NUTRITIONAL STATUS OF PREGNANT WOMEN – EFFECTS ON THE COURSE AND PREGNANCY OUTCOME

TELESNA UHRANJENOST TRUDNICA – EFEKAT NA TOK I ISHOD TRUDNOĆE

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Summary

Introduction. In recent decades, obesity has taken on epidemic proportions and is becoming one of the most significant public health problems today. The results of clinical and epidemiological studies show that obese pregnant women can be considered a high risk group, given the increased risk of maternal and fetal complications. The aim of this study was to examine the relationship between pregnant women’s nutritional status and the development of arterial hypertension, gestational diabetes and obstetric cholestasis during pregnancy, as well as the impact of pregnant women’s nutritional status on newborn birth weight and vital parameters at birth, assessed by Apgar score.

Material and Methods. This retrospective study included 71 pregnant women who were divided into two groups, depending on the nutritional status. The first group included 28 pregnant women with a body mass index < 25 kg/m² or less, whereas the second group included obese pregnant women with a body mass index > 30 kg/m² or more. Birth protocol data were used for the newborns.

Results. In obese pregnant women, the termination of pregnancy by cesarean section was statistically significant more frequent (p = 0.05). Newborns of obese mothers had a statistically lower Apgar score at 5 minutes, while higher body weight of newborns and a lower Apgar score at 1 minute were at the limit of statistical significance (p = 0.068). Arterial hypertension was more common in obese pregnant women (p = 0.014), while gestational diabetes (p = 0.42) and obstetric cholestasis (p = 0.51) were more common in obese pregnant women, but without statistical significance. Conclusion. Obesity in pregnancy is a risk factor for the development of hypertension, a higher incidence of cesarean section, and a lower Apgar score of newborns.

Key words: Obesity; Pregnancy; Risk Factors; Hypertension; Diabetes, Gestational; Cholestasis; Cesarean Section; Apgar Score; Pregnancy Outcome

Sažetak

Uvod. Poslednjih decenija gojaznost poprima epidemije razmere i postaje jedan od najznačajnijih javnozdravstvenih problema današnjice. Rezultati kliničkih i epidemioloških studija pokazuju da se gojazne trudnice mogu smatrati „rizičnom grupom” s obzirom na povećan rizik od maternalnih i fetalnih komplikacija. Cilj rada bilo je ispitivanje povezanosti stepena telesne uhranjenosti telesne uhranjenosti trudnica sa razvitkom arterijske hipertenzije, gestacij-skog dijabetesa i opstretičke holestaze tokom trudnoće, kao i uticaja stepena uhranjenosti trudnica na porodajnu masu novo-rođenčeta i vitalne parametre na rođenju, ocenjene kroz Apgar skor. Materijal i metode. Istraživanje je sprovedeno u vidu retrospektivne studije kod 71 trudnice, podele u dve ispitivane grupe u zavisnosti od stepena uhranjenosti. Prvu grupu činilo je 28 trudnica čiji je indeks telesne mase < 25 kg/m², dok su drugu grupu činile gojazne trudnice sa indeksom telesne mase > 30 kg/ m². Iz protokola novorođenčadi korišćeni su podaci o novođenčadi. Razultati. Kod gojaznih trudnica statistički je značajno veća razmisljanje trudnoće carskim rezom (p < 0,05). Novorođenčadi gojaznih majki imaju statistički značajni niži Apgar skor u petom minuto, dok su veća telesna masa novorođenčadi i niži Apgar skor u prvoj minuti na granici statističke značajnosti (p = 0,068). Arterijalna hipertenzija je češća kod gojaznih trudnica (p = 0,014), dok su gestacijski dijabetes (p = 0,42) i opstretička holestaza (p = 0,51) češći kod gojaznih trudnica, ali nisu dostigli statističku značajnost. Zaključak. Gojaznost u trudnoći predstavlja faktor rizika za nastanak hipertenzije, veću incidenciju operativnog završavanja trudnoće i niži Apgar skor novorođenčeta.

Ključne reči: gojaznost; trudnoća; faktori rizika; hipertenzija; gestacijski dijabetes; holestaza; carski rez; Apgar skor; ishod trudnoće

Introduction

Obesity is a disease characterized by an increase in body weight caused by excessive accumulation of body fat. It is a significant risk factor for the development of numerous chronic conditions.

