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SERUM LIPID PROFILE AND METABOLIC SYNDROME OCCURRENCE AMONG OBESE RURAL WOMEN FROM LUBLIN REGION (EASTERN POLAND)

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Abstract: Obesity is a multivariate syndrome which can negatively affect whole body functioning. It is most common in highly developed countries, and in recent years a progressive increase in obesity occurrence is noticeable. The aim of the study was to assess serum lipid profile and metabolic syndrome occurrence among obese rural women from Lublin Region in Eastern Poland. The study was conducted in the Institute of Agricultural Medicine in Lublin (IAM). All subjects had a negative history of diseases and treatment that could affect serum lipid profile or glucose measurements. The inclusion criterion for the study group was overweight and obesity, defined as a body mass index above 25 (BMI>25) and living in a rural area. 44 women participated in the study. There were no women fulfilling the criteria or who had a history of incorrect fasting glucose (IFG) or incorrect glucose tolerance (IGT). In contrast, the prevalence of arterial hypertension (or treatment) was high - 53%. 22.7% women had normal serum TC values. The proportion of those with hyper-LDL-C was 38.6% and with hyper-TG - 18.2%. 20.5% of studied women had incorrect serum HDL-C levels, and in 15.9% hypo- HDL-C was accompanied by high serum TC levels. Analysis of correlation showed that serum TC was positively correlated with both LDL- and HDL-C. 55% of the studied obese or overweight women had at least 2 additional components of the metabolic syndrome.

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INTRODUCTION

Obesity is a multivariate syndrome which can negatively affect whole body functioning. It is most common in highly developed countries, and in recent years a progressive increase in obesity occurrence is noticeable. A commonly accepted criterion for obesity diagnosing is a body mass index (BMI) ratio value over 28 in men and over 27 in women. Obesity occurrence is determined by genetic, endocrinological and environmental factors.

Heredity of genes determining impaired functioning hunger/satiety centre as well as disturbances in leptin secretion or tissue sensitivity to leptin are considered the main genetic background of overweight and obesity. The influence of environmental factors, such as low physical activity or a fat and carbohydrate rich diet, due to its common appearance in societies, is no less important. Serum lipid pattern is dependent of nutritional habits. The intake of dietary cholesterol, saturated and trans-fatty acids, vegetables and fruits significantly influence serum

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levels of total cholesterol (TC), LDL-cholesterol (LDL-C) and HDL-cholesterol (HDL-C) [6, 11, 22]. The changes in economic conditions and life style resulting from urbanisation have caused a large increase in obesity in traditional rural societies (such as Eastern Poland) that have adopted an "new" way of life [4]. On the other hand, changes in dietary habits in North America and Western Europe within the last 3 decades have led to a decline in total cholesterol levels, and consequently to the decline of coronary heart disease (CHD) mortality, which was the result of the practical implementation of large preventive programmes [8, 16, 19].

Until now, the Polish rural population has not been studied in depth; however, available data suggest that there are significant differences in plasma TC, HDL-C and LDL-C, triglycerides (TG), as well as in the prevalence of arterial hypertension, obesity, smoking and alcohol consumption between rural and urban populations [15]. It was confirmed that the differences in plasma lipids and lipoproteins concentration are related to the differences in age, sex, education level and alcohol consumption, e.g. increase in education level is related to increase in plasma concentration of TC, LDL-C and TG and decrease of HDL-C. However, obesity remains one of the most important factors determining the serum lipid profile.

The World Health Organization (WHO) working definition of metabolic syndrome includes a raised plasma TG and/or low HDL-C, central obesity and/or high BMI ratio, measurement of impaired glucose regulation or/and insulin resistance, arterial hypertension and microalbuminuria [21]. To the best of our knowledge, the prevalence of metabolic syndrome among traditionally rural population has not been studied in depth in Eastern Poland.

The aim of the study was to assess the serum lipid profile and metabolic syndrome occurrence among obese rural women from the Lublin Region in Eastern Poland.

MATERIALS AND METHODS

Subjects. The study was conducted in the Institute of Agricultural Medicine in Lublin (IAM). Subjects were recruited in 2003 from a large population sample attending the Clinic of Internal and Occupational Diseases of the IAM.

Caucasian women living in rural areas were eligible for the study. All subjects had a negative history of diseases and treatment that could affect serum lipid profile or glucose measurements. The inclusion criterion for the study group was overweight and obesity defined as a body mass index above 25 (BMI>25). Of the 50 women eligible to participate in the study, 44 were ultimately involved. The study was approved by the Local Ethics Committee.

