

Students' Scientific Society at the Department of Cardiology  
Medical University of Lublin

ANNA SZCZYGIELSKA, SYLWIA WIDOMSKA,  
MAGDALENA JARASZKIEWICZ, PATRYCJA KNERA, KAMIL MUC

*Blood lipids profile in obese or overweight patients*

Obesity is defined as an increase of body mass beyond what is considered as normal, caused by excessive development of fat tissue. It is the result of excessive filling with triglycerides of the currently existing fatty cells or forming new ones, or it is the effect of both. The BMI (body mass index) is the most useful means to define obesity. It is calculated by dividing the weight in kilograms by the height in meters squared ( $\text{kg}/\text{m}^2$ ). World Health Organisation (WHO) asked for the standardization of the classification of overweight and obesity in terms of BMI: BMI  $<18.5$  – underweight, BMI 18.5-24.9 – normal weight, BMI 25-29.9 – overweight ( or pre-obese), BMI 30-34.9 – obesity class I, BMI 35-39.9 – obesity class II, BMI  $>40$  – obesity class III (14).

Because the fatty tissue is not only a passive store of fat, but it is the place of active metabolism and active bioenergetic processes, obesity is associated with everyday physical activity being handicapped and the occurrence of several accompanying diseases. Excessive body weight is related to an increased risk of coronary heart disease, hypertension, stroke, diabetes, degenerative joint disease and some cancers like breast or colon cancer (7). A severe metabolic disorder in obese people is insulin-dependent and insulin-resistant diabetes mellitus. This kind of diabetes is an important risk factor for an accelerating development of atherosclerosis and it is connected with early mortality in coronary heart disease (13). Other metabolic disorders accompanying obesity are: high serum level of free fatty acid, hypertriglyceridemia, high concentration of low-density lipoprotein (LDL) and small concentration of high-density lipoprotein (HDL), elevated level of apoB (4). There is evidence that obesity is related to fibrinolysis disturbances caused by an increased activity of plasminogen activator inhibitor (11).

Obesity and overweight are common disorders and their occurrence is increasing all over the world. Epidemiological data referring to prevalence of obesity in Poland indicate that every other adult Polish is obese or overweight (10). The data affecting prevalence of obesity and accompanying metabolic disorders in the Lublin region are more and more alarming. Only 20–30% of inhabitants (according to sex, age and environment) have normal body weight. Over 30% of population are obese, 30–40% people are overweight. From the latest data it appears that dyslipidemia affect 77% obese persons in the city and 61% in the country, diabetes 20% in the city and 30% in the country, hypertension 62% in the city and 71 % in the country (15).

The aim of this study was to evaluate lipid blood profiles in obese or overweight patients. Abnormalities of lipid profile were subjected to assessment as well as the occurrence of other risk factors for coronary heart disease such as

hypertension, diabetes, smoking and family history of cardio-vascular disorders.

## METHODS

The subjects were 83 people from the Aleksandrow country commune (64 women and 19 men) aged 28–81 years (average 59.6), who spontaneously applied for medical examination performed as student research. Blood samples were collected and total cholesterol, fractions LDL, HDL and triglycerides were determined in blood plasma. Height and weight were measured in participants standing without shoes. Body mass index was calculated as weight (kg)/ height <sup>2</sup> (m) and self-administered questionnaire provided information about the presence of (family) history of cardiovascular diseases, current medication, smoking and, for women, reproductive history was recorded. Patients were physically examined, blood pressure was measured and ECG was performed.

To analyze blood lipids three groups of subjects (comparable with number, age and gender) were selected: I – n=24 normal weight subject (BMI <25), 19 women, 5 men; II – n=28 overweight subjects (BMI 25-29.9), 19 women, 9 men; III – n=31 obese subjects (BMI>30), 26 women, 5 men. Statistical analysis was carried out using the t- Student test. Correlation was calculated using Pearsons test. P-values of less than 0.05 were considered statistically significant.

## RESULTS

28.9% subjects had normal body weight, 33.7% were overweight and 37.4% were obese. In the whole group the calculated mean BMI was 28.7 (28.9 in women, 27.2 in men). In particular, differences in subgroups in blood lipids profiles were observed according to BMI. The unfavourable blood lipids profile was characteristic of obese or overweight persons in comparison to normal weight subjects. Mean serum concentration of total cholesterol and its particular fractions (HDL, LDL) and mean serum concentration of triglycerides are shown in Table 1.