Obesity is becoming one of the most significant public health problems today. The increase in the incidence of obesity worldwide has a different distribution; in some parts of the world obese people account for 20 – 40% of the population, while in other parts it is observed that every second person is obese [1–3]. Obesity is a consequence of various etiopathogenic factors: genetic factors, regulation of hunger and satiety, energy imbalance, various endocrine-metabolic factors, psychological factors, and socio-economic status [4]. The hyperalimentation obesity is mostly the consequence of dispro-
Effects of Nutritional Status on the Course and Pregnancy Outcome

In order to get a more accurate picture of the degree of obesity, the World Health Organization (WHO) introduced the body mass index (BMI) as an indicator of the degree of obesity [5]. In Europeans, obesity is believed to account for 85% of the risk for developing type 2 diabetes, 2.35% of ischemic heart disease, and 55% of arterial hypertension [1]. Adipose tissue was considered as a passive energy reservoir of the body, but its significant endocrine activity has been discovered in the 20th century. It secretes more than 50 peptide mediators, adipokines, such as leptin, resistin, adiponectin, tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), visfatin and a number of others, many of which are still in the research phase [6]. The name leptin is derived from the Greek word “leptos” which means slender, thin. The main function of leptin is to regulate body weight by informing the central nervous system (CNS) about the body's total energy reserves. Obese pregnant women with higher BMI values and a higher amount of adipose tissue have a high value of leptin, which leads to insulin resistance and the development of gestational diabetes [7]. Adiponectin is the main adipokine with positive metabolic effects. It reduces insulin resistance, the concentration of free fatty acids, lowers glycemia, and reduces atherogenesis [8]. Visfatin has insulomimetic effects and it lowers blood glucose levels. Interestingly, visfatin acts by binding to the insulin receptor [6]. Resistin is known to produce adipose tissue and some studies show that serum resistin levels increase with obesity [9].

The effects of obesity are manifested in almost every aspect of a woman’s reproductive life including metabolic and reproductive complications; results of clinical and epidemiological studies show that obese pregnant women are considered to be a “risk group” given the increased risk of maternal complications such as gestational diabetes, hypertension, thromboembolic complications, peripartum complications, and increased incidence of surgical delivery. There is also an important problem in clinical practice - difficult visualization of fetal morphology during ultrasound examination, difficult access during surgery, problems with intubation, complications of wound healing, etc. [10]. Accumulation of fat mass in central depots leads to more frequent insulin resistance and disorders of adipokine secretion, which increases the risk of gestational diabetes [11]. Arterial hypertension is one of the most common disorders in pregnancy. Gestational hypertension is a blood pressure ≥ 140/90 mmHg that occurs after the 20th week of gestation in women who did not have hypertension before pregnancy, and blood pressure values are normalized 6 weeks after delivery [12]. Arterial hypertension in pregnancy is a common cause of preterm birth, surgical termination of pregnancy and premature birth [13]. Fetal complications of maternal obesity are hyperglycemia, traumatic birth as a consequence of macromelia (birth weight over 4000 g), neonatal jaundice, increased risk of congenital anomalies, and premature birth [14].

The aim of this study was to examine the relationship between pregnant women’s nutritional status and the incidence of maternal complications, manner of childbirth, neonatal birth weight, as well as the vital parameters at birth.

Material and Methods

The retrospective study included 71 pregnant women that were hospitalized after the 37 weeks of gestation (WG) at the Clinic of Gynecology and Obstetrics of the Clinical Center of Vojvodina. Pregnant women gave birth in the period from January 2011 to January 2015. The subjects were divided into two groups, depending on the nutritional status: the first group included 28 pregnant women with normal body weight and a BMI < 25 kg/m², while the second group included 43 obese pregnant women with a BMI > 30 kg/m². Anthropometric data on the body height, body weight, weight gain (during the current pregnancy), existence of arterial hypertension, gestational diabetes, and obstetric cholestasis were gathered from the medical history. The neonatal protocol included data related to newborns: body length, body weight at birth, and Apgar scores at 1 and 5 minutes after birth. A t-test was used for parametric data (measured quantities). For nonparametric data, the χ square test was used, i.e. Fisher’s exact test. The threshold of statistical significance was p ≤ 0.05.

