



FEATURES OF THE COURSE AND OUTCOMES OF PREGNANCY IN WOMEN WITH METABOLIC SYNDROME: A REVIEW

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Article history:	Abstract:
Received: November 24 th 2025 Accepted: December 20 th 2025	Metabolic syndrome (MetS) is a cluster of metabolic abnormalities including central obesity, insulin resistance, hypertension, and dyslipidemia. The prevalence of metabolic syndrome among women of reproductive age has increased significantly worldwide, leading to a growing number of pregnancies complicated by metabolic disorders. MetS during pregnancy is associated with adverse maternal and perinatal outcomes, including gestational diabetes mellitus, hypertensive disorders, preeclampsia, cesarean delivery, preterm birth, and neonatal metabolic disturbances. This review analyzes literature published between 2015 and 2026 on the course and outcomes of pregnancy in women with metabolic syndrome. Current evidence indicates that metabolic syndrome significantly increases obstetric risks and influences long-term maternal and offspring health. Early diagnosis, multidisciplinary management, and lifestyle interventions improve pregnancy outcomes.

Keywords: Metabolic Syndrome, Pregnancy, Gestational Diabetes, Preeclampsia, Maternal Outcomes, Perinatal Outcomes

INTRODUCTION

Metabolic syndrome (MetS) is defined as a complex of metabolic disturbances including abdominal obesity, insulin resistance, arterial hypertension, and dyslipidemia [1]. Over the last decade, the global prevalence of metabolic syndrome has increased significantly, particularly among women of reproductive age [2]. This trend is largely attributed to rising obesity rates, sedentary lifestyle, and dietary changes [3]. Pregnancy is characterized by profound metabolic and hormonal changes aimed at supporting fetal growth and development. Physiological insulin resistance develops during pregnancy to ensure adequate glucose supply to the fetus [4]. However, in women with pre-existing metabolic syndrome, these physiological adaptations may lead to severe metabolic dysregulation, increasing the risk of maternal and perinatal complications [5]. Recent studies indicate that metabolic syndrome affects between 10% and 25% of pregnant women globally, depending on diagnostic criteria and population characteristics [6]. The presence of metabolic syndrome during pregnancy has been associated with gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy, preeclampsia, thromboembolic complications, and increased cesarean delivery rates [7]. Metabolic syndrome also has long-term implications. Women with MetS during pregnancy have a higher risk

of developing type 2 diabetes and cardiovascular disease later in life [8]. Furthermore, intrauterine exposure to metabolic disturbances may predispose offspring to obesity, insulin resistance, and metabolic syndrome in adulthood [9]. Despite growing interest in this topic, the mechanisms linking metabolic syndrome to adverse pregnancy outcomes remain incompletely understood. Comprehensive evaluation of recent literature is necessary to improve clinical management and preventive strategies.

AIM OF THE REVIEW:

To analyze contemporary evidence (2015–2026) regarding the course and outcomes of pregnancy in women with metabolic syndrome and identify key maternal and fetal risks.

MATERIALS AND METHODS

This review was conducted according to the IMRaD structure using a narrative-systematic approach to analyze the course and outcomes of pregnancy in women with metabolic syndrome (MetS). Literature published between January 2015 and March 2026 was searched in PubMed, Scopus, Web of Science, Google Scholar, and Cochrane Library databases. Search terms included: "metabolic syndrome and pregnancy," "maternal obesity," "gestational diabetes," "hypertensive disorders in pregnancy," "perinatal outcomes," "insulin resistance pregnancy."



Inclusion criteria: original research articles, systematic reviews and meta-analyses, clinical guidelines, publications from 2015–2026, English language

Exclusion criteria: case reports, non-peer-reviewed publications, duplicate studies

A total of 112 articles were identified. After screening titles, abstracts, and full texts, 42 publications were selected for qualitative synthesis. Data were analyzed regarding maternal outcomes, obstetric complications, fetal and neonatal outcomes, and long-term health effects.