Table 1. Mean serum concentration of total cholesterol and fractions (HDL, LDL) and mean serum concentration of triglycerides

	Normal body weight	Overweight	Obesity
BMI	23.1±1.3	27.5±1.4	35.7±4.5
Cholesterol (mg/dl)	200.4±33.7	217.9±43.6	219.2±31.7
LDL (mg/dl)	109.5±39.0	123.4±34.4	128.8±36.6
HDL (mg/dl)	68.6±9.2	66.2±9.8	55.8±12.1
TG (mg/dl)	88.9±14.8	120.8±76.2	152.4±84.9

Mean concentration of plasma total cholesterol was statistically significant in the group of obese subjects in comparison to normal weight patients (p=0.04). No significant differences were found if groups of normal weight and overweight patients were compared (p=0.08). Analyzing plasma level of LDL cholesterol, no significant differences in particular subgroups were shown. However, concentration of plasma HDL cholesterol was significantly lower in the

group of obese patients in comparison to the group of normal weight persons ( $p=0.001$ ) as well as in comparison to overweight subjects ( $p=0.03$ ). There was no significant difference between groups of normal weight and overweight patients ( $p=0.6$ ). Mean level of plasma triglycerides was significantly higher in the group of obese patients in comparison to the group of normal body weight persons ( $p=0.002$ ), however no significant difference was found in other groups ( $p=0.1$ ).

Table 2. Correlation between the value of BMI and mean concentration of HDL and LDL cholesterol and mean concentration of triglycerides

	Total cholesterol	HDL	LDL	Triglycerides
r	0.18	-0.27	0.22	0.25
p	0.1	0.01	0.04	0.02

A significant correlation between the value of BMI and mean concentration of HDL and LDL cholesterol and mean concentration of triglycerides was also found, as is shown in Table 2. Subjecting the blood lipid profile to further analysis we found that obese or overweight patients have more frequently abnormal blood lipid values (concentration of total cholesterol  $>200$  mg/dl, HDL cholesterol  $<35$  mg/dl in men and, 40 mg/dl in women, concentration of LDL cholesterol  $>130$  mg/dl or/and total cholesterol/HDL cholesterol ratio  $>5$ , as is shown in Fig.1.

In the whole examined group, in 66 patients (79.5%) hypertension was found, 54 (65%) had positive cardiovascular family history, 3 (3.61%) suffered from diabetes (earlier diagnosed), 21 (25.3%) were cigarette smokers. Distribution of coexisting risk factors for coronary heart disease is shown in Fig.2.

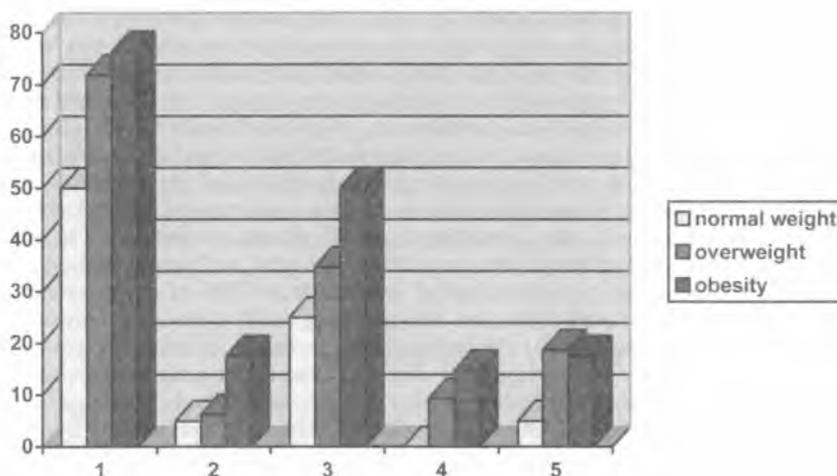


Fig. 1. Frequency of abnormal blood lipids values in particular subgroups (%); 1 – total cholesterol concentration  $>200$  mg/dl, 2– HDL cholesterol  $<35$ mg/dl in men,  $<40$  mg/dl in women, 3– LDL cholesterol  $>130$  g/dl, 4– triglycerides concentration  $>200$  mg/dl, 5– total cholesterol / HDL cholesterol ratio  $>5$