Results

The average age of respondents was 29.92 ± 5.78 years (minimum 18, maximum 43 years). The average gestational age of the examined group was 39.35 ± 1.01; 37 – 41 WG. The mean body weight of respondents was 82.68 ± 15.35 kg (54 kg – 121 kg). The average BMI was 30.10 ± 5.98 kg/m² (21.09 kg/m² – 45.12 kg/m²). The average weight gain during pregnancy in all subjects was 14.51 ± 6.32 kg (8 kg – 35 kg).

During pregnancy, 11.27% of subjects had arterial hypertension, 11.27% had gestational diabetes, 2.82% had obstetric cholestasis, and in 43.94% the pregnancy was completed by cesarean section (Table 1).

There were a total of 71 newborns, with an average body length of 49.99 ± 2.16 cm (45 cm – 54 cm). The average body weight of newborns was 3486.15 ± 564.15 g (2370 g – 4780 g). The Apgar score at 1 minute was 9.11 ± 1.25, and at 5 minutes it was 9.67 ± 0.73.

In relation to the nutritional status, the respondents were divided into two groups:
Comparing the two examined groups, the average age in group I of pregnant women with normal nutritional status was 28.93 ± 5.11, while in group II of obese pregnant women it was 30.56 ± 6.15. There was no statistically significant age difference between group I and group II. The average age in group I was 39.21 ± 0.92 and 39.44 ± 1.08 in group II. The gestational age was not statistically different between the two groups (p = 0.36). The average body height in group I was 169.47 ± 5.64 cm, and 163.86 ± 7.24 cm in group II. The average body weight in group I was 68.86 ± 6.42 kg, and 91.67 ± 12.49 kg in group II. There was a highly statically significant difference in body weight between the examined groups (p < 0.0005). The pregnant women in group I had an average BMI of 23.92 ± 1.026 kg/m², while in the group II the average BMI was 34.13 ± 4.09 kg/m², showing a highly statically significant difference in BMI between the examined groups (p < 0.0005).

Weight gain during pregnancy between the two groups was statistically significantly different (p < 0.05). The comparison between the two examined groups showed a statistically significant difference in the incidence of arterial hypertension, while the difference between gestational diabetes and obstetric cholestasis was observed, but it was not statistically significant in our sample (Graph 1). The frequency of cesarean section was statistically significantly more common in obese pregnant women.

The results of our study showed that infants of obese mothers had a higher birth weight and body length, but this difference was not statistically significant between the two groups (p = 0.36). The average body height in group I was 49.7 ± 2.35 cm, and 50.18 ± 2.02 cm in group II. The average body weight in group I was 3327.4 ± 502.36 g, and 3596.4 ± 584.26 g in group II. There was a highly statically significant difference in body weight between the examined groups (p < 0.0005). Weight gain during pregnancy between the two groups was statistically significantly different (p < 0.0005).

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**Graph 1.** Maternal complications among groups of respondents

**Tabela 1.** Učestalost komplikacija tokom trudnoće u celoj grupi ispitanica

| Parameters (N/Br. = 71)/Parametri (N/Br. = 71) | %    |
|-----------------------------------------------|------|
| Arterial hypertension/Arterijska hipertenzija | 11.27|
| Gestational diabetes/Gestacijski dijabetes      | 11.27|
| Obstetric cholestasis/Opstetrička holestaza     | 2.82 |
| Cesarean delivery/Porodaj carskim rezom          | 43.94|

**Table 2.** Comparison of body length, body weight and Apgar score in newborns in relation to the maternal nutritional status

**Tabela 2.** Komparacija telesne dužine, telesne mase i Apgar skora kod novorođenčadi u odnosu na stepen telesne uhranjenosti majki

| Parameters | Pregnant women with normal nutritional status (X ± SD) | Obese pregnant women (X ± SD) | P    |
|------------|-------------------------------------------------------|--------------------------------|------|
| Newborn body length (cm) | 49.7 ± 2.35 | 50.18 ± 2.02 | 0.383|
| Newborn body weight (g) | 3327.4 ± 502.36 | 3596.4 ± 584.26 | 0.056|
| Apgar score at 1 minute | 9.44 ± 0.751 | 8.87 ± 1.47 | 0.068|
| Apgar score at 5 minutes | 9.89 ± 0.32 | 9.51 ± 0.89 | 0.038|

