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Obesity and pregnancy

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ABSTRACT

Introduction: *Obesity is the most frequent metabolic disturbance that can target women of reproductive age, among other population groups, and when obese pregnant women become patients, it represents a serious risk factor for both mother and fetus.*

Aim: *The aim of this study is to offer an overview of the effects exerted by this disturbance on pregnancy.*

Material and methods: *The study targets 157 pacients admitted to "Alessandrescu-Rusescu" National Institute for Mother and Child Health – Polizu (INSMC), Bucharest, Romania. In order to define the criterion for obesity, WHO classification (body mass index > 30 kg/m^2) was used. Data was collected restrospectively after acceptance by the Ethics Committee. Also, we gathered anthropometric data (weight, body mass index and analysis regarding the metabolic profile, including total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride, blood sugar, glycosylated haemoglobin) from all subjects. Each analysis was correlated with each patient's body mass index. Another correlation was made between metabolic profile, antenatal complications and onset of gestational diabetes and premature birth. Statistical analysis was conducted using GraphPad 8 and MedCalc 14.1.*

Results: *Patients had an average body weight of 66.75 kg with a standard deviation of 12.99 kg and a median of 64 kg. Average body mass index was 25.05 kg/m^2, with a standard deviation of 5,03 kg/m^2 and a median of 24.2 kg/m^2. There is a directly proportional and statistically significative correlation between the*

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values of blood sugar, glycosylated haemoglobin, LDL, TG, uric acid and BMI. Also, there is a inversely proportional and statistically significative correlation between the values of HDL and BMI. The CT/HDL ratio, low HDL level and elevated LDL level are the main risk factors for premature birth, while the CT/HDL ratio, low HDL level and elevated TG are the main risk factors for the onset of gestational diabetes.

Conclusion: *According to the results of this study, the onset of obesity in pregnant woman is rather dependent on each patient's metabolic profile than body weight.*

Keywords: obesity, pregnancy, the metabolic syndrome.

BACKGROUND

Obesity is the most frequent metabolic disturbance which is affecting various groups of people, including female patients of reproductive age. However, when obesity occurs during pregnancy, it becomes a major risk factor for both mother and fetus (1).

Given the alarming growth of obesity, the World Health Organization (WHO) called it one of the most serious global health issues of the XXIst century. Obesity has been defined as a condition characterised by the presence of an excessive amount of body fat which threatens patients' health, thus raising morbidity and mortality. According to WHO, the prevalence of obesity in pregnancy is between 1.8 and 25.3%. The etiology is likely multifactorial, the simplest explanation being that obesity is caused by a disturbance in the energy balance of the body, that is, more calories accumulated than spent (2).

Obesity is associated with a wide range of medical complications, including diabetes, cardiovascular disease, dyslipidemia, arterial hypertension, cancer and osteoarthritis. Also, obesity is associated with an increase in patient mortality (3). A body mass index (BMI) above 22.5-25 kg/m^2 is a strong predictor for general patient mortality (4). Obese as well as underweight women are less fertile compared to those with normal body weight. Among obese woemn, subfertility is due to a reduction in, or absence of, ovulation frequency (5). Also, a predominant cause for oligo- or anovulation is represented by the polycystic ovary syndrome, which is characterized by central visceral obesity in 40% of cases (6). In addition, in the larger context of metabolic disturbances, low levels of HDL cholesterol and elevated levels of triglycerides and LDL cholesterol can be found. Metabolic disturbances raise the risk of developing arterial hypertension, coronary artery disease and thrombosis (7). Pregnancy is characterized by a significant elevation of plasma lipid concentrations during gestation. According to the literature, plasma cholesterol and triglyceride concentrations increase by 25-50% and 200-400%, respectively (8).

Metabolic syndrome is defined as an association of signs including abdominal obesity, elevation of serum triglyceride level, lowering of HDL-cholesterol level, arterial hypertension and insulin resistance (9). All the above-mentioned signs are consequences of an unhealthy lifestyle that can also lead to perivisceral accumulation of fat tissue (10). The incidence of metabolic syndrome is perpetually rising; at present, it affects approximately 20% of the world's population. The proportion is increasing with age (12). Although there are no doubts regarding the increased frequency of well defined signs for the metabolic syndrome, its pathogenesis is still controversial (13). Comparative physiology describes metabolic syndrome as being similar to the biological process by which animals store fat in anticipation of calorie deficit periods (14). Obesity in humans is probably a consequence of a genetic predisposition, in conjunction with environmental factors (15).

