

CHALLENGES AND COMPLICATIONS OF MATERNAL OBESITY IN  
PREGNANCY

## IZAZOVI I KOMPLIKACIJE GOJAZNOSTI MAJKE U TRUDNOĆI

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## Abstract

The prevalence of obesity and obesity-related health problems is increasing worldwide, especially among woman and man of reproductive age where obesity is designated as one of the most important global health threats in 21st century. Pregnancy in obese woman is considered as a high-risk pregnancy. Pre-pregnancy obesity and excessive gestational weight gain (GWG) are distinct risk factors with differing associated adverse outcomes, and they could also carry a cumulative negative impact on pregnancy course. Pre-pregnancy obesity is the anthropometric parameter most strongly correlated with perinatal complications. Maternal complications following obesity include antepartum, intrapartum and postpartum complications, such as pregnancy related hypertension, preeclampsia, gestational diabetes mellitus, preterm birth, venous thromboembolism, labor dystocia, labor induction, instrumental and cesarean delivery. Fetal complications related to maternal obesity might include increased prevalence of congenital anomalies, growth abnormalities, prematurity and stillbirth. Pre-pregnancy overweight and obesity is a potentially modifiable risk factor compromising pregnancy outcome. Among all complications that might arise during pregnancy and that could not be predicted and therefore prevented, pre-pregnancy overweight and obesity management control can significantly reduce potential pregnancy complications. Pre-conceptual counseling should provide an awareness of this arising medical condition in a timely manner and provide risk reduction of complications following pre-pregnancy obesity and excessive GWG.

## Keywords:

obesity,  
pre-pregnancy obesity,  
excessive gestational  
weight gain,  
pregnancy risk factors,  
pregnancy  
complications

## Sažetak

Učestalost gojaznosti je u porastu među ženama i muškarcima reproduktivne životne dobi. Gojaznost je označena kao jedan od najznačajnijih pretnji po zdravlje čoveka u 21. veku. Trudnoća komplikovana gojaznošću smatra se visokorizičnom trudnoćom. Prekonceptijska gojaznost i prekomerni prirast u telesnoj težini u toku trudnoće dva su nezavisna faktora rizika po tok i ishod trudnoće, ali mogu imati i kumulativni efekat. Prekonceptijska gojaznost je antropometrijski parametar sa najjačim stepenom korelacije sa perinatalnim komplikacijama. Maternalna gojaznost nosi potencijalne antepartalne, intrapartalne i postpartalne komplikacije, poput hipertenzije u trudnoći, preeklampsije, gestacijskog dijabetesa melitusa, prevremenog porođaja, tromboembolijskih komplikacija, distocije u porođaju, povećane učestalosti instrumentalno završenog porođaja i porođaja završenog carskim rezom. Fetalne komplikacije koje mogu da budu udružene sa komplikacijama maternalne gojaznosti su makrozomija ploda, povećana učestalost kongenitalnih anomalija, poput povećane učestalosti spine bifide, anomalija kardiovaskularnog sistema, prematuritet i neonatalna smrt.

### Ključne reči:

gojaznost,  
prekonceptijska  
gojaznost,  
prekomerni prirast  
telesne težine u  
trudnoći,  
faktori rizika u  
trudnoći,  
komplikacije u trudnoći

Smatra se da maternalna gojaznost predstavlja značajnu odrednicu u fetalnom programiranju i da može biti precipitirajući faktor za nastanak oboljenja u toku života novorođenčeta.

Prekonceptijska gojaznost i prekomerni prirast u telesnoj težini u toku trudnoće potencijalno su promenljivi faktori rizika u trudnoći. Za razliku od mnogih komplikacija u trudnoći koje ne mogu da se predvide i stoga preveniraju, mogućnost kontrole telesne težine pre koncepcije i prirasta telesne težine u toku same trudnoće naglašavaju značaj adekvatnog pristupa budućim majkama po ovom važnom, potencijalno promenljivom faktoru rizika.

