e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.12.38

International Journal of Pharmaceutical Quality Assurance 2025; 16(12); 220-226

Original Research Article

Evaluation of Correlation of Serum Triglycerides Level with Macrosomia in Non-GDM Healthy Mothers

Sakshi Chauhan[1], Bhanita Deka[2], Bishnu Prasad Das[3]

[1]Postgraduat Resident, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam

[2]Associate Professor, MBBS, MD, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam

[3]Professor and Head of the Department, MBBS, MD, FICOG, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam

Received: 25-09-2025 / Revised: 23-10-2025 / Accepted: 26-11-2025

Corresponding Author: Dr. Sakshi Chauhan

Conflict of interest: Nil

Abstract:

Background: Macrosomia, typically characterized by a neonatal birth weight exceeding 4000 grams, constitutes a significant obstetric challenge due to its association with heightened perinatal morbidity and delivery-related complications. Although gestational diabetes mellitus (GDM) is a well-established etiological factor, the pathophysiological contributors to macrosomia in euglycemic pregnancies remain inadequately elucidated.

Objective: To investigate the potential correlation between maternal serum triglyceride concentrations in the third trimester with macrosomia among normoglycemic, non-obese metabolically healthy pregnant women.

Methods: A prospective observational study was undertaken at the Department of Obstetrics and Gynaecology, Gauhati Medical College, encompassing a cohort of non-diabetic, non-obese, normotensive gravid women devoid of pre-existing metabolic comorbidities. Maternal serum triglyceride levels were quantified during the third trimester, and participants were longitudinally followed until parturition. Neonatal birth weights were meticulously recorded, and instances of macrosomia were identified.

Results: Analysis revealed a statistically significant and positive association between elevated maternal triglyceride levels in late gestation and the occurrence of macrosomia. Subjects exhibiting hypertriglyceridemia were demonstrably more predisposed to delivering macrosomic neonates relative to counterparts with normative lipid profiles.

Conclusion: Third-trimester maternal hypertriglyceridemia may function as an autonomous risk factor for macrosomia in the absence of gestational diabetes. The incorporation of routine lipid profiling into antenatal care protocols may facilitate the early stratification of risk and inform evidence-based dietary and lifestyle modifications aimed at mitigating the incidence of excessive fetal growth.

Keywords: Macrosomia; Maternal serum triglycerides; Non-diabetic pregnancy; Hypertriglyceridemia; Fetal growth; Third trimester; Lipid metabolism; Antenatal screening.

Introduction

Fetal macrosomia, characterized by excessive fetal growth resulting in an abnormally large neonate, remains a significant obstetric concern due to its association with increased maternal and neonatal morbidity.

The term "macrosomia" is generally applied to infants with birth weights exceeding 4,000 grams or 4,500 grams, independent of gestational age, while "large for gestational age" (LGA) denotes fetal weights above the 90th percentile for a specific gestational age. Although the clinical implications of macrosomia are well recognized, there is no universally standardized definition, which complicates its epidemiological assessment and clinical management. A constellation of maternal factors has been identified as contributory to the development of macrosomia, including pre-existing diabetes mellitus, GDM, maternal obesity, excessive gestational weight gain, dyslipidemia, impaired glucose tolerance, and prolonged gestational duration. Gestational age exerts a pivotal influence, as the risk of macrosomia rises with advancing pregnancy, particularly beyond term.

The prevalence of macrosomia varies worldwide, affecting approximately 3% to 15% of pregnancies

globally, with higher rates (5% to 20%) reported in developed countries. Alarmingly, the incidence of macrosomia has escalated by 15–25% over the past two decades, likely reflecting increasing rates of maternal obesity and diabetes.

Notably, a prior history of delivering a macrosomic infant remains one of the most potent predictors of recurrence, increasing the likelihood five- to ten-fold even after adjusting for other factors such as maternal body mass index (BMI), gestational weight gain, and glycemic status. Other recognized risk factors include maternal birth weight, multiparity, genetic predispositions, and parental phenotypes. Epidemiological data further suggest that taller women and pregnancies involving male fetuses carry an elevated risk of macrosomia.