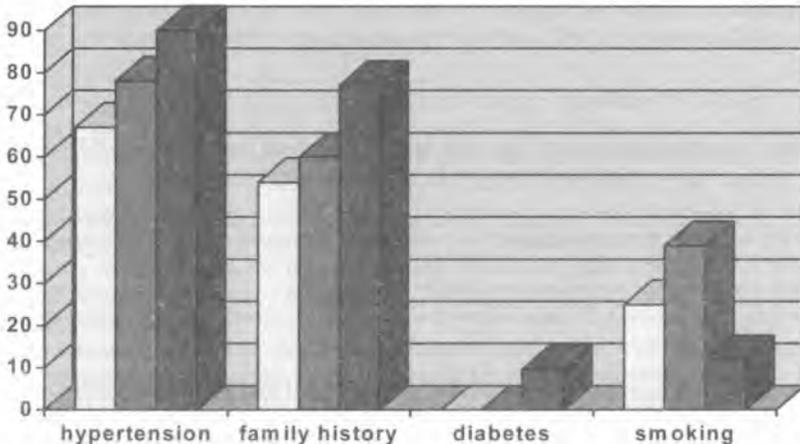


Fig. 2. Coexistence of other another risk factors of coronary heart disease in particular subgroups (%)

## DISCUSSION

We found widely widespread obesity and overweight, even exceeding their prevalence in the whole Lublin region in the examined group of Aleksandrow Commune inhabitants. Our paper confirmed also other data that obesity or overweight are associated with unfavorable influences on blood lipid profile (6). There was a significantly higher concentration of plasma total cholesterol and triglycerides in obese subjects in comparison to normal weight patients. In these patients a significantly lower concentration of HDL cholesterol was also found in comparison to both normal weight and only overweight subjects. A positive correlation between the concentration of plasma total cholesterol and triglycerides and the degree of obesity or overweight was shown. It is important because, as previously proven, the risk for coronary heart disease increases with the increasing level of plasma cholesterol. The data from Framingham indicate that although the concentration of total cholesterol over 240 mg/dl is obviously related to a high risk of myocardial infarct, almost 20% of acute coronary events occur despite the values of total cholesterol below 200 mg/dl (2). It should be stressed that the mean concentration of plasma total cholesterol in all particular subgroups exceed the recommended values. However, in the groups of obese or overweight patients the percentage of hypercholesterolemic subjects was higher than in a group of normal body weight patients.

A lot of attention while evaluating the risk of coronary heart disease is paid to the concentration of low density lipoproteins, the most atherogenic fraction of lipoproteins. In patients with the concentration of LDL cholesterol between 130 and 160 mg/dl, coronary incidents often occur (9). A high level of small, dense LDL particles, hipertriglyceridemia and low concentration of protective fraction of HDL cholesterol create a triplet very often observed in diabetes and metabolic syndrome X, especially contributing to vascular atherosclerosis development (5). In our study the percentage of subjects with dyslipidemia, defined as a ratio of total cholesterol to HDL cholesterol greater than 5, was higher in patients with abnormal body

weight. This ratio predicts the occurrence of cardiovascular disease events better than measurements of total cholesterol or HDL alone. It should be taken into consideration that the percentage of people with low concentrations of LDL cholesterol was rather small. However, the concentration of HDL cholesterol over 60 mg/dl is considered as a negative risk factor for coronary heart disease (12). Mean concentration of triglycerides in all subgroups was less than 200 mg/dl, which is considered normal. But when the concentration of triglycerides exceed 100 mg/dl, the number of LDL particles type B (small, dense, especially atherogenic) increase, so some specialists recommend that borderline of normal value should be decreased to 100 mg/dl (1).

In most examined patients we observed hypertension, earlier treated or just diagnosed. It is known that hypertension is an important risk factor for cardio-vascular complications (myocardial infarct, stroke, kidney insufficiency) and diabetes. Some environmental factors, apart from genetic predispositions are very important in pathogenesis of hypertension and they may cause frequent prevalence of hypertension in the studied group. The occurrence of other risk factors for coronary heart disease such as diabetes and family history was most common in a group of obese patients. But most of all, cigarette smokers were among over-weight subjects. It may be caused by the highest percentage of men in this group.

