



STATISTICAL RELATIONSHIPS BETWEEN OBESITY, CHOLESTEROL, CREATININE AND THE RISK OF DEVELOPMENT OF SUGAR DIABETES IN PERSONS OVER 50 YEARS OLD IN MUREȘ COUNTY

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Abstract: Context and objectives: To establish correlations between obesity, serum cholesterol, triglycerides, serum glucose and systolic Blood Pressure (BP) correlated to the risk of developing diabetes. Materials and Methods: We made a study on a group of 108 subjects, women and men. The answers we got were included in a database statistically processed in Medcalc and Excel softwares. Results: The high values of glucose are recorded in people with BMI between 35-39.99 and are represented by women with ages raging between 60-69 years old. Total cholesterol serum and glucose values are more suggestive in the case of people aged between 60-69. The high creatinine values (>1.2 mg/dl) are represented by women aged between 60-69 years. High levels of systolic blood pressure can be seen in women aged 60-69 years old. Conclusions: Obesity associated with high glucose values is a major risk factor for developing diabetes and its complications especially in people aged 50 and over.

INTRODUCTION

These days, diabetes is a global public health problem and is the most important case in death rates because of the associated cardiovascular diseases.(1)

Globally, the World Health Organization (WHO) estimated that there are 27 million people with diabetes in 2005. Until 2030, WHO estimates that this number will increase to 366 million. Statistics show that there is a clear correlation between cardiovascular diseases and diabetes. Cardiac diseases and strokes are number one in death causes.(2)

The prevalence of diabetes and pre-diabetes in the adult population in Romania in the year 2017: it shows that from an adult population of 14.382.000, there was 1.785.300 cases of diabetes in adults aged between 20 and 79, with a prevalence of 12.40%. It is estimated that this number will decrease to 1.246.00 until the year 2045.(3)

MATERIALS AND METHODS

To reach our aim we made a randomized study in Mureș county, in 2015, on a group made up of 108 subjects, adults, males and females who accepted to fill out an evaluation questionnaire. They were evaluated clinically and had recent lab results. To obtain this data we used a questionnaire that we gave to our subjects. The questionnaire applied to the subjects was composed of 24 questions. The questions were as followed: open questions, closed questions, control questions, direct and indirect questions.

The subjects were divided in 4 age groups: 50-59 years old, 60-69 years old, 70-79 years old and 80-89 years old with their residence in urban or rural environment, healthy and with different pathologies: hyperthyroidism, hypercholesterolemia and obesity, renal diseases, cardiomyopathies and high systolic BP in association with bronchopulmonary and uterine neoplasms.

The answers obtained using this questionnaire were included in a database, statistically interpreted using Medcalc and Excel programs. In our study we only statistically processed the pathological values of the measured parameters.

RESULTS

The age mean of the subjects was 68 +/- 7.61 years. Regarding the sex of the group 75 (69.44%) were women. Regarding the age groups, the 60-69 years old age group was the highest, with 59 (54.62%) patients.

Regarding the correlation between age-sex-glucose, we evaluated the data on a group of 26 subjects (24.07%) and can be seen in figure 1.

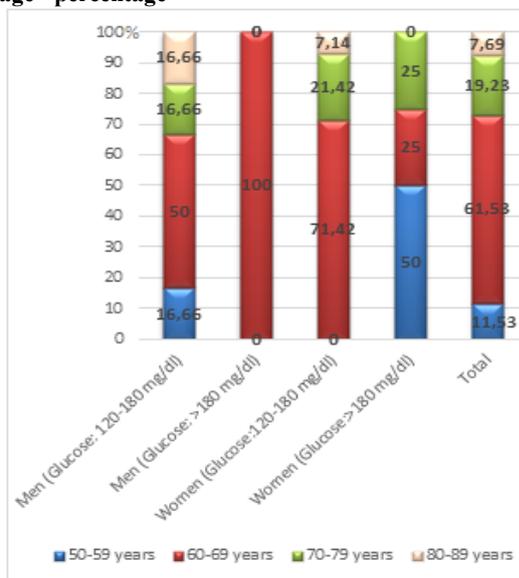
Correlation between BMI and glucose. We interpreted the results on a group of 15 subjects (13.88%) who had their BMI calculated and glucose values between 120-180 mg/dl and >180mg/dl. Of this group, 12 subjects (80.00%) had their glucose value between 120-180 mg/dl, 3 (20.00%) subjects had their values over 180 mg/dl. Subjects who had their glucose

