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PERINATAL CONSEQUENCES IN PREGNANT WOMEN SUFFERING FROM METABOLIC SYNDROME

Abstract. *The aim of the study was to evaluate perinatal outcomes in pregnant women suffering from metabolic syndrome*
Material and methods. The study was carried out on the basis of Maternity House No. 7" (Odesa) in 2014-2021. 57 women with metabolic syndrome were examined. Anthropometric parameters, basic metabolism, leptin content and lipid profile, frequency of complications of pregnancy and childbirth were evaluated. Statistical processing was carried out by methods of dispersion and correlation analysis using Statistica 13.0 software (TIBCO, USA).
Research results.
The average age of the examined women was 27.4±1.1 years. Of them, 16 (28.1%) pregnant women were primiparous, and 41 (71.9%) pregnant women gave birth again. BMI in all women was above 25 kg/m2 (on average 29.2±0.6 kg/m2) with a fat content of 47.3±2.4%. During pregnancy, leptin level was on average 39.3±1.6 ng/ml, LDL content was 1.8±0.1 mmol/l. The presence of metabolic syndrome significantly increased the frequency of obstetric and perinatal complications. The possible relationship between the identified disorders and qualitative changes in the intestinal microbiome is discussed.
Conclusions:
1. In women with manifested metabolic syndrome, the course of pregnancy was complicated by preeclampsia in 24.6% of cases, placental dysfunction in 29.8% of cases. The threat of premature birth occurred in 40.4%, gestational diabetes – in 31.6% of women.
2. With metabolic syndrome, the frequency of operative delivery increases to 35.1%. The main indications for a cesarean section were a clinically narrow pelvis, a severe form of preeclampsia, and weakness of labor that cannot be corrected with medication.
3. During childbirth, women in labor with metabolic syndrome often experience such complications as weakness of labor (19.3%), premature discharge of amniotic fluid (24.6%). The main complication of the postpartum period was subinvolution of the uterus (15.8%).
4. Most of the children born had signs of macrosomia, which closely depended on leptin concentration (r=-0.31)
5. The proven existence of a strong correlation between the level of leptin production and LDL (rs=0.76).
Keywords. *pregnancy, metabolic syndrome, leptin, visceral fat, complications, clinical prognosis*

Introduction. One of the challenges of civilization is a change in the way of life of a person [1]. A decrease in physical activity, the predominance of refined carbohydrates and fats in the food structure, and its energy surplus lead to an increase in the proportion of the population with excess body weight and associated conditions, among which the metabolic syndrome (MS) occupies a special place [2, 3]. The latter is understood as a set of indicators that reflect characteristic metabolic disorders. As a rule, they include atherogenic dyslipidemia, arterial hypertension, insulin resistance, excess body weight, prothrombotic and proinflammatory conditions [2]. Patients with MS have a significantly increased risk of cardiovascular diseases, oncology, type 2 diabetes, and chronic kidney disease [2-5]. When pregnancy occurs in a woman with MS, a number of risks are realized, which are related to the fact that, even during the physiological course, pregnancy is a pro-inflammatory, prothrombotic, highly resistant to insulin and hyperlipidemic state [6-8]. At the same time, there are no reference values for metabolic changes during pregnancy, which complicates the prediction of perinatal outcomes.

It is known that the frequency of such complications as preeclampsia and gestational diabetes may increase in pregnant women with MS [6, 7]. On the other hand, pregnant women with MS often face the problem of miscarriage and spontaneous premature birth - according to some estimates, in the presence of MS, the risk of these complications increases three times [6, 8].

Excessive body weight during pregnancy causes fetal macrosomia, which increases intermuscular adipogenesis during intrauterine development [6, 9]. In the future, this leads to the development of obesity in childhood, as well as type 2 diabetes and cardiovascular diseases in adulthood. Thus, we are talking about fetal programming of diseases that will develop in the offspring of a woman with manifested MS [6, 10].