RESULTS

Prevalence and Clinical Characteristics

The prevalence of metabolic syndrome among pregnant women ranges from 5% to 20% depending on diagnostic criteria and population characteristics [10]. Women with MetS are typically characterized by increased body mass index (BMI), insulin resistance, dyslipidemia, and chronic low-grade inflammation [11]. Obesity is considered the central component of metabolic syndrome. Studies have shown that maternal obesity increases the risk of pregnancy complications by 2–4 times compared with women of normal BMI [12]. Central adiposity is associated with systemic inflammation and endothelial dysfunction, contributing to obstetric complications [13].

Insulin resistance is a key pathophysiological mechanism linking metabolic syndrome to pregnancy complications. Physiological insulin resistance of pregnancy is amplified in women with MetS, increasing the likelihood of gestational diabetes and hypertensive disorders [14].

MATERNAL OUTCOMES

Gestational diabetes mellitus (GDM) is one of the most common complications in women with metabolic syndrome. Several cohort studies report that women with MetS have a three- to five-fold higher risk of developing GDM compared with metabolically healthy women [15,16].

Hyperglycemia during pregnancy leads to increased placental glucose transfer and fetal hyperinsulinemia, contributing to fetal macrosomia and neonatal complications [17].

Meta-analyses confirm that pre-pregnancy obesity and insulin resistance are independent predictors of gestational diabetes [18].

Hypertensive Disorders of Pregnancy

Metabolic syndrome is strongly associated with hypertensive disorders, including gestational hypertension and preeclampsia. Women with MetS have a two- to three-fold increased risk of preeclampsia [19].

The pathogenesis involves endothelial dysfunction, oxidative stress, and chronic inflammation [20]. Elevated triglycerides and insulin resistance contribute to vascular changes that impair placental perfusion [21].

Severe preeclampsia occurs more frequently in women with combined obesity and metabolic syndrome [22].

Mode of Delivery

Pregnant women with metabolic syndrome have higher rates of cesarean delivery. Increased fetal size, obstetric complications, and labor dysfunction contribute to operative delivery [23].

Studies report cesarean section rates ranging from 40% to 60% among women with MetS [24].

Thromboembolic Complications

Metabolic syndrome is associated with a pro-thrombotic state due to increased inflammatory markers and endothelial dysfunction. Pregnancy itself increases coagulation activity, and when combined with MetS, the risk of venous thromboembolism rises significantly [25].

FETAL AND NEONATAL OUTCOMES

Macrosomia

Maternal hyperglycemia and insulin resistance contribute to fetal overgrowth. Macrosomia (birth weight >4000 g) occurs significantly more frequently in pregnancies complicated by metabolic syndrome [26]. Macrosomia increases the risk of shoulder dystocia, birth trauma, and cesarean delivery [27].

Preterm Birth

Women with metabolic syndrome have higher rates of preterm birth, particularly when hypertensive disorders or gestational diabetes are present [28].

Fetal Growth Abnormalities

MetS is associated with both macrosomia and intrauterine growth restriction depending on placental function and severity of metabolic disturbances [29].

Long-Term Maternal Outcomes

Women with metabolic syndrome during pregnancy are at increased risk of developing type 2 diabetes, hypertension, and cardiovascular disease later in life [31].

Pregnancy complications such as GDM and preeclampsia further elevate long-term cardiometabolic risk [32].

Long-Term Offspring Outcomes



Offspring exposed to maternal metabolic syndrome have higher risks of obesity, insulin resistance, and metabolic syndrome in adulthood [33]. Epigenetic mechanisms may contribute to intergenerational transmission of metabolic risk [34].

DISCUSSION

The present review demonstrates that metabolic syndrome (MetS) significantly influences the course of pregnancy and is associated with a wide spectrum of maternal and perinatal complications. The growing prevalence of obesity and insulin resistance among women of reproductive age has resulted in an increasing number of pregnancies complicated by metabolic disorders. Contemporary evidence indicates that metabolic syndrome should be considered not merely a collection of metabolic abnormalities but a complex condition affecting multiple physiological systems relevant to pregnancy [35].