In pregnancies unaffected by diabetes, emerging evidence implicates elevated maternal serum triglyceride levels as an independent risk factor for macrosomia and LGA. However, heterogeneity in study designs, population demographics, and ethnicity contributes to inconsistencies in reported associations.

Physiologically, pregnancy induces a state of hypertriglyceridemia driven by enhanced hepatic triglyceride synthesis and reduced catabolism of triglyceride-rich lipoproteins, mediated primarily by hormonal changes in late gestation, particularly elevated estrogen and insulin resistance. These hormonal alterations diminish the activity of lipoprotein lipase and hepatic lipase, enzymes essential for triglyceride metabolism, thereby exacerbating hypertriglyceridemia.

While maternal triglycerides do not cross the placental barrier intact, placental enzymes such as lipases hydrolyze triglycerides into free fatty acids, which are actively transported across the placenta to fulfill fetal energy requirements and contribute to fetal growth. This placental metabolic processing potentially underlies the association between maternal hypertriglyceridemia and excessive fetal growth.

Given these considerations, the present study seeks to elucidate the correlation between third-trimester maternal serum triglyceride concentrations and the risk of macrosomia in metabolically healthy, non-diabetic pregnant women.

Aim: To elucidate the relationship between maternal serum triglyceride levels and the occurrence of fetal macrosomia in metabolically healthy, non-gestational diabetic pregnant women.

Objectives

1. To determine the strength and nature of the association between third-trimester maternal serum triglyceride concentrations and macrosomia in non-diabetic pregnancies.
2. To identify and characterize maternal risk factors that predispose to macrosomia in the absence of gestational diabetes.
3. To evaluate neonatal outcomes and complications related to macrosomia within this cohort.

Materials and Methods

Study Population: This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Gauhati Medical College and Hospital, Guwahati. The study included antenatal patients presenting between November 2023 and October 2024.

Sample Size: A total of 97 pregnant women meeting the eligibility criteria were enrolled.

Inclusion Criteria:

- Singleton pregnancies at 34 to 36 completed weeks of gestation.
- Pre-pregnancy BMI within the normal range.
- Patients who subsequently delivered at term.

Exclusion Criteria:

- Obesity (pre-pregnancy BMI above the normal threshold).
- Diagnosis of GDM.
- Pregnancy-induced hypertension.
- Anaemia.
- Thyroid disorders.
- Multiple gestations.
- Presence of congenital fetal anomalies.
- Intrauterine fetal demise.

Data Collection Procedure: Between 32 and 34 weeks of gestation, patients presenting to the outpatient department underwent comprehensive clinical appraisal, including vital signs assessment and BMI calculation based on pre-gestational weight and height. Obstetric and medical history were recorded with emphasis on prior macrosomia, NICU admissions, and congenital anomalies. Screening protocols excluded GDM, hypertension, and metabolic disorders. Eligible participants underwent serum triglyceride testing in the third trimester and were followed until delivery. Neonatal birth weight, delivery mode, sex, and immediate postnatal status were documented.