The aim of the study was to evaluate perinatal outcomes in pregnant women suffering from metabolic syndrome

Material and methods. The study was carried out on the basis of KP "Maternity House No. 7" (Odesa) in 2014-2021. 57 women with MS were examined, the verification of which was carried out according to WHO criteria (1999): violation of glucose tolerance, violation of fasting glucose or insulin resistance , and any two criteria from the following list [2]:

- Blood pressure ≥ 140/90 mm Hg.
- Dyslipidemia: triglycerides (TG) ≥ 1.695 mmol/l and HDL cholesterol ≤ 1.0 mmol/l
- Central obesity: waist-to-hip ratio > 0.85 (for women), or BMI > 30 kg/m2
- Microalbuminuria: urinary albumin excretion rate ≥ 20 μg/min or albumin:creatinine ratio ≥ 30 mg/g

Anthropometric indicators (body weight, height, waist circumference, abdominal circumference, Lang's caliper) were evaluated. BMI and % fat, including visceral fat [11] were calculated using the EXRX calculator (Fig. 1) [12].

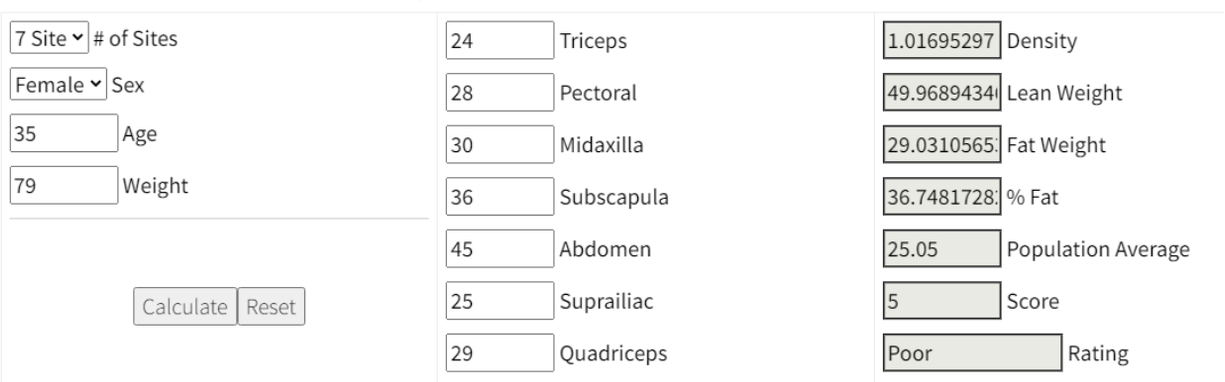

Fig. 1 Calculation of body structure using the EXRX calculator

The main exchange was estimated according to the Haris-Benedict formulas [13]

In addition, leptin content was evaluated by the ELISA method, LDL level by the colorimetric photometric method [14].

The frequency of complications of pregnancy and childbirth, the weight of the newborn and its functional state according to Apgar were evaluated [15].

Statistical processing was carried out by methods of dispersion and correlation analysis using Statistica 13.0 software (TIBCO, USA) [16].

Research results.

The average age of the examined women was 27.4±1.1 years. Of them, 16 (28.1%) pregnant women were primiparous, and 41 (71.9%) pregnant women gave birth again.

The BMI of all women was above 25 kg/m2 and averaged 29.2±0.6 kg/m2. Regarding the fat content, it was 47.3±2.4% in pregnant women with MS, which is significantly higher than the average population values. The quota of visceral fat deposition was also significantly increased, which was 189.8±11.4 units.

The waist size of the examined women at the beginning of pregnancy was on average 79.6±1.7 cm, the basic metabolism did not exceed 1800 kcal per day.

During pregnancy, the leptin level was on average 39.3±1.6 ng/ml, the LDL content was 1.8±0.1 mmol/l.

The course of pregnancy was complicated by preeclampsia in 14 (24.6%) cases, placental dysfunction in 17 (29.8%) cases. The threat of

premature birth occurred in 23 (40.4%), gestational diabetes – in 18 (31.6%) women.

A significant part of women with MS were delivered surgically - there were 20 (35.1%) of them. The main indications for a cesarean section were a clinically narrow pelvis, a severe form of preeclampsia, persistent weakness of labor activity that is not amenable to medical correction. The rest were born per via naturales. During childbirth, such complications as weakness of labor activity (11 or 19.3%), premature discharge of amniotic fluid (14 or 24.6%) often occurred. The main complication of the postpartum period was subinvolution of the uterus (9 cases or 15.8%).

Most of the children born had signs of macrosomia. Thus, the average height of a newborn was 53.4±5.8 cm with a body weight of 4236±82 g.