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value between 120-180 mg/dl; 5 subjects (41.66%) had their BMI values between 35.00-39.99. The correlation between subjects with diabetes and BMI can be seen in figure no. 2.

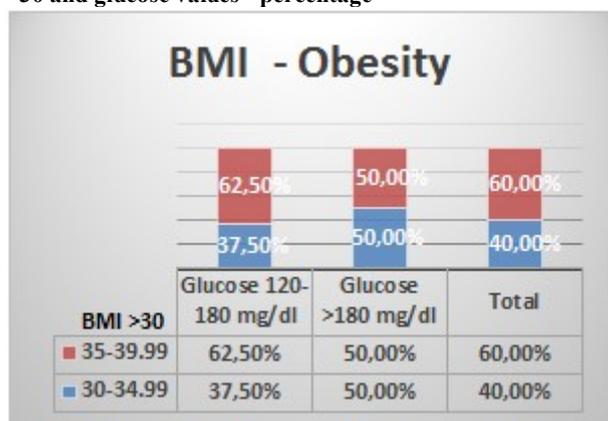
Figure no. 1. Distribution of diabetic subjects based on sex and age - percentage



Regarding the correlation between obesity and glucose, the interpretation was made on a group made up of 14 (12.96%) subjects with obesity (BMI>30) with glucose values over 120-180 mg/dl. Of this group: 10 subjects (71.42%) were females and 4 subjects (28.57%) were males. From the age group 50-59 years, old the subjects had normal glucose values. From the 60-69 age group, we had 10 subjects (71.52%), 2 subjects (14.28%) from the age group composed of 70-79 years old and 2 subjects (14.28%) from the 80-89 age group.

The glucose levels reported to obese patients based on sex and age can be seen in figure no. 2.

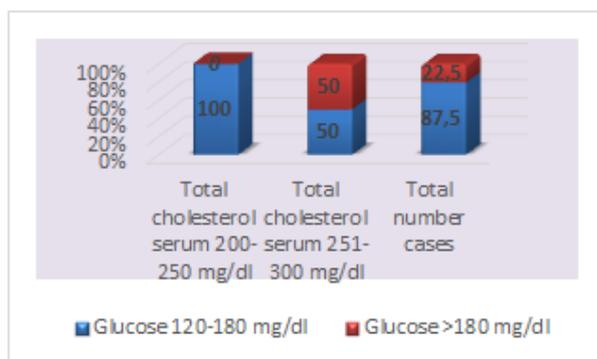
Figure no. 2. Distribution of obese subjects based on BMI >30 and glucose values - percentage



Correlation between total cholesterol and glucose. The interpretation was made on a group made up of 8 subjects (7.40%) with determined values of total cholesterol. Of this group: 6 subjects (75.00%) had cholesterol values between 200-250 mg/dl, 2 subjects (25.00%) had values between 250-300 mg/dl and no subject had values over 300 mg/dl; 7 subjects (87.50%) had glucose values between 120-180 mg/dl and 1 (12.50%) had glucose values over 180 mg/dl. Regarding the division based on sexes we had 5 (62.50%) female and 3 male

subjects (37.50%) with cholesterol values between 200-250 mg/dl and glucose values between 120-180 mg/dl. The distribution of subjects according to the levels of total serum cholesterol is shown in figure no. 3.