This study aims to reveal the extent of the problem, offering a general view of the consequences of obesity on pregnancy.

MATERIAL AND METHOD

We used the definition for obesity corresponding to WHO classification (BMI> 30 kg/m^2). Also, we considered the onset of obesity before the gestation period.

Inclusion criteria: pregnant women aged over 18 who were admitted to INSMC and agreed to be enrolled in the study.

Exclusion criteria: patients with obesity caused by endocrine disorders, patients aged 18 and those who did not agree to participate in the study.

Data was collected after obtaining acceptance from the Ethics Committee.

Anthropometric data (body weight, BMI, and routine analysis regarding the evaluation of metabolic profile, including total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride, blood sugar, and glycosylated haemoglobin) were registered for all patients. Each analysis has been correlated with each patient's BMI. Another correlation was made between metabolic profile, antenatal complications and onset of gestational diabetes and premature birth.

One hundred and fifty seven patients who were admitted to INSMC participated in the present study. Data confidentiality was ensured for each patient. Also, patient enrollment started only after obtaining the Ethics Committee's approval. Both the principal investigators and the study coordinator attended „Good Clinical Practice" online courses and had a valid diploma for the entire duration of the study.

Statistical analysis was conducted using GraphPad 8 and MedCalc 14.1. In order to compare differences between averages, we used t-student tests for two lots. ANOVA test with Bonfferoni correction was used when we had to analyse three lots or more. We analysed the r correlation coefficient, which can range between -1 and 1. The inversely proportional correlation between the studied parameters can vary between -1 and 0.

Values equal, or close, to 0 show the lack of any correlation, while those between 0 and 1 show a linear directly proportional relationship between variables. For each analysis, we studied the Gaussian data distribution. If this was respected, we used the Pearson coefficient, if not, we used the Spearman coefficient. All analyses with p value < 0.05 were declared valid and statistically significant. These correlations were graphically represented using linear regression analysis methods. For comparing the distribution frequency of different parameters, we used the Chi Square test and where appropriate, hazard ratio (RR) or odds ratio (OR) in order to investigate the chances and risks.

RESULTS

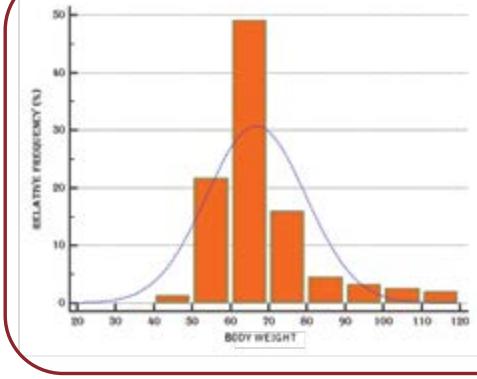
Patients' average body weight was 66.75 kg, with a standard deviation (SD) of 12.99 kg and a median of 64 kg (Figure 1).

Average BMI was 25.05 kg/m^2, with a SD of 5.03 kg/m^2, and a median of 24.2 kg/m^2 (Figure 2).

The average blood sugar value in the first trimester of pregnancy was 97.04, with a SD of 20.84 and a median of 95 mg/dL (Figure 3).

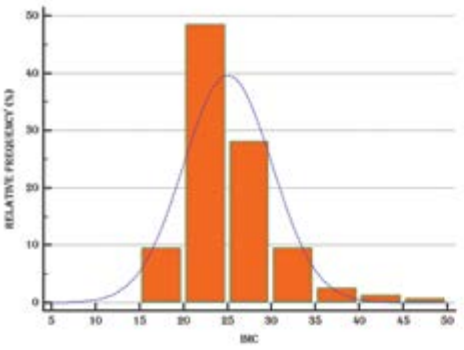
There was a positive directly proportional correlation between blood sugar and BMI values (Figure 4).

The average glycosylated haemoglobin value in the first trimester of pregnancy was 5.75, with a SD of 0.8 and a median of 5.7 (Figure 5).



