table 1). The Nurses' Health Study showed that all-cause mortality among middle-age women depended directly on their body mass [Manson *et al*., 1995; Kushner *et al*., 2003]. Mortality of women with the BMI>29 was over twice as high as that of the slimmest women [Shaper *et al*., 1997; Manson *et al*., 1995; Kushner *et al*., 2003; Haskell *et al*., 2003]. The increased body mass is associated with an increased risk of potential development of atherosclerosis, an increase of arterial blood pressure, more frequent complications resulting from the occurrence of thrombotic and embolic complications as well as type 2 diabetes [Manson *et al*., 1995; Grundy, 2000; Kushner *et al*., 2003; Haskell, 2003]. While analysing the body composition, it was found that all women, regardless of the physical activity type, were characterised by a high percentage of fatty tissue in the body. The active women had on average 31.5% of fatty tissue, while in sporadically active women or those with a low level of physical activity and no physical activity the fatty tissue content was higher and amounted to 32.3%, 32.0% and 34.2%, respectively (Table 1). While observing the mean waist circumference, it was found that the whole subpopulation was characterised by alarming values of over 80 cm, which may be, along with other risk factors, a sufficient condition to diagnose a metabolic syndrome (Table 1) [Jakicic *et al.,* 2005; Volek *et al*., 2004]. The highest values were noted for the women with no physical activity (88.5 cm), while the lowest values were recorded for the active women (80.2 cm), (Table 1).

In analysing the biochemical parameters, the total cholesterol level should be considered as the greatest threat to health, as its level exceeded the safe range (Table 1), [Skoumas *et al*., 2003; Tchernof & Poehlman, 1998; Yunsheng *et al.,* 2005]. While analysing the levels of glucose, triglyceride and HDL-cholesterol, the values closest to the safe limits were recorded in the group of women with no physical activity (Table 1). The determined level of glucose should be regarded as appropriate, but it is not synonymous with a total lack of risks. People with the metabolic syndrome may have blood glucose concentrations at a reference range as a result of the compensating action of the pancreatic beta cells, enabling the secretion of sufficient amounts of insulin. The moment pancreas cannot maintain a sufficient hyperinsulinemic response, impaired toleration to glucose occurs, followed by an overt type 2 diabetes [Tchernof & Poehlman, 1998]. It should also be underlined that even values of the biochemical parameters being at the reference range are an element of health risk in the female population [European guidelines…, 2007]. It should be not-

TABLE 1. The analysed parameters *vs*. physical activity of the analysed population ($\bar{X}$±SD).

Parameter	Physical activity					p
	Active N=44	Quite active N=63	Low level of activity N=55	Active sporadically N=148	Passive N=58	
Body mass (kg)	65.3±10.8	66.2±10.6	70.0±15.3	66.7±12.5	74.3±17.4	<0.01
Fat mass in the body (kg)	20.8±5.7	22.0±6,0	22.9±7.9	22,0±7.2	26.1±10.1	0.02
Fat mass in the body (%)	31.5±4.5	32.9±4.5	32.0±5.1	32.3±5.4	34.2±5.2	0.12
Fat free body mass (kg)	44.5±6.2	44.2±5.6	47.1±8.7	44.7±6.5	48.0±8.2	0.02
Waist circumference (cm)	80.2±11.4	80.4±8.6	83.4±14.4	81.0±11.5	88.5±15.0	<0.01
Hip circumference (cm)	100.9±7.3	102.6±7.5	104.9±10.4	101.9±8.9	107.6±12.1	<0.01
Waist to hip ratio	0.79±0.07	0.78±0.05	0.79±0.07	0.79±0.06	0.81±0.06	0.10
BMI (kg/cm^2)	25.5±4.5	26.0±4.2	26.6±6.0	25.7±4.9	28.89 ±6.3	<0.01
Glucose (mmol/L)	5.20±1.10	5.19±0.67	5.23±0.65	5.32±0.87	5.58±2.80	0.55
Total cholesterol (mmol/L)	5.47±0.90	5.66±0.86	5.67±1.13	5.65±0.90	5.52±0.86	0.73
HDL cholesterol (mmol/L)	1.86±0.44	1.81±0.32	1.79±0.40	1.81±0.36	1.70±0.38	0.35
LDL cholesterol (mmol/L)	3.13±0.90	3.22±0.88	3.34±1.46	3.28±0.92	3.23±0.80	0.87
Triglycerides (mmol/L)	1.27±0.85	1.33±0.62	1.46±1.12	1.35±0.64	1.49±1.31	0.64

N-sample size, $\bar{X}$- mean value, SD- standard deviation.

ed, however, that the beneficial effect of physical activity on cardiovascular prevention has been observed in many studies, regardless of body mass and composition [Macdonald *et al*., 2004; Tchernof & Poehlman, 1998]. Of especial significance are the studies demonstrating the impact of physical activity on the level of HDL-cholesterol [Skoumas *et al*., 2003; Tchernof & Poehlman, 1998]. For example, the level of HDL--cholesterol in women with moderate and high physical activity was higher by 6% and 9%, respectively, than in those with a low level of physical activity, which indicates that even moderate physical activity in women has a beneficial effect on lipid-related parameters [Haskell *et al*., 2003; Skoumas *et al*., 2003; Tchernof & Poehlman, 1998]. The beneficial changes in biochemical marker levels observed in the study were independent of body mass, which shows the need for more physical activity in women regardless of their body mass and composition. The above relations have not been found in men; this indicates the specificity of cardiovascular disease development in women. It has also been found in other studies that physical activity is favourable to regulation of arterial blood pressure by reducing body mass in overweight and obese women, which indicates a wide range of benefits resulting both from physical activity and body mass reduction. Women should be encouraged to become more active as soon as possible, as delay in intervention might result in more severe health risks.

CONCLUSIONS

1. The anthropometric parameters of the women with low physical activity and sedentary lifestyle could increase the risk of diet-related diseases development.

2. A low level of physical activity may contribute to an increase in body mass and fatty tissue content. This shows the importance of a high level of physical activity in reducing the risk of the development of such diseases.

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