Figure no. 3. Distribution of subjects based on total cholesterol serum



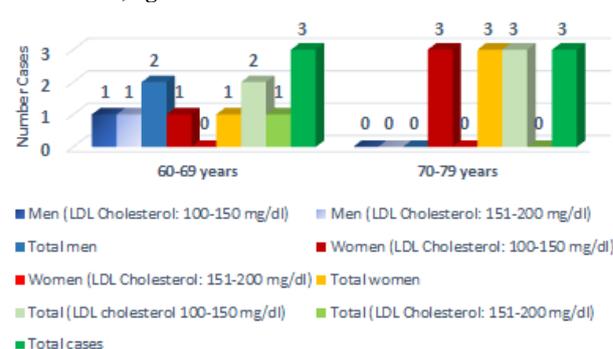
For the correlation HDL cholesterol-glucose-age-sex, the interpretation was made on a group of 9 subjects (8.33%) who had determinations of HDL cholesterol values. The distribution of HDL cholesterol values by age and sex are presented in table no. 1.

Table no. 1. Distribution of HDL cholesterol values by age sex and glucose

Age Group (years)	HDL cholesterol values					
	<40 (mg/dl)			Men Nr. (%)	Women Nr. (%)	Total Nr. (%)
	Men Nr. (%)	Women Nr. (%)	Total Nr. (%)			
50-59	1 (50.00)	-	1 (50.00)	2 (25.00)	-	2 (25.00)
60-69	1 (50.00)	-	1 (50.00)	3 (37.50)	-	3 (37.50)
70-79	-	-	-	2 (25.00)	-	2 (37.50)
80-89	-	-	-	1 (12.50)	-	1 (12.50)
Total	2 (100)	-	2 (25.00)	8 (100)	-	8
Glucose 120-180 Mg/dl	2 (100)	-	2 (25.00)	8 (100)	-	8

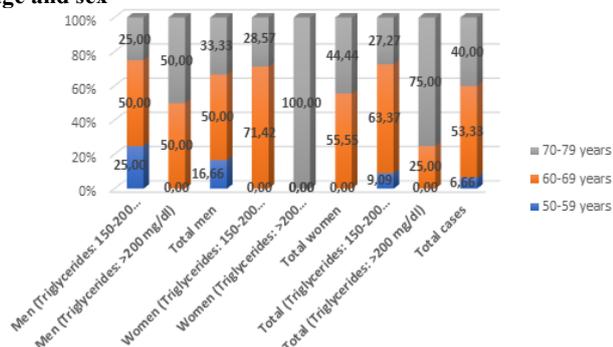
Regarding the correlation between LDL cholesterol and glucose, the interpretation was made on a group of 6 subjects (5.55%) who had LDL cholesterol results. The results regarding the LDL values related to the age and gender of the subjects are reflected in figure no. 4.

Figure no. 4. Distribution of subjects based on LDL cholesterol, age and sex



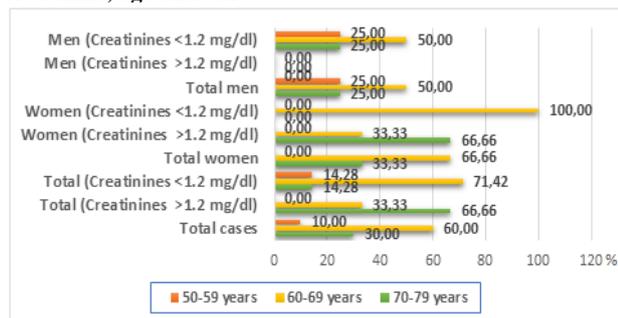
The correlation between triglycerides and glucose was made on a group of 15 subjects (13.88%) who had serum triglyceride determinations and is shown in figure no. 5.