Results

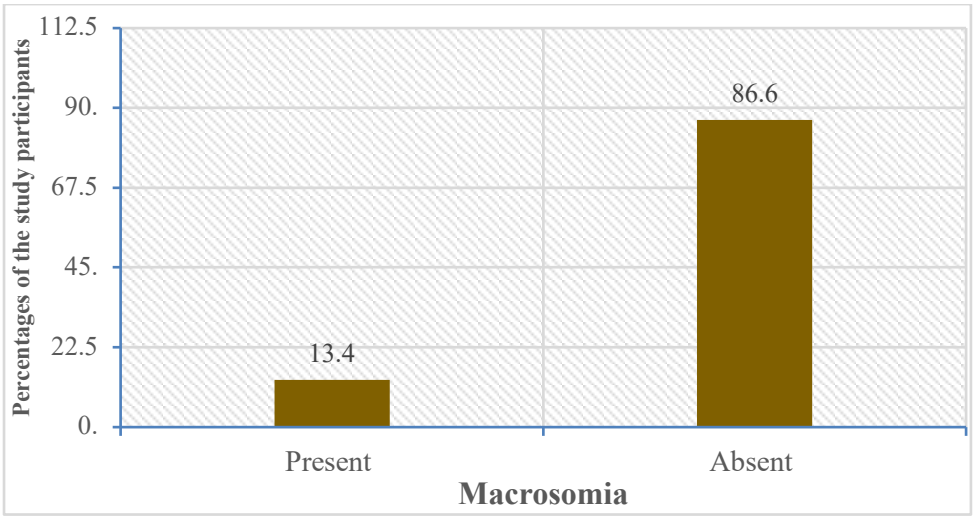


Figure 1: Percentage of Macrosomia in Study Population

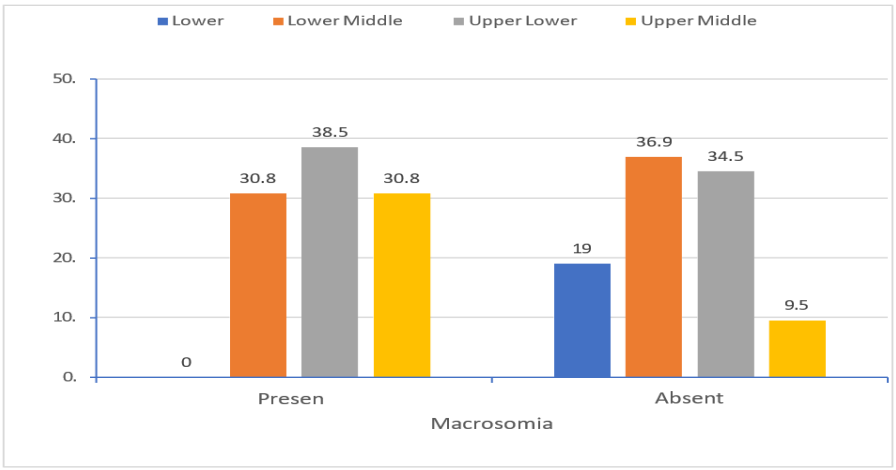


Figure 2: Distribution of Macrosomia According Socio -Economic Class

The association between macrosomia and socio-economic status among the 97 study participants is detailed in the following observations: Among the 13 neonates classified as macrosomic, the highest proportion—5 cases (38.5%)—belonged to the upper lower socio-economic class, followed by 4 cases (30.8%) each from the lower middle and upper middle classes. Notably, no macrosomic neonates were reported in the lower socio-economic class. In contrast, among the 84 neonates without macrosomia, the majority were distributed within the lower middle class (31 cases; 36.9%) and the upper lower class (29 cases; 34.5%). The lower class and upper middle class accounted for 16 cases (19.0%) and 8 cases (9.5%) respectively.

When comparing proportions:

- The upper middle class exhibited a disproportionately higher percentage of macrosomic neonates (30.8%) relative to its share among non-macrosomic cases (9.5%).
- The upper lower class had a slightly higher representation among macrosomic neonates (38.5%) compared to non-macrosomic cases (34.5%).
- Conversely, the lower middle class showed a reduced proportion of macrosomia (30.8%) compared to its representation in the non-macrosomia group (36.9%).
- The lower socio-economic class, despite constituting 19.0% of the non-macrosomic group, did not include any macrosomic neonates.

Statistical analysis revealed no significant correlation between socio-economic status and macrosomia ($p = 0.082$).

However, a trend was observed toward increased prevalence of macrosomia in the upper lower and upper middle socio-economic strata.