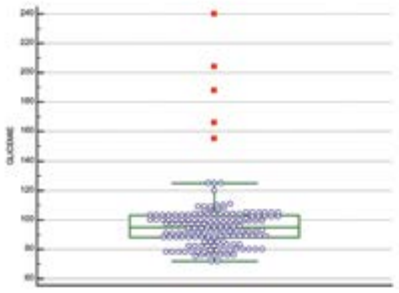
Test value	0
Difference	25.0554
95% CI	24.2609 to 25.8498
Degrees of freedom (DF)	156
t-test	62.29468
Significance level	P < 0.0001

FIGURE 1. Gaussian curve representing the body weight of pregnant women involved in the study



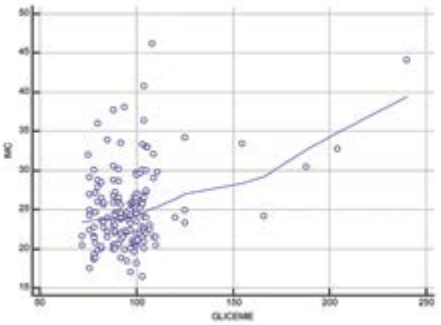
Test value	0
Difference	25.0554
95% CI	24.2609 to 25.8498
Degrees of freedom (DF)	156
t-test	62.29468
Significance level	P < 0.0001

FIGURE 2. Gaussian curve of participants' BMI



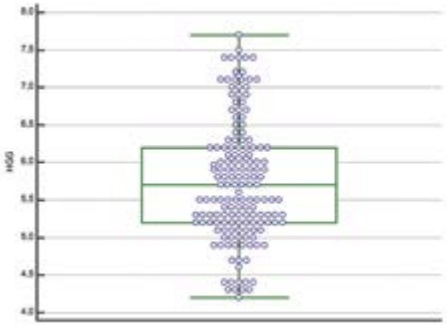
Test value	0
Difference	97.0446
95% CI	93.7588 to 100.3304
Degrees of freedom (DF)	156
t-test	58.33947
Significance level	P < 0.0001

FIGURE 3. Graphical representation of blood sugar values in the first trimester of pregnancy



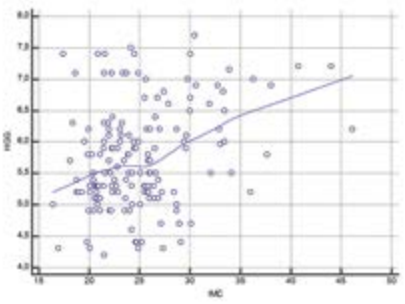
Sample size	157
Correlation coefficient r	0.3529
Significance level	P<0.0001
95% confidence interval for r	0.2078 to 0.4829

FIGURE 4. Correlation between blood sugar and BMI values



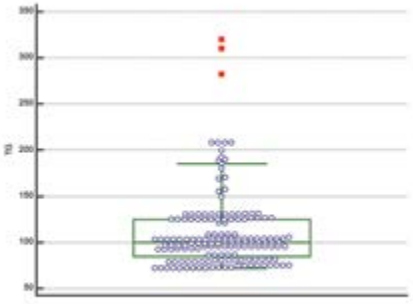
Test value	0
Difference	5.7529
95% CI	5.6249 to 5.8809
Degrees of freedom (DF)	156
t-test	88.78524
Significance level	P < 0.0001

FIGURE 5. Graphical representation of glycosylated haemoglobin value in the first trimester of pregnancy



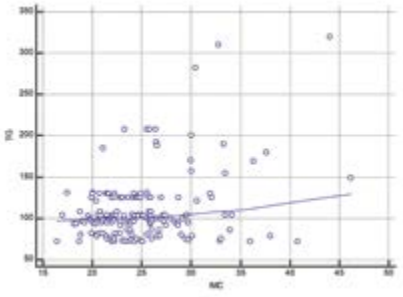
Sample size	157
Correlation coefficient r	0.2986
Significance level	P=0.0001
95% confidence interval for r	0,.490 to 0.4349

FIGURE 6. Correlation between glycosylated haemoglobin and BMI in the first trimester of pregnancy