Figure no. 5. Distribution of subjects based on triglycerides, age and sex



Correlation between creatinine and glucose. The interpretation was made on a group of 10 subjects (9.25%). Of this group 3 subjects (30.00%) had creatinine values over 1.2 mg/dl. 10 subjects (100%) had glucose levels between 120-180 mg/dl, there no subject with glucose levels over 180 mg/dl. Of the group of 10 subjects, 6 subjects (60.00%) were female and 4 male subjects (40.00%). There was no case of values over 180 mg/dl. The distribution of subjects regarding creatinine and glucose levels by age group and gender are presented in figure no. 6.

Figure no. 6. Distribution of subjects based on serum creatinine, age and sex



For the correlation between systolic BP and glucose, the interpretation was made on a group of 12 subjects (11.11%). Of this group, 9 subjects (75.00%) had systolic BP between 140-159 mmHg, 1 subject (8.33%) had systolic BP values between 160-179 mmHg and 2 subjects (16.66%) had systolic BP values >180 mmHg. 12 subjects (100%) had glucose values between 120-180 mg/dl, there was no case with glucose level over 180 mg/dl. Of this group, 8 subjects (66.66%) were females and 4 subjects (33.33%) were males. From the age group 50-59 years: 1 subject (8.33%) had systolic BP values between 140-159 mmHg and glucose levels between 120-180 mg/dl; 60-69 years, 4 subjects (80.00%) had BP values between 140-159 mmHg and glucose levels between 120-180 mg/dl; 70-79 age group, 3 subjects (75.00%) had systolic BP values; 80-89 age group, 1 subject (50.00%) with systolic BP values between 140-159 mmHg and glucose levels between 120-180 mg/dl and 1 (50.00%) subject with systolic BP values >180 mmHg and glucose levels between 120-180 mg/dl.

DISCUSSIONS

Regarding the correlation between age and glucose, the high levels of glucose are more evident in women in the 60-

69 age group, with a number of 10 (71.42%) subjects. This increase of glucose with age is predominantly in women and is shown in Avci et al on a lot of 111 subjects with a mean age higher than our group, of 76.2 +/- 6.6 years (63.10%) n=70.(1) The strong association of diabetes and metabolic syndrome with a high age and female sex is shown in Giguels study (2) and Ali et al study.(4)

Regarding, the obesity-glucose correlation, the high values of glucose are recorded in people with BMI between 35-39.99 (62.50%) and are represented by women with ages raging between 60-69 years old; 70.00% of the female subjects had glucose values between 120-180 mg/dl. The correlation between obesity, BMI and glucose is shown in our study where we showed a strong correlation with age and creatinine as shown also by Jain et al.(5) The prevalence in the excess increase in weight and obesity, as shown by Ali et al in their study in India, has a direct link with the increase in prevalence of obesity, hypertension, metabolic syndrome, dyslipidemia, diabetes and cardiovascular disease.(4) Changing your lifestyle through a healthy diet with small meals and frequent ones is shown by Ștefănescu et al.(6)

Regarding the correlation between total cholesterol serum and glucose, our results are more suggestive in the case of subjects with cholesterol values between 200-250 mg/dl (82.25%), females predominantly and aged between 60-69 years, with high glucose values of 120-180 mg /dl. The possibility that cholesterol has a negative effect over patients with diabetes is relevant as shown by our study and the study of Fernandez et al.(7) The high values of HDL cholesterol is reported in our case in subjects with HDL cholesterol values over 40 mg/dl, males, aged between 60-69 years, 85.71% of these subjects had glucose levels between 120-180 mg/dl. These results take us to the idea that in case of men aged 60-69 years old, the increase in HDL cholesterol over the normal limit (40 mg/dl) is in a positive correlation with an increase in glucose levels (>120 mg/dl) and the risk of developing diabetes, cardiovascular disease, dyslipidemia, and metabolic syndrome. The main characteristics of metabolic syndromes are a high HDL cholesterol and hyperglycemia as said by Ali et al (4). As said by Chowdhury et al, Indian diabetics have atherogenic consequences and dyslipidemia is characterized through high levels of HDL cholesterol.(7)