## Epidemiological characteristics and classification

Obesity is an arising medical condition that jeopardizes human health and life quality. The prevalence of obesity and obesity-related health problems are increasing worldwide, especially among woman and man of reproductive age. Currently, more than 1.9 billion people are overweight and dealing with obesity, designated as one of the most important global health threats in 21st century (1). Pregnancy in obese woman is considered as a high-risk pregnancy since it may be associated with numerous complications (2). Pre-pregnancy obesity and excessive gestational weight gain (GWG) are distinct risk factors with differing associated adverse outcomes. Aside these immediate correlations, contributing impact of pre-pregnancy obesity and GWG, as a combined risk factor, carries a risk of adverse perinatal outcomes (3). Standards in defining obesity in pregnancy haven't been adopted yet. Body mass index (BMI) has been proposed by World Health Organization (WHO) and National Institute of Health (NIH) as a potential standard, though it should be noticed that BMI cut-off values are age and sex independent, not specific for pregnancy, as well as the fact that BMI doesn't take into account differences between total body weight and body fat weight and relative contributions of bone, muscle and adipose tissue. Both WHO and NHI classify obesity according to nutritional status and BMI values as underweight (BMI below 18.5), normal weight (BMI between 18.5 and 24.9), pre-obesity (BMI between 25.0 and 29.9), obesity class I (BMI between 30.0 and 34.9), obesity class II (BMI between 35.0 and 39.9)

and obesity class III (BMI above 40) (4, 5). Other determinations of pregnancy obesity include absolute measures of gravid weight more than 200 lb, increased waist circumference (more than 88cm) and increased waist-to-hip ratio defined as more than 0.85 (6).

## Obesity and comorbidities

Obesity is closely related to global expansion of cardiovascular and liver disease, metabolic disorders, insulin resistance, type 2 diabetes, osteoarthritis, neurodegenerative diseases, and some malignancies associated with excessive estrogen production (breast, ovarian, endometrial, liver, colorectal and hematologic cancer). Cumulative effects of physiological changes of pregnancy and pathophysiological effects carried by the burden of obesity are well known. Cardiovascular changes following pregnancy (cardiac output and circulation blood volume increase), pulmonary function alterations (imbalance of ventilation and perfusion), changes in hematological system (hypercoagulation and venous thromboembolism increased risk), as well as contribution of systemic inflammation (imbalance of interleukin 6 (IL-6), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), leptin and adiponectin) increases possibility of pregnancy related complications and outlines the importance of reduction of obesity induced pathophysiological interference (7). Pre-pregnancy obesity is the anthropometric parameter most strongly correlated with perinatal complications (8). Obesity related complications may affect the physiological course of conception. It reduces fertility and time taken to conceive (9). Prevalence of polycystic ovary syndrome (PCOS) among obese women

is higher and it is a well known contributor to infertility among reproductively challenged population of woman (10). Higher prevalence of miscarriages is also recorded in population of overweight and obese woman (11).

## Pregnancy-related complications

Maternal complications following obesity include antepartum, intrapartum and postpartum complications. Antepartum complications include pregnancy related hypertension (PRH), preeclampsia (PE), gestational diabetes mellitus (GDM), obstructive sleep apnea, gastrointestinal reflux disease and preterm birth. Potential intrapartum complications are labor dystocia, labor induction, instrumental and cesarean delivery and obesity-related general and regional anesthesia complications. Postpartum complications of obesity are increased prevalence of venous thromboembolism, endometritis, wound healing complications, postpartum depression, weight retention and difficulties considering breastfeeding initiation and sustention (12,13,14,15,16). Fetal complications related to this conditions affecting maternal health prenatally are congenital anomalies, growth abnormalities, prematurity and stillbirth. During labor and childbirth there is an increased possibility of fetal distress, neonatal injury and shoulder dystocia (17,18). Neurodevelopment alteration in child development is the matter of concern. Pre-pregnancy obesity is associated with compromised neurodevelopmental outcomes, it increases the risk of attention deficit-hyperactivity and autism spectrum disorder and developmental delay (19). Long term fetal complications related to maternal obesity include developmental and cognitive abnormalities, diabetes, hypertension and obesity (20). Pre-pregnancy obesity is associated with some congenital abnormalities, such as open neural tube defect and cardiac defects. Congenital abnormalities risk is closely correlated with obesity degree. Several potential mechanisms justifying these hypotheses have been proposed, including impact of hyperglycemia and micronutrient deficiency on congenital anomalies (21). Calorie intake and nutritive supply imbalance, high-energy and high-fat food intake, remains a modern life style challenge and obese woman are at risk of micronutrient deficiency such as folic acid deficiency. Recommended prophylactic intake of 400 mcg of folic acid remains a dilemma, since this intake level might not be sufficient to decrease the risk of open neural tube deficiency among obese pregnant woman (22). Gestational diabetes mellitus is associated with increased risk of fetal macrosomia and development of diabetes later in life. It is one of the strongest predictors of diabetes mellitus type 2 and some studies imply that nearly 50% of mothers with gestational diabetes mellitus will develop diabetes mellitus type 2 within 10 years from delivery (23). Hypertensive disorders of pregnancy, including preeclampsia, are associated with overweight, obesity and BMI values. It is estimated that nearly 16% of all pregnancies are complicated with hypertensive disorders. The effect of obesity on cardiac, vascular and endothelial dysfunction is directly