These differences, though clinically suggestive, did not reach statistical significance—potentially due to limitations in sample size.

Association between Macrosomia and Gravidity:

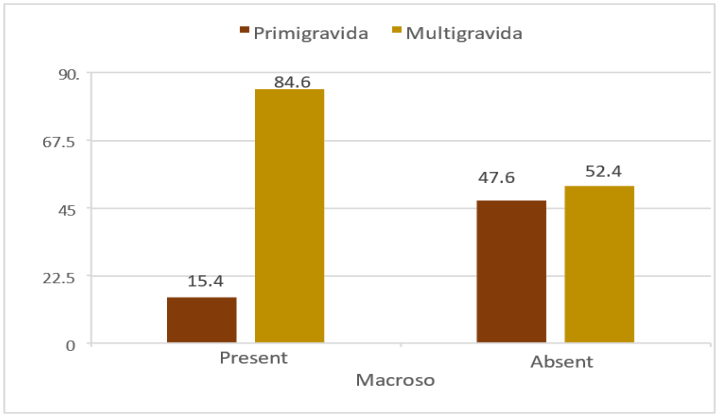


Figure 3:

The data delineate a significant association between maternal gravidity and the incidence of fetal macrosomia in the studied cohort. Among the 13 neonates classified as macrosomic, 11 (84.6%) were born to multigravida mothers, in striking contrast to only 2 (15.4%) macrosomic cases born to primigravida women.

In comparison, among the 84 non-macrosomic neonates, primigravida women constituted nearly half (47.6%) of the births, while multigravida mothers accounted for 52.4%. This disparity suggests a heightened predisposition for macrosomia with increasing parity.

A statistically significant p-value of 0.036 substantiates that gravidity is not merely a coincidental factor but may independently contribute to the risk profile for macrosomia. Several pathophysiological mechanisms may underlie this association. Multigravida women are more likely to experience cumulative metabolic alterations—such as increased insulin resistance, elevated lipid profiles, and gestational weight retention from prior pregnancies. These changes can enhance nutrient availability to the fetus, thereby promoting excessive fetal growth. Furthermore, repeated pregnancies may induce lasting modifications in uterine and placental function, potentially facilitating augmented placental nutrient transfer. Behavioral factors may also contribute; multiparous women might display altered health-seeking behaviors, dietary patterns, or reduced adherence to gestational weight management recommendations.

Overall, gravidity emerges as a crucial variable in the complex etiological landscape of fetal macrosomia and warrants inclusion in prenatal risk assessment models.

Association between Previous History of Macrosomia and Current Pregnancy: The analysis also revealed a statistically significant association between a maternal history of macrosomia and the incidence of macrosomia in the index pregnancy ($p = 0.016$). Among mothers who delivered macrosomic neonates in the current pregnancy, 23.1% had a documented history of macrosomia. This finding indicates that the odds of delivering a macrosomic infant are substantially higher in women with a previous macrosomic birth compared to those without such a history. The strength of this association highlights the predictive value of maternal obstetric history in identifying pregnancies at elevated risk for macrosomia recurrence.

Association of Macrosomia with Previous History:

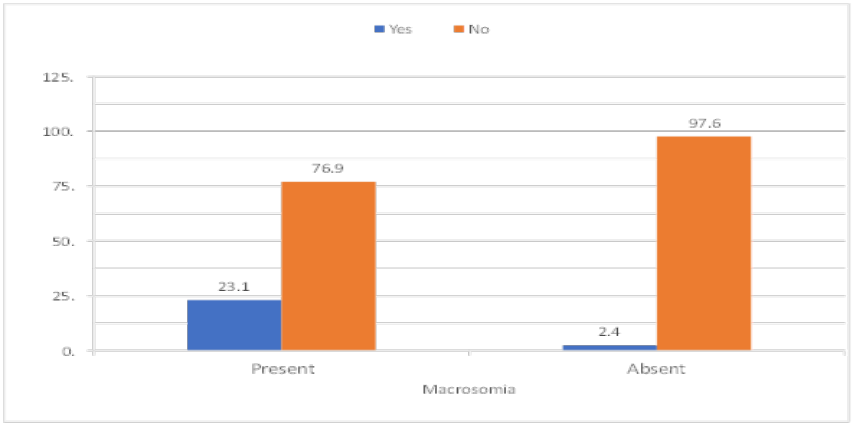
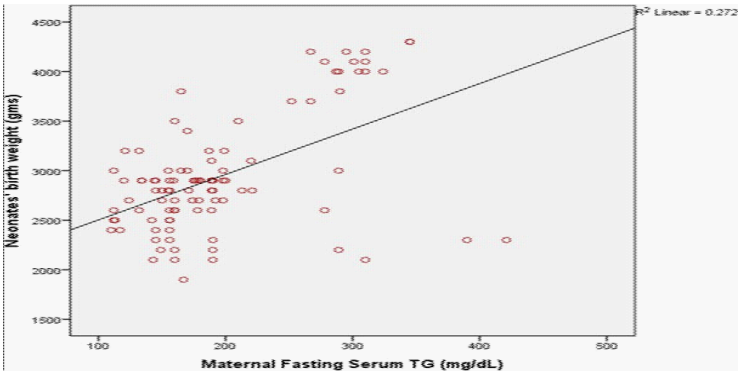


Figure 4:

Among the mothers who delivered macrosomic neonates, 23.1% had a documented history of prior macrosomia.

In contrast, this proportion was markedly lower—only 2.4%—in the non-macrosomic cohort. This finding indicates that the odds of delivering a macrosomic infant are significantly higher in women with a previous macrosomic birth compared to those without such a history. The observed difference in proportions between the two groups underscores the strong predictive value of a prior macrosomic delivery for recurrence in subsequent pregnancies. These results highlight the importance of detailed obstetric history in prenatal risk stratification. A history of macrosomia should prompt closer monitoring, early nutritional counselling, and tailored antenatal care to mitigate recurrence and its associated complications.

SPEARMAN CORRELATION ANALYSIS BETWEEN NEONATE'S BIRTH WEIGHT AND MATERNAL SERUM TG :



ROC CURVE FOR EACH VARIABLE AS AN IDENTIFYING FACTOR OF MACROSOMIA :

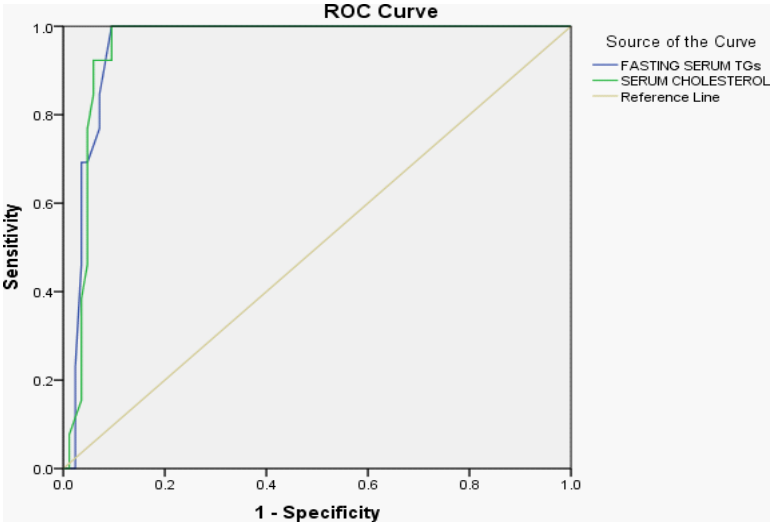


Figure 5:

Discussion

The present study established a significant positive correlation between elevated maternal serum triglyceride (TG) concentrations in the third trimester and the occurrence of macrosomia in non-diabetic, non-obese, normotensive pregnant women.

