

Risk Factors and Outcomes of Intrauterine Growth Restriction in Pregnancies

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ABSTRACT

Background: Intrauterine growth restriction (IUGR) is a major obstetric complication associated with significant perinatal morbidity and mortality. It results from complex interactions between maternal, fetal and placental factors and remains a key contributor to adverse neonatal outcomes, particularly in low-resource settings. **Objective:** This study aimed to evaluate the risk factors and maternal-neonatal outcomes of IUGR in a tertiary care hospital in Bangladesh. **Methods & Materials:** A case-control study was conducted in the Department of Obstetrics and Gynaecology, Bangladesh Medical University, Dhaka, from January to December 2025. A total of 80 pregnant women were included, with 40 IUGR cases and 40 matched controls. Data on socio-demographic variables, clinical risk factors, obstetric complications and neonatal outcomes were collected using structured forms and hospital records. Statistical analysis was performed using SPSS version 25.0 and odds ratios with 95% confidence intervals were calculated. **Results:** Maternal age extremes, low socioeconomic status, low BMI and inadequate antenatal care were significantly associated with IUGR. Pregnancy-induced hypertension, preeclampsia and anemia were important clinical risk factors. Obstetric complications such as oligohydramnios, placental insufficiency and preterm delivery were significantly higher among cases. Neonates born to IUGR mothers had higher rates of low birth weight (80%), NICU admission (50%), respiratory distress (35%) and low Apgar scores. **Conclusion:** IUGR is strongly associated with adverse maternal conditions and poor neonatal outcomes. Early detection and targeted antenatal interventions are essential to reduce associated morbidity and improve perinatal health outcomes.

Keywords: Intrauterine growth restriction, pregnancy outcomes, placental insufficiency, antenatal risk factors.

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INTRODUCTION

Intrauterine growth restriction (IUGR) represents a significant obstetric and neonatal concern characterized by failure of the fetus to achieve its genetically predetermined growth potential. It is associated with increased perinatal morbidity, mortality and long-term health consequences, including metabolic and cardiovascular disorders [1]. Globally, IUGR remains a major contributor to low birth weight and adverse perinatal outcomes, particularly in low- and middle-income countries where maternal health disparities are prominent [2]. The etiology of IUGR is multifactorial, involving maternal, fetal and placental factors. Among maternal determinants, age extremes, nutritional status, socioeconomic conditions and inadequate antenatal care have been consistently implicated [3]. Gardosi et al. emphasize that fetal growth is influenced by maternal constitutional

factors and placental function, highlighting the importance of individualized assessment in identifying growth-restricted fetuses [4]. Similarly, Sharma et al. describe IUGR as a complex condition with both antenatal and postnatal implications requiring early detection for improved outcomes [1]. Placental insufficiency is considered a central pathological mechanism in IUGR development. Krishna et al. reported that impaired uteroplacental circulation leads to reduced oxygen and nutrient delivery to the fetus, resulting in restricted growth [5]. Additionally, maternal hypertensive disorders, including preeclampsia, have been strongly associated with placental dysfunction and fetal growth impairment [6]. Maternal anemia has also been identified as a significant risk factor due to reduced oxygen-carrying capacity, affecting fetal development [7].

Several epidemiological studies from low-resource settings have reported similar associations between maternal factors and IUGR. Tesfa et al. identified maternal undernutrition, hypertensive disorders and inadequate antenatal care as major predictors of IUGR in Ethiopian populations [8]. Mohammad et al. further highlighted that maternal age, socioeconomic status and obstetric complications significantly influence fetal growth outcomes [3]. These findings underscore the multifactorial nature of IUGR and its strong link with maternal health conditions.

