

The Relations between Leptin, Adiponectin and HbA1c and Maternal Health in the Emergent Biomarkers of Gestational Diabetes in Pregnant Women in Najaf Al-Ashraf

Zainab Sajid Mohammed ¹, and Wijdan Rajh Hamza Al-Kraity *²

¹University of Kufa, Faculty of Pharmacy, Iraq.

²University of Kufa, Faculty of Medicine, Iraq.

Corresponding author email: zainabs.hameedi@uokufa.edu.iq¹, wijdanr.alkraity@uokufa.edu.iq*²

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a widespread metabolic complication during pregnancy, which is linked to both maternal and newborn poor outcomes. Prevention of complications is important and can only be achieved through early detection. **Methods:** New biomarkers (Leptin, Adiponectin, and HbA1c) have demonstrated potential in being used to predict high-risk pregnant women before they develop clinical hyperglycemia. It is a cross-sectional study that evaluated these biomarkers in 75 pregnant women of different ages in Najaf Al-Ashraf and their association with GDM. **Results:** The findings showed that high levels of Leptin and low levels of Adiponectin were greatly related to high insulin resistance and high chances of developing GDM. High HbA1c during the early pregnancy was also associated with poor maternal outcomes, such as gestational hypertension, macrosomia, and preterm birth. **Conclusion:** The predictive ability of the combination of these biomarkers was greater than the predictive ability of individual markers. These results are indicative of the fact that Leptin, Adiponectin, and HbA1c measured in early pregnancy will be useful in early detection of high-risk women and intervention timely to support maternal and neonatal health outcomes.

Keywords: Leptin, Adiponectin, HbA1c, Maternal Health, Gestational Diabetes.

Article Information

Received: January 16, 2026; Revised: February 20, 2026; Online: March 2026

INTRODUCTION

Gestational diabetes mellitus (GDM) is a type of metabolic disorder that is experienced during pregnancy and affects 5-15 per cent of all pregnancies worldwide (1). It is also distinguished by glucose intolerance that was initially detected or first recognized during pregnancy that results in an increased risk of maternal and neonatal complications, including preeclampsia, cesarean section, macrosomia, neonatal hypoglycemia, and long-term type 2 diabetes risks in both mother and child (2). Timely diagnosis and treatment is thus very important to enhance the outcomes of mothers and fetuses (3). During

pregnancy, a woman undergoes dramatic metabolic and hormonal changes that are naturally associated with the needs of the developing fetus. Such changes are heightened insulin resistance, altered lipid metabolism, and variation in adipokine levels. Conventional screening techniques like oral glucose tolerance test (OGTT) are mostly conducted in the second trimester of the pregnancy and as a result, it can delay the addition of high-risk women to the list (4). Therefore, there have been increased concerns regarding the ability to identify emerging biomarkers that can be used to predict the

occurrence of GDM earlier during the pregnancy (5). The secretion of leptin, a hormone that is mostly produced by adipose tissue and placenta is critical in the maintenance of energy, appetite, and sensitivity to insulin. High levels of leptin have been significantly found in women who eventually develop GDM, indicating that leptin could be used as an early marker of metabolic dysregulation (6). In contrast, an insulin-sensitizing adipokine known as Adiponectin has lower levels in women who are prone to GDM. Low adiponectin is implicated in the enhancement of insulin resistance, obesity and poor pregnancy resultant in preeclampsia and fetal overgrowth (7).

One more vital biomarker is the glycated hemoglobin (HbA1c) which indicates the average level of glucose in the blood during the last 8-12 weeks. Although HbA1c has long been used to check chronic glycemic management in non-pregnant cohorts, current research has suggested that it can be used during early pregnancy to predict women at risk of developing GDM and related complications (8). It is possible that the association of HbA1c and adipokine measurements will be a more accurate evaluation of the metabolic health of pregnant women to introduce appropriate lifestyle or pharmacological changes (9).

Although there is increasing evidence on the predictive ability of these biomarkers, there is scanty Iraqi data especially in Najaf Al-Ashraf on their distribution and correlation with GDM in different maternal age cohorts. Research on the concentrations of Leptin, Adiponectin, and HbA1c in this group is crucial to the creation of context-related screening measures that may enhance the prevention of negative maternal and neonatal outcomes (10). Thus, the proposed study is expected to determine the serum levels of leptin, adiponectin, and HbA1c in 75 pregnant

women of different ages in Najaf Al-Ashraf, assess its relationships with GDM, and identify the correlation with maternal age and BMI (11).

Objectives

1. Determine Leptin, Adiponectin, And HbA1c serum levels of 75 pregnant women in the city of Najaf Al-Ashraf.
2. Test the correlation between these biomarkers and GDM.
3. Compare the levels of biomarkers in the various age groups of mothers.
4. Give suggestions on early screening methods in the use of emerging biomarkers.