Protocol. Blood samples were collected from all women after an overnight fast between 08:00–10:00 in the supine position. The subject were asked to abstain from food intake for at least 12 hours. The coagulated blood after 20 min was centrifuged at 1,500 t-min during 30 min.

The serum TC and HDL-C were analysed by enzymatic method (CHOD-PAP) [17]. Serum TG was analyzed by enzymatic method (GOD-PAP) [20]. The LDL-C was calculated by the following equation: LDL-C = TC – HDL-C – (TG × 0.2). Serum fasting glucose was analyzed using the colorimetric-enzymatic method with glucose oxidation [3].

The analyses were performed in the Department of Clinical Biochemistry of the Central Laboratory of IAM. The applied criteria for classification of dyslipidemias were: hypercholesterolaemia (TC) ≥ 200 mg/dl (5.2 mmol/l), hyper-LDL-C ≥ 160 mg/dl (4.1 mmol/l), hyper-TG ≥ 200 mg/dl (2.3 mmol/l), hypo-HDL-C < 40 mg/dl (1.0 mmol/l). The applied criterion for borderline high fasting serum glucose was 110 mg/dl (6.1mmol/l). Women with metabolic syndrome were defined as those having 3 or more of the following criteria: EBP ≥ 130/85 or treatment, waist circumference > 88 cm, serum TG ≥ 150 mg/dl (1.7 mmol/l), HDL-C < 40 mg/dl (1.0 mmol/l), serum fasting glucose ≥ 110 mg/dl (6.1 mmol/l) or treatment.

Medical history, basic physical examination, blood collection and anthropometry were performed on the same day. Nutritional habits were assessed using a self-administered food frequency questionnaire that included items about the frequency of consumption of certain foods within last 6 months.

Statistics. Standard statistical methods were used to calculate means and standard deviations (SD), and when distribution of variables was not normal, medians with ranges were calculated. The Kolmogorov-Smirnov one-sample test was used to check whether variables were normally distributed. Significance was defined as $p \leq 0.05$. The entire statistical analysis was carried out using Statistica PL v. 6.0.

RESULTS

Selected characteristics of the study population is presented in Table 1. Based on correlation analysis, the level of TC, LDL-C, TG tends to increase with age, while HDL-C tends to decrease with age; however, statistical significance was not found (data not shown). The prevalence of screened diabetes was 4.5% in the study population. There were no women fulfilling the criteria or with a history of incorrect fasting glucose (IFG) or incorrect glucose tolerance (IGT) (Tab. 2). In contrast, the prevalence of arterial hypertension (or treatment) was high - 53%. The proportion of smokers was only 6.8%; moreover, there were no heavy drinkers or alcohol abusers among the studied obese women (Tab. 2).

Only 22.7% of women had normal serum TC values. The proportion of those with hyper-LDL-C was 38.6%, and with hyper-TG was 18.2% (Tab. 3). In contrast to the high prevalence of hypercholesterolaemia, only 20.5% of studied women had incorrect serum HDL-C levels. In

Table 1. Selected characteristics of the study population.

	Mean ± SD	Min.	Max.
Age (years)	57.04 ± 3.62	51	64
Years after menopause (years)	8.37± 5.83	1	24
Height (cm)	158.68 ± 6.26	148	174
Weight (kg)	86.96 ± 14.43	59	121
BMI (kg/m^2)	34.56 ± 5.64	25.78	50.21
Hipline (cm)	117.95 ± 11.43	101.00	146.00
Waistline (cm)	101.41 ± 10.11	84.00	127.00
Total Cholesterol (mg/dl)	228.22 ± 39.23	144	341
HDL Cholesterol (mg/dl)	42.89 ± 9.57	25	71
LDL Cholesterol (mg/dl)	156.2 ± 36.06	70.8	259.8
Triglicerides (mg/dl)	152.89 ± 79.61	55	476

Table 2. Selected social factors and metabolic syndrome components in the study population.

Education	primary	secondary	high	
	61.4%	22.7%	15.9%	
Blood pressure		Normal	> 140/90 or treatment	
		47%		53%
Glucose	Normal	IFG *	IGT **	Diabetes
	95.5%	0%	0%	4.5%
Smoking		No smoking		Regular smoking
		93.2%		6.8%
Alcohol consumption	Abstinent or moderate users			Heavy drinkers
		100%		0%

* Incorrect Fasting Glucose; ** Incorrect Glucose Tolerance.

Table 3. Prevalence of dyslipidaemias in obese rural women from Lublin Region.

