Analysis of lipid status, body mass index and waist-hip ratio in post-menopausal women

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Abstract

Introduction: Menopause is the absence of menses in the period longer that one year. It is widely accepted that menopause leads to changes in hormonal status, metabolism and lipid profile. The aim of this study was to analyze the influence of menopause on the concentrations of lipids, lipoproteins and also the influence of body mass index (BMI) and waist-hip ratio (WHR) on lipid profile in post-menopausal women.

Methods: Sixty post-menopausal women of average age of 52.82 years were compared to a group of 34 pre-menopausal women average age of 47.92 years.

Results: Post-menopausal women had higher, but non significant ($p>0.05$) concentrations of total cholesterol, very low density lipoproteins (VLDL), low density lipoproteins (LDL) and triglycerides than pre-menopausal women. The concentration of high density lipoproteins (HDL) was significantly lower in post-menopausal women than pre-menopausal ($p<0.05$). The concentration of apolipoprotein B was also significantly higher in post-menopausal women ($p<0.05$), but the concentrations of apolipoprotein and lipoprotein (a) were lower but without significance ($p>0.05$). There was no difference between body mass index (BMI) and waste-hip ratio (WHR), but the WHR has shown as a significant predictor of the LDL and cholesterol concentrations in post-menopausal women.

Conclusion: We can conclude that menopause leads to changes in lipid profile by lowering of HDL and increasing the levels of apolipoprotein B, that increases the risk for cardiovascular disease. The WHR is the significant predictor of cardiovascular risk in post-menopausal women.   © 2012 All rights reserved

Keywords: menopause, lipid status

Introduction

Menopause is cessation of menstruation in a period longer than one year, and begins with changes in ovarian function. After menopause, changes in lipid profile of a woman occur, but not all of those mechanisms have been explained. One of the important factors in that mechanism is change in adipose tissue distribution. Higher levels of cholesterol, triglycerides, LDL, apolipoprotein B and lower levels of HDL and apolipoprotein A are characteristic in menopause. The increase of LDL level is not the only indicator; the composition of LDL molecules also changes. Participation of low density lipoproteins in menopause rises for 30-40% (1).

During menopause, concentration of triglycerides also increases, which is linked to abdominal fat amount increase and insulin resistance. Menopause causes decrease of HDL concetration and also changes in HDL structure. The concentration of HDL2 decreases and concentration of HDL3 increases. HDL concentration is in inverse proportion with level of abdominal fat (2). Adipose tissue is not just a passive depot of fat which contains energetic balance and termoregulation, but is also an important endocrine organ (3). According to contemporary knowledge, adipose tissue cells – adipociytes – are multiplying and proliferating during lifetime. Aside from having different kinds of receptors and participating in processes of lipogenesis and lipolysis, adipocytes have high levels of P 450 aromatase enzyme and 17-β-hydroxysteroid dehydrogenase, which catalyze processes of aromatization of androgens into estrogens.

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Adipose tissue also produces other hormones which have autocrine and paracrine functionS, but mechanisms of autonomous production of hormones in adipose tissue are not yet fully explained. One of the important adipose tissue hormones is leptin, with polypeptide structure, which shows differences in concentration depending on sex (it is higher in women, especially obese women). It "informs" hypothalamus about adipose tissue amounts in organism and also has influence on activity of neuropeptide Y and somatostatin. By decreasing the somatostatin concentration it decreases appetite, regulates the activity of frontal lobe of hypophysis and also affects metabolism and energy homeostasis. During menopause, not only leptin, but also decreased level of growth hormone, estradiol and androgenes, cause changes in lipogenesis and lipolysis mechanisms, which leads to characteristic distribution of adipose tissue in menopause (centripetal weight gaining). These changes increase the risc of cardiovascular diseases, endometrium cancer and breast cancer. The increase of body mass in menopause and different distribution of adipose tissue is the result of changes in estrogen and androgen level in circulation, but also is a result of changes in lipid and carbohydrates metabolism, reduction of energetic needs and physical activity. Galanin, GnRH, endogenous opoids and neuropeptide Y have an important role in stimulating the need for lipid and carbohydrate intake, while holecystokinin, glucagon, TRH and calcitonin reduce appetite. There is small number of studies which investigate relations between lipoprotein concentrations and different antropometric parameters in post-menopausal women. This study represents an attempt of clarifying this problem by investigating of a lipid profile in post-menopausal women and comparison it with a lipid profile in pre-menopausal women. Next, the aim is to investigate what is the influence of body mass index and waist-hip ratio on lipid profile in post-menopausal women.