Neonatal outcomes of IUGR are equally concerning. Malhotra et al. reported that growth-restricted infants are at increased risk of respiratory distress, hypoglycemia and NICU admission due to impaired physiological adaptation at birth [9]. Long-term consequences include neurodevelopmental delay and increased

susceptibility to chronic diseases in adulthood [10]. The burden is particularly high in developing countries where access to specialized perinatal care is limited [11]. Despite growing evidence, there remains a gap in region-specific data on the combined influence of maternal socio-demographic, clinical and obstetric factors on IUGR in Bangladesh. Most available studies focus on isolated risk factors rather than an integrated analysis of maternal and neonatal outcomes. Furthermore, limited case-control evidence exists within tertiary care settings in Bangladesh Medical University, highlighting the need for context-specific research. Therefore, this study aims to evaluate the risk factors and outcomes of IUGR among pregnant women in a tertiary care hospital in Dhaka, Bangladesh. Understanding these associations is essential for early identification, prevention strategies and improving maternal and neonatal health outcomes in similar resource-constrained settings.

OBJECTIVES

The objective of this study was to evaluate the risk factors and maternal-neonatal outcomes of IUGR in a tertiary care hospital in Bangladesh.

METHODS & MATERIALS

This case-control study was conducted in the Department of Obstetrics and Gynaecology at Bangladesh Medical University (BMU), Dhaka, Bangladesh, over a one-year period from January to December 2025. The study population consisted of pregnant women attending antenatal care or admitted for delivery, with a total sample size of 80 participants,

including 40 cases diagnosed with intrauterine growth restriction (IUGR) and 40 age-matched controls with uncomplicated pregnancies and appropriate fetal growth. IUGR cases were identified based on clinical assessment and ultrasonographic evidence of estimated fetal weight below the 10th percentile for gestational age, in accordance with standard obstetric criteria. Participants were selected using purposive sampling after applying predefined eligibility criteria. Inclusion criteria for both groups included singleton pregnancy, gestational age of 28 weeks or more and willingness to participate. Women with multiple gestations, known fetal congenital anomalies, or chronic maternal medical conditions such as severe cardiac disease, renal failure, or other systemic illnesses were excluded, along with those having incomplete clinical records or unwilling to provide consent. Data were collected using a structured, pretested questionnaire and review of hospital records to ensure accuracy and consistency. Information regarding socio-demographic characteristics, including maternal age, residence, socioeconomic status, body mass index and antenatal care utilization, was obtained through direct interview. Clinical and obstetric data such as pregnancy-induced hypertension, preeclampsia, gestational diabetes mellitus, anemia status and previous history of IUGR were extracted from antenatal cards, laboratory reports and physician documentation. Ultrasound findings were reviewed to confirm fetal growth status, amniotic fluid volume and placental condition. Neonatal outcomes including birth weight, Apgar score at five minutes,

NICU admission and respiratory distress were recorded immediately after delivery from neonatal registers. Standardized measurement techniques were applied for anthropometric and clinical assessments to maintain reliability. Confidentiality was strictly maintained by assigning unique identification codes to participants and all data were securely stored with restricted access. Data were checked regularly for completeness and consistency throughout collection. Statistical analysis was performed using SPSS version 25.0. Descriptive statistics were used to summarize categorical variables as frequencies and percentages. Associations between variables were assessed using chi-square tests and odds ratios with 95% confidence intervals were calculated to determine the strength of associations. A p-value of less than 0.05 was considered statistically significant.

RESULT

Table I shows maternal socio-demographic characteristics among cases and controls. Maternal age <20 or >35 years was observed in 45.0% of cases versus 22.5% of controls (OR 2.83, p=0.028). Low socioeconomic status was significantly higher in cases (75.0%) compared to controls (47.5%) with an OR of 3.29 (p=0.010). Maternal BMI <18.5 kg/m² was found in 52.5% of cases versus 25.0% of controls (p=0.012). Inadequate antenatal care (<4 visits) was more frequent in cases (65.0%) than controls (30.0%, p=0.002). Rural residence showed a higher proportion in cases but was not statistically significant.

Table I
Maternal socio-demographic characteristics.