High values of LDL cholesterol are shown by female subjects aged 60-69 years with LDL values between 100-150 mg/dl, 83.33% of these subjects have glucose levels between 120-180 mg/dl. Regarding the high values of triglycerides correlated with normal values of glucose, this is more evident in subjects with triglyceride values between 150-200 mg/dl; 71.42% of subjects are females with glucose values between 120-180 mg/dl. This data shows us the role of high LDL cholesterol values in female subjects aged between 60-69 years old who are in a relation with complications regarding menopause and post-menopause over developing diabetes, coronary diseases, dyslipidemia, and metabolic syndrome. As said by Ali et al, in our study LDL constitutes a marker for diagnosing the severity of metabolic syndrome. Also, the high levels of LDL cholesterol are associated with a sensibility at low insulin. So, a high LDL cholesterol value is a unique marker and is extremely good at predicting a metabolic syndrome and a metabolic syndrome tied to diabetes.(4) The primary characteristics of a metabolic syndrome also includes hypertriglyceridemia besides obesity. Also, Chowdhury et al support that in Indian diabetics, high LDL values have atherogenic consequences and dyslipidemia is characterized through high LDL cholesterol values and triglycerides.(8)

The high creatinine values (>1.2 mg/dl) are

represented in our case by women aged between 60-69 years with glucose values between 120-180 mg/dl. The correlation between age, creatinine, and glucose and chronic renal diseases is confirmed by the Jain et al study. He also noticed a strong positive association between BMI and creatinine serum values, a thing we saw in our study in people aged 60-69 years old especially women with glucose values between 120-180 mg/dl in a proportion of 70%, subjects predisposed at diabetes and also at chronic renal insufficiency. In this context, Jain supports that renal insufficiency reflects high levels of creatinine; non-diabetics had creatinine values higher than diabetics (1.15 vs 1.10 mg/dl, $p < 0.001$) and the differences between diabetics and non-diabetics decrease with age (5).

High levels of systolic blood pressure can be seen in women aged 60-69 years old with glucose levels of 120-180 mg/dl. In our opinion, the correlation between age-sex-hypertension-hyperglycemia in female subjects with aging can be associated to complications of menopause and post-menopause and a high risk of cardiovascular diseases, metabolic syndrome. Giguël et al shown, in their study, that the prevalence of metabolic syndrome in the general population is 17-25% and predisposes to diabetes, cardiovascular diseases and hypertension. Hypertension is a major factor in cardiovascular diseases. Hypertensions is approximately 2 times as frequent in patients with diabetes as opposed to the latter. Factors that contribute to hypertension in these patients include obesity, resistance to insulin and renal diseases. Also, patients with hypertension have a risk of developing diabetes. Renal diseases can increase the cardiovascular risk and the pathology is worsening by a preexisting diabetes.(2) Piatkewich shows in her study that in the case of patients aged 70 and over, diabetes that was diagnosed for a long time (>20 years) that has vascular complications, HbA1c is equal or under 8.0%. The mean age of patient from her group compared to our study (68 ± 7.61 years) was 76.0 ± 11.1 years.(9) Selthofer supports in his study that diabetes is a major pathogenic factor to microvascular complications and resistance to insulin and this is a reason for macrovascular complications.(10)

CONCLUSIONS

Obesity associated with high glucose values, high cholesterol values is a major risk factor for developing diabetes and his complications especially in people aged 50 and over.

A special role in preventing diabetes in people aged 50 and over is having a balanced diet, without and excess of carbohydrates and lipids, higher in fiber, informing patients and training family doctors and diabetologists over the risks of an unhealthy lifestyle and diet that can developed diabetes.

Changing your lifestyle with daily exercise and/or a healthy diet can postpone or prevent diabetes.

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