There are some limitations in this study that may affect its conclusions. First of all, BMI as a marker of obesity or overweight may only indirectly evaluate adipositas, but does not reflect the distribution of fatty tissue in the body. Moreover, it is not possible to differentiate between fatty tissue mass and muscle tissue mass while analyzing BMI. Underestimation of fatty tissue quality in older people may occur as the aging muscle tissue undergoes atrophy. The examined group relatively was not very large and it was impossible to select a representative population according to sex and age because the participants applied for medical examination spontaneously. The majority of subjects were women, which may influence the results. It is known that in women some imbalances in the concentration of serum lipoproteins and lipids are associated with their hormonal state. Taking contraceptive pills and estrogen replacement therapy may influence the concentration of serum lipids (3). The majority of the examined women were of peri- or postmenopausal age, when according to earlier studies unfavourable changes occur within risk factors for cardio-vascular diseases such as increasing of total cholesterol, LDL cholesterol, hypertriglyceridemia and decreasing of HDL cholesterol. However, the accordance of our results with the results of many studies involving large, representative populations indicates their importance on a local scale.

In conclusion, in patients with increased BMI, even in the group of overweight people, unfavourable changes in blood lipid profile occur. In a large number of these patients other risk factors for coronary heart disease coexist such as hypertension, family history of cardio-vascular disorders. The data regarding diabetes mellitus are of little importance, because they are based only on anamnesis. Our results emphasize the importance of prevention and treating obesity as an element of coronary heart disease prophylaxis.

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## SUMMARY

Elevated levels of total and low density lipoprotein (LDL) cholesterol and low levels of high density lipoprotein (HDL) cholesterol are important risk factors for coronary heart disease. Another established predictor of cardiovascular disease is obesity. Obesity and overweight are widespread phenomena and they have reached epidemic proportions in the developed countries, including Poland. Only 30% of people in the Lublin region have normal weight (BMI<25). The aim of this study was to asses the relationship between BMI (body mass index) and blood lipids in the population of 83 people from Aleksandrow commune (64 women and 19 men aged 28–81) who spontaneously applied for medical examination performed as student research. Mean total cholesterol and triglycerides concentrations were higher in obese persons in comparison to normal weight subjects and HDL cholesterol concentration was lower in obese subjects as compared to normal and overweight individuals. Differences in mean concentrations of LDL cholesterol were not significant. A linear correlation between the degree of obesity and plasma level of LDL cholesterol and triglycerides was shown. In conclusion, obesity and overweight are accompanied by unfavourable blood lipids patterns and in a considerable proportion of overweight or obese patients other risk factors for coronary heart disease, such as hypertension, smoking, diabetes or family history of cardiovascular diseases coexist.

## Profil lipidowy u pacjentów z otyłością lub nadwagą

Podwyższone stężenie cholesterolu LDL i obniżone stężenie HDL są ważnymi czynnikami ryzyka choroby niedokrwiennej serca. Innym uznanym czynnikiem ryzyka jest otyłość, która obecnie jest szeroko rozpowszechniona. Na terenie Lubelszczyzny tylko 30% populacji

charakteryzuje się prawidłową masą ciała. Celem pracy była ocena zależności pomiędzy wartością BMI a profilem lipidowym osocza w grupie 83 mieszkańców gminy Aleksandrów (64 kobiety, 19 mężczyzn w wieku 28–81 lat), którzy zgłosili się na badania lekarskie przeprowadzane w ramach studenckiego obozu naukowego. Średnie stężenie cholesterolu całkowitego i trójglicerydów było wyższe u osób otyłych w porównaniu z grupą z prawidłową masą ciała, a stężenie cholesterolu HDL niższe u otyłych w porównaniu zarówno z grupą z prawidłową masą ciała, jak i z nadwagą. Średnie stężenia cholesterolu LDL nie różniły się istotnie. Wykazano korelację pomiędzy stopniem otyłości i stężeniem w osoczu cholesterolu LDL i trójglicerydów. Sumując, otyłości i nadwadze towarzyszy niekorzystny profil lipidowy, a u znacznej liczby osób z otyłością lub nadwagą występują również inne czynniki ryzyka choroby wieńcowej.