**Discussion**

Obesity is a major socio-epidemiological problem today. Obesity in the preconception period and during the pregnancy itself is accompanied by many risks for...
the development of both maternal and fetal complications [1]. Pathophysiologically, due to the accumulation of adipose tissue in the central part of the body of obese pregnant women, due to changes in the secretory function of adipokines, the tendency towards insulin resistance and development of gestational diabetes increases. As a consequence of gestational diabetes, the incidence of fetal macrosomia, polyhydramnios, premature birth of infants of diabetic mothers, higher rate of cesarean delivery, higher incidence of congenital fetal malformations, especially cardiovascular defects, has increased. In our study, an increased incidence of gestational diabetes was observed in obese pregnant women, but this difference was not statistically significant. In addition to the degree of obesity, weight gain during pregnancy is now in the focus of interest of experts as a special risk factor for numerous complications during pregnancy primarily affecting the increased amount of central adipose tissue of the fetus, and later for the development of obese children with increased adipose tissue [15]. Obese children have an increased tendency to develop type 2 diabetes during childhood and early adolescence, and their risk of developing cardiovascular disease is increased [16]. Pregnancy is characterized by an increased vascular volume, which, in addition to reduced vascular resistance typical for pregnancy, leads to arterial hypertension in predisposed pregnant women. Also, glomerular endotheliosis in preeclampsia is the pathophysiological basis for the development of hypertensive syndrome in pregnancy. The consequences of maternal arterial hypertension are preeclampsia, eclampsia, increased susceptibility to peripartum cardiomyopathy, thromboembolic incidents, while in the fetus the consequences can be premature birth, reduced body weight and fetal death. In our study, as in many others, a statistically significant higher incidence of hypertension was observed in obese pregnant women. Obstetric cholestasis is characterized by the appearance of pruritus, increased serum levels of bile acids and transaminases in the second and third trimesters of pregnancy [17]. The disease occurs in the second half of pregnancy when the level of estrogen reaches its maximum [18]. Similar to the literature data, a higher incidence of obstetric cholestasis was observed in obese pregnant women, but in our study this difference was not statistically significant. As in many other studies, our study also showed a significantly higher incidence of surgical delivery in obese pregnant women [19]. Unfortunately, there is a lot of discussion today regarding non-medical reasons for surgical termination of pregnancy. Interviews with obstetricians highlighted non-medical factors implicated in the high rate of CSs, including a convenience incentive, lack of supervision and training in public hospitals, as well as absence or lack of adherence with clinical guidelines. According to the Statement on Caesarean Section (CS) Rates released by the World Health Organization, population-based CS rates higher than 10% are not optimal [20]. Although WHO has indicated that countries should not strive to achieve a specific rate, the rationale for the 10% recommendation is based on a systematic review and ecological analysis which have shown that CS rates exceeding 10% do not correlate with reductions in maternal and newborn mortality [21]. Higher incidence of CS in obese pregnant women increases the risk of developing postpartum complications such as bleeding, infections and wound dehiscence, and slower maternal recovery [22]. In obese pregnant women, due to the increased risk of poor pregnancy outcome, the risk of early termination of pregnancy and consequent iatrogenic prematurity is also increased [23]. In our subjects, the newborns had a higher birth weight and the Apgar scores were lower in obese mothers, although only at the limit of statistical significance. A statistically significantly lower Apgar score at 5 minutes was observed in newborns of obese mothers. Our data are in line with the literature data that support the fact that obese mothers give birth to children of higher birth weight and lower Apgar score. Fetal growth is a complex biological process that is regulated by both maternal and fetal factors including genes and environment. Maternal obesity probably contributes to macrosomia via mechanisms including increased insulin resistance (even in women who do not have diabetes) resulting in higher fetal glucose and insulin levels [24]. Placental lipases metabolize triglycerides in maternal blood, allowing free fatty acids to be transferred in excess to the growing fetus [25]. Fetal macrosomia has been shown to be a risk factor for obesity, diabetes, and increased cardiovascular risk in childhood and adolescence [26, 27].

**Conclusion**

Our research shows that hypertension is statistically significantly more common in obese pregnant women. A high incidence of gestational diabetes and obstetric cholestasis was observed, but this difference was not statistically significant. In our subjects, childbirth was statistically significantly more often completed by cesarean section in obese pregnant women. Newborns of obese women had a higher body weight and a lower Apgar score at the border of statistical significance at 1 minute. A statistically significantly lower Apgar score at 5 minutes was recorded in infants of obese mothers.

This paper may be used as a pilot study to plan research on the impact of the nutritional status on the course and outcome of pregnancy on a larger sample of respondents.

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