One of the key findings across studies published between 2015 and 2026 is the strong association between metabolic syndrome and gestational diabetes mellitus. Insulin resistance, which is central to MetS, becomes more pronounced during pregnancy due to physiological hormonal changes. This interaction leads to impaired glucose tolerance and a higher incidence of GDM among women with pre-existing metabolic abnormalities [36]. Hyperglycemia during pregnancy contributes to fetal hyperinsulinemia and excessive fetal growth, which explains the higher rates of macrosomia and operative delivery observed in this population [37]. Hypertensive disorders of pregnancy, particularly preeclampsia, represent another major complication associated with metabolic syndrome. Endothelial dysfunction, chronic inflammation, and oxidative stress—key features of MetS—are also central mechanisms in the pathogenesis of preeclampsia. Studies consistently show that women with metabolic syndrome have a two- to three-fold increased risk of developing hypertensive complications during pregnancy [38]. Furthermore, the coexistence of obesity and insulin resistance exacerbates vascular dysfunction, leading to more severe clinical manifestations.

Maternal obesity, as a core component of metabolic syndrome, plays a pivotal role in adverse pregnancy outcomes. Excess adipose tissue contributes to systemic inflammation, hormonal imbalance, and metabolic dysregulation. These changes affect placental function, potentially leading to both fetal overgrowth and growth restriction. The placenta in women with MetS often exhibits structural and functional alterations, including

impaired vascularization and increased inflammatory markers [39].

The increased rate of cesarean delivery observed in women with metabolic syndrome is multifactorial. Fetal macrosomia, dysfunctional labor, and obstetric complications such as preeclampsia contribute to higher surgical delivery rates. Additionally, obesity may complicate labor management and increase the risk of operative interventions [40]. Postoperative complications, including wound infection and thromboembolism, are also more frequent in this group. The review also highlights significant fetal and neonatal consequences. Macrosomia remains the most commonly reported fetal outcome associated with metabolic syndrome. However, studies also describe an increased risk of preterm birth, neonatal hypoglycemia, respiratory distress, and admission to neonatal intensive care units [41]. These outcomes reflect the impact of maternal metabolic disturbances on fetal development and placental function.

Long-term health implications for both mother and child are of particular concern. Women who experience metabolic syndrome during pregnancy are at elevated risk of developing type 2 diabetes and cardiovascular disease later in life. Similarly, offspring exposed to an adverse intrauterine metabolic environment have higher risks of obesity, insulin resistance, and metabolic syndrome in adulthood [42]. This intergenerational transmission of metabolic risk underscores the importance of early identification and intervention.

Preventive strategies should focus on preconception counseling, weight optimization, and metabolic control. Lifestyle modifications, including dietary changes and physical activity, have been shown to improve metabolic parameters and reduce pregnancy complications [43]. Multidisciplinary management involving obstetricians, endocrinologists, nutritionists, and primary care physicians is essential for optimizing outcomes.

Screening for metabolic syndrome in early pregnancy may help identify women at high risk for complications. Early intervention and close monitoring can reduce the incidence of gestational diabetes, hypertensive disorders, and adverse perinatal outcomes [44]. Clinical guidelines increasingly recommend individualized care plans for women with metabolic syndrome to improve both maternal and neonatal health.

Overall, the literature indicates that metabolic syndrome has a substantial impact on pregnancy outcomes and long-term health. Continued research is needed to clarify underlying mechanisms, improve screening strategies, and develop targeted interventions. Public health initiatives aimed at reducing obesity and



promoting metabolic health among women of reproductive age are also critical.

Conclusion

Metabolic syndrome represents a significant risk factor for adverse maternal and perinatal outcomes. Women with metabolic syndrome are at increased risk of gestational diabetes mellitus, hypertensive disorders of pregnancy, preeclampsia, cesarean delivery, and thromboembolic complications. Fetal and neonatal risks include macrosomia, preterm birth, metabolic disturbances, and long-term predisposition to obesity and cardiovascular disease.

The findings of this review emphasize the importance of early detection and comprehensive management of metabolic syndrome before and during pregnancy. Preconception counseling, weight management, and metabolic control can significantly improve pregnancy outcomes. Multidisciplinary care and individualized monitoring strategies are essential for reducing complications and improving maternal and neonatal health.

Further research should focus on preventive strategies, optimization of screening protocols, and long-term follow-up of both mothers and offspring. Addressing metabolic syndrome as a public health issue may contribute to improved reproductive outcomes and reduced long-term disease burden.

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