Variable	IUGR cases (n=40)	Controls (n=40)	OR (95% CI)	p-value
Maternal age <20 or >35 years	18 (45.0%)	9 (22.5%)	2.83 (1.10–7.26)	0.028
Rural residence	28 (70.0%)	24 (60.0%)	1.57 (0.62–3.96)	0.34
Low socioeconomic status	30 (75.0%)	19 (47.5%)	3.29 (1.29–8.37)	0.01
Maternal BMI <18.5 kg/m ²	21 (52.5%)	10 (25.0%)	3.30 (1.26–8.62)	0.012
Inadequate antenatal care (<4 visits)	26 (65.0%)	12 (30.0%)	4.25 (1.65–10.90)	0.002

Table II presents maternal clinical risk factors associated with IUGR. Pregnancy-induced hypertension was present in 35.0% of cases versus 12.5% of controls (OR 3.78, p=0.015). Preeclampsia showed a

significant association with cases (30.0%) compared to controls (7.5%, OR 5.31, p=0.008). Gestational anemia was more prevalent among cases (62.5%) than controls (35.0%, p=0.014). Gestational

diabetes mellitus showed no significant association. A previous history of IUGR was higher in cases (15.0%) compared to controls (2.5%).

Table II
Maternal clinical risk factors associated with IUGR.

Risk factor	Cases (n=40)	Controls (n=40)	OR (95% CI)	p-value
Pregnancy-induced hypertension	14 (35.0%)	5 (12.5%)	3.78 (1.21–11.8)	0.015
Preeclampsia	12 (30.0%)	3 (7.5%)	5.31 (1.35–20.9)	0.008
Gestational anemia (Hb <11 g/dL)	25 (62.5%)	14 (35.0%)	3.09 (1.22–7.84)	0.014
Gestational diabetes mellitus	5 (12.5%)	6 (15.0%)	0.80 (0.23–2.78)	0.73
Previous history of IUGR	6 (15.0%)	1 (2.5%)	6.94 (0.80–59.6)	0.048

Table III describes obstetric and placental outcomes. Oligohydramnios occurred in 40.0% of cases versus 15.0% of controls (OR 3.80, p=0.011). Placental insufficiency

was significantly higher in cases (45.0%) compared to controls (12.5%, OR 5.68, p=0.003). Preterm delivery was observed in 55.0% of cases versus 20.0% of controls

(OR 4.92, p=0.001). PROM and cesarean delivery showed higher proportions in cases but were not statistically significant.

Table III
Obstetric and placental outcomes.

Outcome	Cases (n=40)	Controls (n=40)	OR (95% CI)	p-value
Oligohydramnios	16 (40.0%)	6 (15.0%)	3.80 (1.26–11.4)	0.011
Placental insufficiency (clinical diagnosis)	18 (45.0%)	5 (12.5%)	5.68 (1.83–17.6)	0.003
Preterm delivery (<37 weeks)	22 (55.0%)	8 (20.0%)	4.92 (1.79–13.5)	0.001
PROM	10 (25.0%)	6 (15.0%)	1.88 (0.62–5.72)	0.25
Cesarean delivery	24 (60.0%)	18 (45.0%)	1.83 (0.75–4.47)	0.18

Table IV presents neonatal outcomes among cases and controls. Low birth weight was significantly higher in cases (80.0%) compared to controls (25.0%, OR

12.8, p<0.001). Very low birth weight occurred in 22.5% of cases versus 5.0% of controls (p=0.031). Low Apgar score was observed in 37.5% of cases compared to

12.5% of controls (p=0.009). NICU admission and neonatal respiratory distress were significantly higher among cases.

Table IV
Neonatal outcomes.