This observation aligns with the growing body of evidence indicating that maternal lipid metabolism plays a critical role in fetal growth independent of glucose homeostasis [5,8,10]. Several studies corroborate these findings. Panigrahi et al. (2022) reported significantly higher maternal TG levels (~333 mg/dL) among mothers of macrosomic neonates compared to controls (~253 mg/dL; p = 0.001), highlighting hypertriglyceridemia as a consistent metabolic predictor of excessive fetal growth [5]. Similarly, Wang et al. (2018) found that women with TG concentrations in the ≥90th percentile (~310 mg/dL) had a significantly increased incidence of large-for-gestational-age

(LGA) infants compared to those with lower TG levels (~275 mg/dL) [6]. Son et al. (2010) also reported that maternal hypertriglyceridemia in GDM pregnancies conferred an increased odds ratio (~3.1) for LGA neonates, reinforcing the link between maternal lipid status and fetal overgrowth [7]. In the present study, mothers who delivered macrosomic infants had mean TG levels of approximately 305 mg/dL, significantly higher than the 180 mg/dL observed in those delivering normal-weight neonates. The unadjusted odds ratio (7.8), which increased to 12.9 upon multivariable adjustment, emphasizes the independent predictive strength of TG levels even after accounting for confounders such as parity and socioeconomic status.

The mechanism underpinning this relationship likely involves placental lipid metabolism. Although triglycerides themselves do not cross the placenta, placental lipases hydrolyze TGs into free fatty acids, which are then transferred to the fetus to support growth [8,13]. Elevated maternal TG levels therefore enhance the pool of available substrates for fetal lipogenesis, resulting in increased adiposity and higher birth weight. This metabolic pathway may explain why hypertriglyceridemia, even in the absence of GDM, is associated with macrosomia [5,9]. The current findings also identified significant associations with multigravidity ($p = 0.036$) and previous history of macrosomia ($p = 0.016$), consistent with existing literature suggesting cumulative metabolic adaptations and recurrent risk patterns across pregnancies [3,6]. These factors may act synergistically with maternal lipid alterations to promote fetal overgrowth. Comparable studies such as those by Scholl and Hediger (1994) and Herrera (2011) have similarly documented that maternal lipid concentrations, particularly TGs, rise physiologically with gestational age and correlate positively with neonatal birth weight [5,10]. The pathophysiological interplay between maternal insulin resistance, estrogen-induced hepatic lipogenesis, and reduced lipoprotein lipase activity results in augmented lipid availability to the developing fetus [8,11,12].

From a clinical standpoint, the findings advocate for routine maternal lipid profiling during antenatal care, particularly in the third trimester, even among non-GDM women. Early identification of hypertriglyceridemia provides an opportunity for dietary counseling, lifestyle interventions, and closer fetal growth monitoring to mitigate macrosomia-related obstetric complications, including shoulder dystocia, birth trauma, and increased cesarean delivery rates [1–3,6].

Furthermore, ROC curve analysis demonstrated a high predictive accuracy (AUC = 0.957) with an optimal TG cut-off value of >282.5 mg/dL (sensitivity 84.6%, specificity 92.9%), confirming the clinical utility of TG measurement as a potential screening marker for macrosomia risk assessment.

While the results are compelling, limitations include the modest sample size (n = 97) and single-center design, which may limit generalizability. Additionally, the study did not evaluate other lipid fractions such as total cholesterol or HDL/LDL ratios, which could further clarify the lipid profile's contribution to fetal growth. Nonetheless, the robust association observed underscores a need for larger, multi-centric prospective trials to validate these findings and develop standardized TG thresholds for clinical use [10–13].