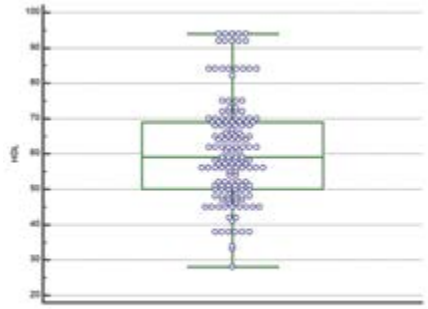
Test value	0
Difference	110.6688
95% CI	104.1405 to 117.1970
Degrees of freedom (DF)	156
t-test	33.48563
Significance level	P < 0.0001

FIGURE 7. Triglyceride values in the first trimester of pregnancy



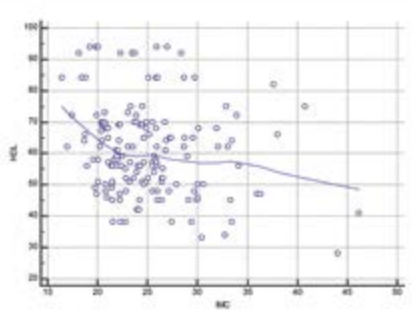
Sample size	157
Correlation coefficient r	0.3332
Significance level	P<0.0001
95% confidence interval for r	0.1863 to 0.4656

FIGURE 8. Correlation between triglyceride and BMI values in the first trimester of pregnancy



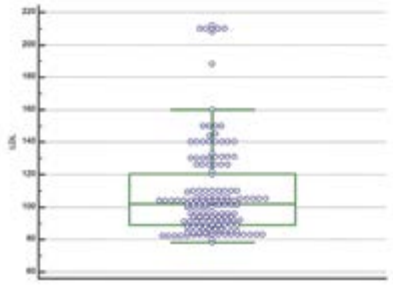
Test value	0
Difference	60.8599
95% CI	58.5962 to 63.1235
Degrees of freedom (DF)	156
t-test	53.10702
Significance level	P < 0.0001

FIGURE 9. The average HDL value in the first trimester of pregnancy



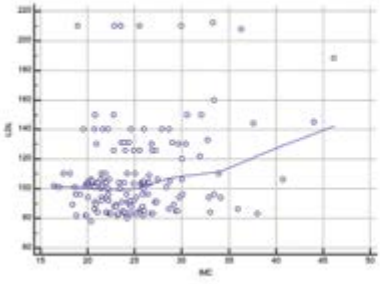
Sample size	157
Correlation coefficient r	-0.2144
Significance level	P=0.0070
95% Confidence interval for r	-0.3590 to -0.05978

FIGURE 10. Correlation between average HDL and BMI values in the first trimester of pregnancy



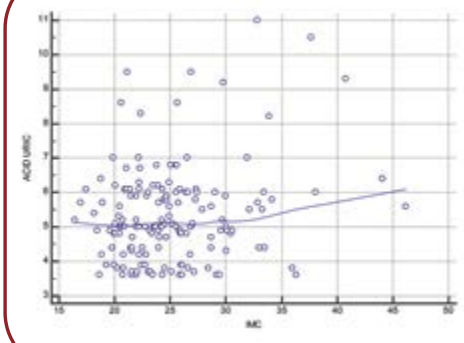
Test value	0
Difference	109.1592
95% CI	104.5080 to 113.8105
Degrees of freedom (DF)	156
Test statistic t	46.35762
Significance level	P < 0.0001

FIGURE 11. The average LDL value in the first trimester of pregnancy



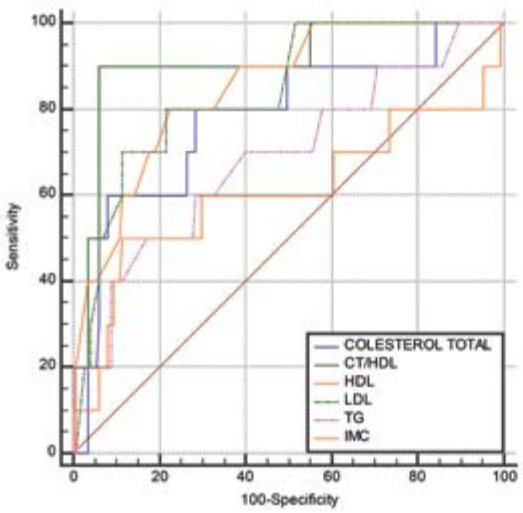
Sample size	157
Correlation coefficient r	0.2620
Significance level	P=0.0009
95% Confidence interval for r	0.1098 to 0.4021