Methods

Patients
This prospective research has been done from September 2000 to September 2004. The sample was a group of sixty women of average age (52.82±8.22)

with average menopause length of 49.56±35.65 months. Inclusion criteria were: hormone therapy, medications affecting lipid profile, smoking more than twenty cigarettes per day, body mass index greater than 35 kg/m2 . Considering that all women included in study had somatic and psychological changes related to menopause and/or painful syndromes related to osteopenia and osteoporosis, all of them were regularly sent to gynecological and neuropsychiatric examinations. Control group was composed of 34 pre-menopausal women with average age of 47.92±1.66, who haven't been taking any hormone therapy or medicaments which could affect the lipid profile.

Procedures
Blood sampling was done in Medical Biochemistry Institute at University Clinical Center Tuzla (UKC Tuzla). Blood was taken from cubital vein. Total cholesterol concentration, triglyceride concentration, LDL, HDL and VLDL concentrations were determined determined on "Dimension RxL" instrument. Evaluation of gained weight was made on the basis of Qeuetelet index (Devenport-Kamp modification) or Body Mass index. On the basis of measurements of waist circumference on the narrowest area and hip circumference on the widest area, waist-hip ratio was calculated, according to this formula: WH ratio = waist circumference (cm) / hip circumference (cm).

Statistical analysis
Calculated values were processed by: arithmetic mean, standard deviation, Mann Withney U test, Student's test, Pearson's test, Spearman-Rank's test of correlation, and multiple regression. Statistical significance was established on the level of differences smaller than 5% and 1%. Statistic program Data Desk version 6.0 (1997, Data Description, Inc,.USA) was used for data processing.

Results
Total values of cholesterol, triglyceride, LDL, HDL and VLDL levels in woman of both groups are shown in Table 1. Total cholesterol concentration in post-menopausal women is a little higher than in pre-menopausal women, which wasn't statistically

TABLE 1. Total values of cholesterol, triglyceride, LDL, HDL and VLDL levels in blood of post-menopausal and control group of pre-menopausal women.

	POST-MENOPAUSE mmol/L ± SD	CONTROL mmol/L ± SD
Cholesterol	6.08 ± 1.14	5.99 ± 1.44
Triglyceride	1.64 ± 0.68	1.56 ± 0.74
LDL	4.12 ± 1.11	3.99 ± 1.46
HDL	1.44 ± 0.41	1.69 ± 0.50
VLDL	0.69 ± 0.68	0.58 ± 0.39

TABLE 2. Total values of apolipoprotein A, apolipoprotein B and Lp(a) levels in blood of post-menopausal and control group of pre-menopausal women.

	POST-MENOPAUSE g/L ± SD	CONTROL g/L ± SD
Apolipoprotein A	1.52 ± 0.27	1.61 ± 0.28
Apolipoprotein B	1.24 ± 0.33	1.02 ± 0.17
Lp(a)	0.28 ± 0.30	0.24 ± 0.23

important (p>0.05). Triglyceride concentration in post-menopausal women also wasn't significantly higher (p>0.05). There weren't statistically important differences in LDL concentration between two groups (p>0.05). But, HDL concentration in post-menopausal women was significantly lower than in pre-menopausal women (p<0.05). VLDL concentration difference between two groups wasn't statistically important (p>0.05). Apolipoprotein A, apolipoprotein B and Lp(a) concentrations in post-menopausal women and in pre-menopausal women are shown in Table 2. Apolipoprotein A concentration in post-menopausal women was lower than in pre-menopausal women , but the difference isn't statistically important (p>0.05). Apolipoprotein B concentration was significantly higher in post-menopausal women (p=0.003). Lp(a) concentration in post-menopausal women was higher than in pre-menopausal women, but statistical difference was not significant (p>0.05). In group of post-menopausal women BMI values were 2.55 ± 0.38, and in group of pre-menopausal women 2.47 ± 0.30, which wasn't statistically significant difference (p>0.05). 15 women (25%) in menopause had a BMI from 25 to 29.9kg/m2 (which reflects increased risk of cardiovascular diseases) and 4 women (6.67%) had BMI from 30 to 34.9 kg/m2 (high risk of cardiovascular diseases). In group of pre-menopausal women , 11 women (18.33%) had BMI from 25 to 29.9kg/m2. Different adipose tissue distribution and centripetal weight gaining are characteristic somatic changes in menopause and are recognized risk of cardiovascular diseases in women (11). WHR in post-menopausal women was 0,78 ± 0,05, while in pre-menopausal women it was 0,81 ± 0,07, so there wasn't a significant difference between the groups (p>0,05). In the group of women in menopause, 2 (3,33%) had WHR bigger than 0,85 and in the group of women with regular menstruation, 4 (6,66%) women. Sultan and associates stated that WHR can be used as screening for identification of postmenopause women with increased cardiovascular risk (14). There wasn't a significant correlation between BMI and lipid and lipoprotein concentration, as well as apoilipoprotein and Lp(a), while there was a
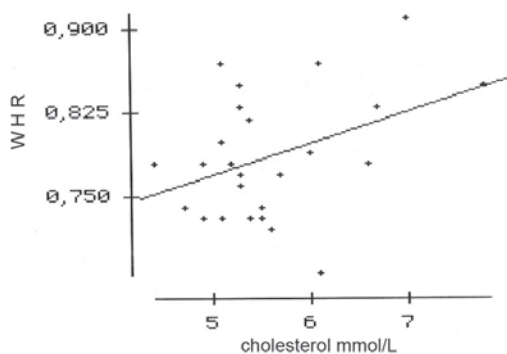