Table 1 presents the data of the correlation analysis of the interdependence of various indicators in pregnant women with MS. As can be seen from the above, the concentration of leptin has an inverse relationship with the degree of macrosomia of the fetus and practically does not depend on the main metabolism of the pregnant woman. In addition, there is a direct strong relationship between the level of leptin production and LDL (rs=0.76). Such relationships between indicators are explained by the fact that leptin secretion depends on the general state of lipid metabolism, as well as on the level of production of pro-inflammatory cytokines [6].

Table 1

Correlation matrices of the main investigated indicators in women with metabolic syndrome

Index	Weight of newborn	Mother's height	Mother's weight	BMI	Waist/hip ratio	Leptin	LDL	% of fat	Visceral fat	Basic metabolism
Age	-0,008	-0,018	0,041	0,072	0,068	0,144	0,102	0,089	0,070	-0,066
Weight of newborn		-0,011	-0,022	-0,028	-0,069	**-0,311**	-0,360	-0,024	-0,035	-0,046
Mother's height			**0,780**	-0,006	-0,051	-0,109	-0,069	-0,052	-0,094	0,025
Mother's weight				**0,578**	0,229	**0,319**	**0,320**	**0,508**	**0,476**	0,021
BMI					**0,492**	**0,688**	**0,675**	**0,940**	**0,964**	0,017
Waist/hip ratio						**0,418**	**0,480**	**0,405**	**0,514**	0,219
Leptin							**0,763**	**0,638**	**0,723**	0,004
LDL								**0,640**	**0,717**	0,018
% of fat									**0,926**	-0,026
Visceral fat										0,033

In discussing the above, we note that pregnancy is a unique metabolic state due to changes in maternal metabolism necessary to support intrauterine growth and increased maternal energy needs. Insulin sensitivity decreases by 40-50% during pregnancy, but improves significantly within a few days after delivery. In women with excessive body weight during pregnancy, the increase in body weight is greater than in women with a normal weight [17]. This process is accompanied by an increase in the degree of insulin resistance, which increases the risk of gestational diabetes. In late pregnancy, obese women have increased levels of circulating triglycerides and very low-density lipoprotein cholesterol, while decreasing high-density lipoprotein levels compared to lean women, which significantly increases the activity of atherogenesis [18]. The literature discusses the role of the microbiome of pregnant women with MS in deepening metabolic disorders and changing the expression of genes responsible for lipid and protein metabolism [19, 20], but there have been no such studies in Ukraine.

Obese women have an increased risk of spontaneous preterm birth. The relative risk for every five unit increase in maternal BMI in overweight and obese women is 1.21 for fetal

death (1.09-1.35), 1.24 for stillbirth (1.18-1.30), 1.16 for perinatal death (1.00-1.35), 1.15 for early neonatal death (1.07-1.23) and 1.18 for neonatal death during the first year of life (1.09-1, 28) [21]. Pregnant women with MS have an increased risk of a failed trial of labor, cesarean section, and endometritis; they also have twice the risk of composite maternal morbidity and a fivefold increased risk of neonatal injury. The length of labor in women giving birth to newborns is inversely proportional to the BMI of the mother. The unadjusted odds ratios for caesarean section are 1.46 (1.60) and 2.05 (1.86-2.27) in overweight and obese women, respectively, compared with women of normal weight [22]. The frequency of successful uncomplicated deliveries after caesarean section [23] is inversely related to BMI (BMI <19.8 (83.1%), BMI 19.8 -26 (79.9%), BMI 26.1-29 (69 .3%) and BMI > 29 (68.2%); P <0.001).

Conclusions:

1. In women with manifested metabolic syndrome, the course of pregnancy was complicated by preeclampsia in 24.6% of cases, placental dysfunction in 29.8% of cases. The threat of premature birth occurred in 40.4%, gestational diabetes – in 31.6% of women.

2. With metabolic syndrome, the frequency of operative delivery increases to 35.1%. The main indications for a cesarean section were a clinically narrow pelvis, a severe form of preeclampsia, a weakness of labor that cannot be corrected with medication.

3. During childbirth, women in labor with metabolic syndrome often experience such complications as weakness of labor (19.3%), premature discharge of amniotic fluid (24.6%). The main complication of the postpartum period was subinvolution of the uterus (15.8%).

4. Most of the children born had signs of macrosomia, which closely depended on leptin concentration (r=-0.31)

5. The proven existence of a strong correlation between the level of leptin production and LDL (rs=0.76).

The prospects of further research are related to the development of algorithms for nutritional correction of the manifestations of metabolic syndrome during pregnancy.

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