FIGURE 12. Correlation between average LDL and BMI values in the first trimester of pregnancy



Sample size	157
Correlation coefficient r	0,2147
Significance level	P=0.0069
95% Confidence interval for r	0.06005 to 0.3592

FIGURE 13. Correlation between uric acid and BMI values



Variable 1	Total cholesterol (TC)
Variable 2	TC_HDL TC/HDL
Variable 3	HDL
Variable 4	LDL
Variable 5	TG
Variable 6	IMC
Classification variable	Premature birth Premature birth

Sample size		157
Positive group:	Premature birth = 1	10
Negative group:	Premature birth = 0	147

	AUC	SE [a]	95% CI [b]
Total cholesterol (TC)	0.778	0.0821	0.705 to 0.840
TC_HDL	0.910	0.0511	0.854 to 0.950
HDL	0.850	0.0556	0.784 to 0.902
LDL	0.839	0.0591	0.773 to 0.893
TG	0.689	0.0951	0.610 to 0.760
IMC	0.606	0.118	0.525 to 0.683

FIGURE 14. Correlation between metabolic profile, antenatal complications and premature birth

There was a directly proportional correlation between the BMI value and the level of glycosylated haemoglobin.

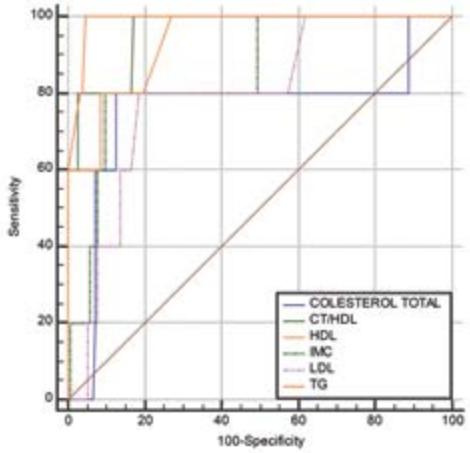
The average triglyceride value in the first trimester was 110.66, with a SD of 41.41 and a median of 100 (Figure 7).

There was a directly proportional and statistically significant correlation between the triglyceride level and the BMI value (Figure 8).

The average HDL value in the first trimester of pregnancy was 60.85, with a SD of 14.35 and a median of 59 (Figure 9).

There was an inversely proportional correlation between HDL and BMI, with P=0.007 (Figure 10).

The average LDL value in the first trimester of pregnancy was 102, with a SD of 29.5 and a median of 102 (Figure 11).



Variable 1	Total cholesterol (TC) TC
Variable 2	TC_HDL TC/HDL
Variable 3	HDL
Variable 4	IMC
Variable 5	LDL
Variable 6	TG
Classification variable	Gestational diabetes Gestational diabetes

Sample size	157
Positive group: Gestational diabetes = 1	5
Negative group: Gestational diabetes = 0	152

	AUC	SE [a]	95% CI [b]
Total cholesterol (TC)	0.755	0.145	0.680 to 0.820
TC_HDL	0.961	0.0307	0.918 to 0.985
HDL	0.988	0.00959	0.956 to 0.999
IMC	0.853	0.0808	0.787 to 0.904
LDL	0.792	0.0917	0.720 to 0.853
TG	0.936	0.0427	0.886 to 0.969

FIGURE 15. Correlation between metabolic profile, antenatal complications and gestational diabetes

There was a directly proportional correlation between LDL and BMI, with P=0.0009 (Figure 12).

There was a directly proportional and statistically significant correlation between uric acid and BMI values (Figure 13).

CONCLUSION

There is a directly proportional and statistically significant correlation between the values of blood sugar, glycosylated haemoglobin, LDL, TG, uric acid and BMI. Also, there is an inversely proportional and statistically significant correlation between HDL cholesterol and BMI values. The CT/HDL ratio, low HDL levels and high LDL levels are the main risk factors for premature birth. The CT/HDL ratio, low HDL levels and high TG levels are the main risk factors for onset of gestational diabetes. In other words, the onset of the pathology in question is rather dependent on a patient's metabolic profile rather than body weight. ❑

Conflicts of interest: none declared.
Financial support: none declared.

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