Serum lipid profile	%
I. hypercholesterolaemia ≥ 200 mg/dl (5.2 mol/l)	77.3
II. hyper-LDL-C ≥ 160 mg/dl (4.1 mmol/l)	38.6
III. hyper-Tg ≥ 200 mg/dl (2.3 mmol/l)	18.2
IV. hypo-HDL-C < 40 mg/dl (1.0 mmol/l)	20.5
I + II	38.6
I + II + III	13.6
I + II + III + IV	2.3
I + IV	15.9
III + IV	4.5
Normal serum lipid profile	11.3

Table 4. Clustering of components of the metabolic syndrome in obese rural women from Lublin Region.

	+ 2 components	+ 3 components
Overweight/Obesity	55%	16%

Table 5. Nutritional habits in obese rural women from Lublin Region.

Selected nutritional habits	%
Fresh vegetables daily in summer	90.9
Fresh vegetables daily in winter	20.5
Fresh fruits daily in summer	95.4
Fresh fruits daily in winter	34.0
Butter on bread	84.1
Margarine on bread	15.9
Lard/grease/animal fat for cooking	9.1
Vegetable oil for cooking	90.9
Raw dairy products	93.2
Low fat dairy products	6.8

15.9%, hypo- HDL-C was accompanied by high serum TC levels. (Tab. 3) Analysis of correlation showed that serum TC was positively correlated with both LDL - and HDL-C.

The educational level had no influence on the level of hypercholesterolaemia. 100% of women with arterial hypertension had increased levels of TC (data not shown).

Selected nutritional habits of the study population are presented in Table 5. Although the study population comprises traditionally rural women, a very low rate of animal fat consumption together with high rates of vegetable oil usage was noticeable.

The clustering of components of the metabolic syndrome (i.e. co-occurrence in the same individual) is shown in Table 4. In our study, 55% of individuals with obesity or overweight had at least 2 additional components of the metabolic syndrome (according to the WHO definition of the metabolic syndrome).

DISCUSSION

The prevalence of risk factors for CVD (cardio-vascular disease), such as arterial hypertension, obesity, diabetes, low physical activity and smoking, increases with the level of urbanisation. The metabolic syndrome, which comprises impaired glucose metabolism, abnormal blood lipid pattern, arterial hypertension and obesity, is also considered to be associated with urban residence and western lifestyle [10]. It is very common among the Polish population; however, the cross sectional studies on occurrence of the metabolic syndrome mainly focus on urban populations [2, 14].

Obesity predisposes to an abnormal lipid profile, and both obesity and lipid abnormalities are more common in urban populations [12, 13]. Compared to lean subjects, obese men and women have significantly higher serum TG, TC and LDL-C. The mean TC, TG and LDL-C increases across successive increases in BMI and waist circumference [12, 13]. In our selected population, the prevalence of dyslipidaemia was high, and exceeded 70%.

The reason for studying obese and overweight women, moreover, most were postmenopausal.

Abnormalities in serum lipid profile (predominantly hypercholesterolaemia and hypertriglycerydaemia), arterial hypertension, diabetes and obesity are often associated with the same individual [18]. The association of these factors in the same individual greatly increases cardiovascular risk. Moreover, hypercholesterolaemia is also more prevalent among smokers compared to non-smokers [9]. These tendencies were also visible in our study among obese rural women. It is noteworthy that in some other studies, low HDL-C levels were associated with obesity and with being a farmer [1].

The MONICA project performed in 21 countries demonstrated a tendency in the decline in TC levels (by 0.015 mmol/l/year in females) [18]. In middle-aged women from North America, mean TC levels declined by 0.2 mmmol/l between 1993-1997, while HDL-C increased by 0.3 mmol/l. These trends can be partially explained by a lowering of the dietary intake of cholesterol, trans fatty acids and saturated fatty acids [5]. The nutritional habits in the presented study were evaluated with the use of a specially prepared food frequency questionnaire. The applied method, although not exact, gives a good picture of nutritional habits of the study population. Obtained results in general correspond to the results of other studies on rural populations in a restricted geographical area [7]. In those studies, similar nutritional habits were demonstrated, e.g. high usage of vegetable oil for cooking together with low animal fat consumption, relatively high consumption of fresh fruit and vegetables during both summer and wintertime.

Although the comparison of the occurrence of the metabolic syndrome in such a selected population with the cross-sectional studies cannot be performed, the high prevalence of arterial hypertension and low prevalence of diabetes IGT and IFG is noteworthy in the presented study.

In conclusion, our findings reflect a subpopulation with a increased risk of cardio-vascular disease. High-risk individuals have to be identified and suitable preventive strategies, including change of lifestyle, should be implemented in rural populations.

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