FIGURE 1. Correlation between cholesterol concentration and WHR in post-menopausal women.
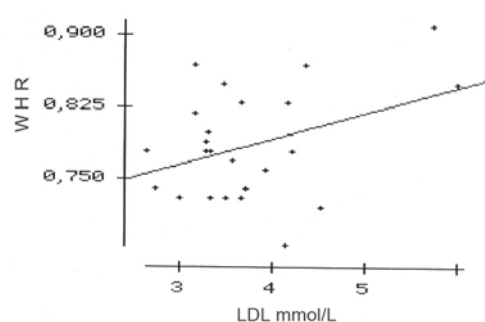

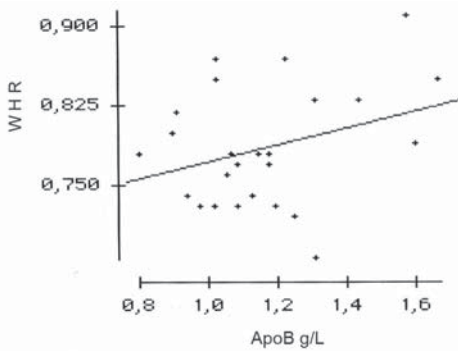FIGURE 2. Correlation between LDL concentration and WHR in women in menopause

FIGURE 3. Correlation between apolipoprotein B concentration and WHR in post-menopausal women.

highly significant positive correlation between waist-hip ratio and cholesterol concentration ($p < 0.01$), LDL concentration ($p < 0.01$) and apolipoprotein B concentration ($p < 0.05$) (Figure 1, 2, 3). The influence of BMI, waist-hip ratio and menopause length on LDL and apolipoprotein concentrations in women in menopause, was examined by multiple regression analysis. It was established that waist-hip ratio is statistically the best predictor ($p = 0.072$). WHR is statistically significant predictor of LDL and total cholesterol concentration in relation to BMI in the same group of women ($p < 0.05$). In the group of pre-menopausal women, there is a highly significant negative correlation ($p < 0.01$) between WHR and HDL and apolipoprotein A concentrations, while there was no correlation between BMI and some lipoprotein fractions.

Discussion

Main findings of our study were: post-menopausal women have significantly lower HDL concentration in raltion to pre-menopausal women, apolipoprotein B concentration is significantly higher in women in menopause, WHR is an important predictor of cholesterol and LDL concentration in women in menopause, in relation to BMI, which has not effect on lipid profile of women in menopause. In contrast to our observations, many other stud-

ies have proved significant deviations in lipid and lipoprotein concentrations in post-menopausal women (4- 8). It is important to emphysize that Lp(a) synthesis is genetically determined and, in contrast to other lipoproteins, its concentration is not changed by diet, workout or under influence of drugs which decrease the concentration of lipids (9). Lp (a) concentration reduction has been described in women who used hormone therapies (10). According to the results of this research, there wasn't a difference in BMI and WHR between post-menopausal women and pre-menopausal women , but WHR appeared to be statistically important predictor of LDL and cholesterol concentration in relation to BMI, in women in menopause. Some similar observations are already published (12, 13). In the group of pre-menopausal women, there was a significantly negative correlation between WHR and HDL and apilipoprotein A concentrations. Having in mind roles of these two lipoproteins in causing the cardiovascular diseases, previously mentioned correlation tells that pre-menopausal women but higher WHR also are in higher risk of cardiovascular diseases. By analysing the influence of centripetal weight gaining in post-menopausal women and pre-menopausal women but same BMI, Ozbey and colleagues. have established a fact that accumulating adipose tissue in abdominal area is an independent risk factor for cardiovascular diseases in both groups of women (15).

Conclusion

Post-menopausal women have significantly lower HDL concentration in raltion to pre-menopausal women while apolipoprotein B concentration is significantly higher in post-menopausal women. WHR is an important predictor of cholesterol and LDL concentration in post-menopausal women, in relation to BMI, which has not effect on lipid profile of post-menopausal women.

Conflict of interest

Authors declare no conflict of interest.

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