Neonatal outcome	Cases (n=40)	Controls (n=40)	OR (95% CI)	p-value
Low birth weight (<2.5 kg)	32 (80.0%)	10 (25.0%)	12.8 (4.3–38.2)	<0.001
Very low birth weight (<1.5 kg)	9 (22.5%)	2 (5.0%)	5.50 (1.07–28.1)	0.031
Low Apgar score (<7 at 5 min)	15 (37.5%)	5 (12.5%)	4.25 (1.35–13.3)	0.009
NICU admission	20 (50.0%)	6 (15.0%)	5.67 (1.93–16.7)	0.001
Neonatal respiratory distress	14 (35.0%)	4 (10.0%)	4.86 (1.46–16.1)	0.006

DISCUSSION

The present study demonstrated a strong association between maternal socio-demographic vulnerability, clinical risk factors and adverse obstetric and neonatal outcomes among pregnancies complicated by intrauterine growth restriction. Maternal extremes of age, low socioeconomic status, undernutrition and inadequate antenatal care were significantly higher among cases. Similar patterns were reported by Mohammad et al., who observed that maternal age, poor socioeconomic conditions and insufficient antenatal visits significantly increased the risk of IUGR in a South Asian population [3]. These findings reinforce the role of social determinants in fetal growth restriction. In this study, maternal BMI <18.5 kg/m² showed a significant association with IUGR. This aligns with findings from Tesfa et al., who reported maternal undernutrition as a strong predictor of fetal growth restriction in low-resource settings [8]. Nutritional deficiency reduces placental perfusion and fetal nutrient supply, which may explain impaired fetal growth patterns observed in our study population. Pregnancy-induced hypertension and preeclampsia were significantly associated with IUGR in the present study. Similar observations were reported by Toloza et al., who demonstrated a strong relationship between hypertensive disorders and impaired placental function leading to fetal growth restriction [6]. Placental insufficiency observed in our study further

supports this mechanism. Krishna et al. also emphasized that uteroplacental vascular compromise is central to the development of IUGR [7]. Gestational anemia was significantly higher among cases in the present study. Rahman et al. reported that maternal anemia is associated with reduced oxygen delivery to the fetus, increasing the risk of low birth weight and growth restriction [7]. These physiological mechanisms are consistent with our findings, where anemia emerged as a significant modifiable risk factor. Obstetric complications such as oligohydramnios and preterm delivery were significantly associated with IUGR in this study. Similar findings were reported by Shrestha et al., who observed increased rates of preterm birth and reduced amniotic fluid volume in IUGR pregnancies [12]. Placental insufficiency in our study further reflects impaired fetal environment, consistent with findings by Melamed et al., who highlighted placental dysfunction as a key determinant of fetal growth restriction [13]. Neonatal outcomes in the present study showed significantly higher rates of low birth weight, low Apgar score, NICU admission and respiratory distress among IUGR cases. Malhotra et al. demonstrated similar neonatal morbidities, attributing them to fetal hypoxia and impaired intrauterine adaptation [8]. Additionally, Monono et al. reported increased NICU admissions and respiratory complications

in growth-restricted neonates, supporting our findings [14]. The strong association between IUGR and very low birth weight observed in this study is consistent with findings by Cutland et al., who emphasized low birth weight as a major outcome of fetal growth restriction with significant perinatal implications [15]. Furthermore, Sharma et al. highlighted that IUGR infants are at increased risk of neonatal complications requiring intensive care support, consistent with our NICU admission rates [8]. Overall, the findings of this study align with existing literature, reinforcing the multifactorial nature of IUGR involving maternal health, placental function and obstetric complications. The consistency between our findings and previous studies suggests that both biological and socio-environmental determinants play a critical role in fetal growth outcomes. This emphasizes the need for integrated maternal healthcare approaches focusing on early identification of high-risk pregnancies.

CONCLUSION

This study demonstrates that intrauterine growth restriction is significantly associated with adverse maternal socio-demographic and clinical factors, including poor antenatal care, hypertensive disorders and anemia. IUGR pregnancies showed markedly increased risks of oligohydramnios, placental insufficiency, preterm delivery and adverse neonatal

outcomes such as low birth weight and NICU admission. Early identification of high-risk pregnancies and improved antenatal surveillance may substantially reduce IUGR-related morbidity and improve maternal and neonatal health outcomes in tertiary care settings.

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CONFLICTS OF INTEREST

None.

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