related to the duration of obesity and it plays a significant role in hypertensive disorder genesis (24,25). Obesity and pregnancy, individually, as well as synergistically, increase the risk of deep venous thrombosis and pulmonary embolism and represent the leading cause of maternal mortality, particularly around delivery and in the puerperium. Obesity is a proinflammatory condition that creates a prothrombotic milieu, but it still remains unclear how this interacts with pregnancy. Since obesity is associated with higher prevalence of cesarean section and prolonged hospital stay, well known risk factors for thromboembolism, risk is significantly higher (26). Preterm birth and induced preterm birth are also perinatal complications that follow maternal obesity and overweight. Overweight and obese women have higher risks of preterm birth (before 32 weeks of gestation) and induced preterm birth (before 37 weeks of gestation) and according to literature data, possible preterm birth (before 37 weeks of gestation) overall. Aside low birth weight, preterm birth is the leading cause of neonatal morbidity and mortality and childhood disability and morbidity and therefore, surveillance for preterm delivery should be considered in overweight and obese women (27).

Pre-pregnancy obesity and excessive GWG are prominent risk factors for both elective and unplanned cesarean section. Pre-pregnancy obesity has a combined cumulative effect with excessive GWG in increased risk for cesarean delivery. Postoperative complications include increased risk of surgical site infection, hospital infections, prolonged hospitalization and formation of intra-abdominal adhesions (28,29). In contrast to the risk for postoperative complications, the risk of intraoperative complication, aside from intraoperative bleeding, does not appear to be increased in obese women. Even though technical aspects of caesarean section are more complex when patient is obese, the incidence of major intraoperative complication such as perioperative and intraoperative blood transfusion, intraoperative injury (bowel, bladder, ureteral injury and broad ligament hematoma), uterus atony, relaparotomy and hysterectomy does not appear to have positive correlation with obesity (30).

Placental changes are also notable. Placental overgrowth, signs of chronic inflammation and hypoxic stress are linked with overweight and obesity. The underlying pathophysiology mechanism remains unclear and presence of placental lesions suggest the possibility of induced compensatory mechanisms in response to chronic fetal hypoxia (31).

## Weight management before and during pregnancy

Approximately 50% of women exceed their weight gain recommendations during pregnancy, with GWG limits constantly being pushed over the recommended boundaries. This especially refers to obese pregnant woman who have conceived before managing to reduce their BMI (32). Weight management during pregnancy is an

absolute imperative for future mothers, given the potential complications. Excessive GWG interferes with physiological course of pregnancy in two separate mechanisms, as a singleton risk factor and as combined risk factor with pre-pregnancy obesity. It significantly increases possibility of pregnancy related complications, such as GDM, PRH, large for gestational age (LGA), preterm birth and preterm prelabor rupture of membranes (PPROM) (33). It is unclear if GWG has a potential impact on neurodevelopmental outcomes of newborns (34). Some studies emphasize the importance of weight balance during pregnancy and imply that gestational weight loss among obese woman is associated with increased risk of small for gestational age (SGA) less than 10<sup>th</sup> percentile (35). Maternal obesity is an important contributor to Developmental Origins of Health and Disease (DOHaD) hypothesis (36), but some studies imply that paternal obesity is also an important factor in context of fetal programming. In this context, paternal obesity, aside being a well-known negative fertility factor, negatively interferes with subsequent pregnancy course and the offspring health burden (37). This hypothesis should raise the importance of weight reduction between both parents. Moderate physical activity is advisable even during pregnancy. Physical activity combined with dietary interventions improves GWG goals and reduces some perinatal risk factors (38).

## Conclusion

Pre-pregnancy overweight and obesity is a potentially modifiable risk factor compromising pregnancy outcome. Among all complications that might arise during pregnancy that could not be predicted and therefore prevented -pre-pregnancy overweight and obesity management control can significantly reduce potential pregnancy complications. Pre-conceptual counseling should provide awareness of this arising medical condition in a timely manner and provide risk reduction of complications following pre-pregnancy obesity and excessive GWG. Responsibility lies in hands of health care providers, especially obstetricians, who should counsel, regularly control, point out and arise awareness of negative effects and complications following maternal obesity.

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