Table 1:

Study (Reference)	Maternal Tg (Mg/Dl) In Women with Macrosomic Babies	Maternal Tg (Mg/Dl) In Women with Non Macrosomic Babies	Association
Current Study	~305.0	~180.0	~7.8 (Unadjusted), Increasing To 12.9 (Adjusted)
Panigrahi Et Al. (2022)	~333.0	~253.0	Significant Association (P = 0.001)
Wang Et Al. (2018)	Median ~3.5 Mmol/L (~310 Mg/Dl)	Median ~3.1 Mmol/L (~275 Mg/Dl)	Increased Risk for Lga with Tg ≥ 90th Percentile
Son Et Al. (2010)	Elevated Tg Values Reported	Lower Tg in Non- Lga Group	~3.1 For Lga in Gdm Pregnancies

Conclusion

Third-trimester maternal hypertriglyceridemia emerges as a significant and independent risk factor for fetal macrosomia among non-diabetic, metabolically healthy women.

The strong correlation observed in this study suggests that maternal lipid metabolism plays an important role in fetal growth dynamics independent of glycemic control. Incorporating serum triglyceride assessment into routine antenatal investigations could enable early risk identification and preventive interventions to reduce

macrosomia-related obstetric and perinatal complications.

Summary:

This prospective observational study involving 97 non-diabetic, non-obese pregnant women at Gauhati Medical College and Hospital revealed the following key findings:

- Incidence of Macrosomia: 13.4% of neonates were macrosomic.
- Maternal Serum Triglycerides: Mean TG levels were significantly higher in mothers of macrosomic babies (~305 mg/dL) compared to non-macrosomic (~180 mg/dL).
- Association with Gravidity: Multigravida status was significantly associated with macrosomia ($p = 0.036$).
- Recurrence Risk: A prior history of macrosomia markedly increased risk in the current pregnancy ($p = 0.016$).
- Predictive Accuracy: TG levels >282.5 mg/dL predicted macrosomia with 84.6% sensitivity and 92.9% specificity.

These results affirm that maternal serum triglyceride level is a powerful independent determinant of macrosomia, advocating the integration of lipid profiling into antenatal screening protocols.

References:

1. American College of Obstetricians and Gynecologists. Practice Bulletin No. 216: Fetal growth restriction. Obstet Gynecol. 2020; 135(2): E40–E57.
2. Catalano PM. Management of obesity in pregnancy. Obstet Gynecol. 2007;109(2 Pt 1):419–33.
3. Boulet SL, Alexander GR, Salihu HM, Pass M. Macrosomic births in the United States: Determinants, outcomes, and proposed grades of risk. Am J Obstet Gynecol. 2003;188(5):1372–8.
4. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363(9403):157–63.
5. Scholl TO, Hediger ML. Maternal serum triglyceride concentration as a predictor of infant birth weight. Am J Clin Nutr. 1994;59(3):553–8.
6. World Health Organization. Global prevalence of macrosomia and related maternal-fetal complications: A systematic review. Geneva: WHO; 2018.
7. Zhang T, He Y, Lin S, et al. Increasing incidence of fetal macrosomia in China: 2000 to 2010. Int J Gynaecol Obstet. 2013;121(3):255–9.
8. Herrera E, Ortega-Senovilla H. Maternal lipid metabolism and placental lipid transfer in pregnancies complicated by diabetes. Adv Exp Med Biol. 2010; 661:91–107.
9. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third report of the NCEP expert panel. Circulation. 2002;106(25):3143–421.
10. Herrera E. Lipid metabolism in pregnancy and its implications for fetal growth. Curr Pharm Biotechnol. 2011;12(6):977–90.
11. Butte NF. Carbohydrate and lipid metabolism in pregnancy: Normal compared with gestational diabetes mellitus. Am J Clin Nutr. 2000;71(5 Suppl):1256S–61S.
12. Pijlman AH, Jansen EHJM, Vekemans M, et al. Influence of pregnancy and gestational diabetes mellitus on plasma lipoprotein profiles. Clin Chem. 2013;59(1):154–61.
13. Herrera E, Amusquivar E. Lipid metabolism during pregnancy and its implications for fetal growth. Curr Pharm Biotechnol. 2000;1(2): 179–87.