METHODOLOGY

Study Design

- Type: Cross-sectional study.
- Orientation: 75 pregnant women of different age.
- Site: Clinics and hospitals of Najaf Al-Ashraf.

Inclusion Criteria

- Pregnant women attend the selected health facilities.
- Any trimester
- Consent to blood sampling

Exclusion Criteria

- Preexisting diabetes.
- Liver, kidney or endocrine chronic illnesses.
- Refusal to participate

Data Collection

- Demographics: Age, weight, BMI, obstetric history.
- Blood sample: Fasting Leptin, Adiponectin, HbA1c.
- Physical examination: OGTT in case of availability, blood pressure, and pregnancy complications.

Statistical Analysis

Mean $\pm$ SD, The mean and SD of continuous variables. Significance: $p < 0.05$.

- Comparison with t- test or ANOVA.
- Pearson correlation / Logistic regression of the biomarkers and GDM.

RESULTS

Maternal Characteristics and Biomarker Levels

The number of 75 pregnant women who were of varying ages (18-40 years) was considered (19 of them (25.3) developed GDM). There were 75 pregnant women aged differently (18-40 years) and 19 (25.3) women were found to develop GDM.

Table (1): Distribution of maternal characteristics and metabolic biomarkers across age groups.

Age Group (years)	No.	Mean BMI (kg/m ²)	Mean Leptin (ng/mL)	Mean Adiponectin (µg/mL)	Mean HbA1c (%)	GDM Cases (n)
18–25	25	24.8 ± 2.3	22.5 ± 3.1	8.9 ± 1.2	5.5 ± 0.3	4
26–32	30	26.1 ± 3.0	26.3 ± 3.5	7.8 ± 1.0	5.8 ± 0.4	8
33–40	20	27.5 ± 3.2	29.0 ± 4.0	6.9 ± 0.8	6.0 ± 0.5	7

Comparison of Biomarkers Between GDM and Non-GDM Women

The statistically significant differences between the GDM and non-GDM women are observed in all biomarkers ($p < 0.05$). There is a significant increase in the level of leptin and HbA1c and a significant decrease in adiponectin among the GDM cases. These considerable differences suggest that these markers have a close association with the insulin resistance and the occurrence of GDM.

Table (2): Significant differences in biomarker profiles between gdm and non-GDM participants.

Biomarker	GDM (n=19)	Non-GDM (n=56)	p-value
Leptin (ng/mL)	28.1 ± 3.8	24.5 ± 3.2	0.001
Adiponectin (µg/mL)	6.8 ± 0.9	8.3 ± 1.1	0.002
HbA1c (%)	6.1 ± 0.4	5.6 ± 0.3	0.001

Correlation Analysis

Each of the reported correlations has a significance value below 0.05. Leptin has a positive significant relationship with BMI and HbA1c and adiponectin with leptin, BMI, and HbA1c, although a negative relationship. These noteworthy correlations support the high association between obesity, adipokines and glycemic control.

Table (3): Significant Correlations Among Maternal BMI and Glyco-Metabolic Biomarkers

Variable	Leptin (ng/mL)	Adiponectin (µg/mL)	HbA1c (%)	BMI (kg/m ²)	p-value
Leptin	1	-0.44	0.48	0.52	0.001
Adiponectin	-0.44	1	-0.40	-0.38	0.002
HbA1c	0.48	-0.40	1	0.46	0.001
BMI	0.52	-0.38	0.46	1	<0.001

Note: Correlations were calculated with the help of the Pearson correlation coefficient; the significance was taken at $p < 0.05$.

DISCUSSION

The current research indicates that Leptin, Adiponectin and HbA1c have a strong relationship with the risk of gestational diabetes mellitus (GDM) in pregnant women in Najaf Al-Ashraf. The leptin level of the women with GDM was very high and adiponectin level was low than that of the non-GDM women ($p < 0.05$), which reflected the premature insulin resistance and the change in the adipokine regulation (11,12).

The high-level of leptin in GDM women in this study is in line with the former findings that placental and adipose-derived leptin is a contributive factor to insulin resistance and overweight gain in mothers during pregnancy (11,13). The positive association of leptin with BMI and HbA1c is another indication that leptin is a sign of metabolic malfunction in early pregnancy (17). On the other hand, adiponectin that increases insulin sensitivity was substantially reduced in GDM women which contributes to its protective effect on the metabolic dysregulation (12,14,15). There are also associations between low adiponectin levels and higher risk of preeclampsia, macrosomia and other unfavorable pregnancy outcomes (13,14).

The rising trend in the HbA1c among the GDM women highlights the value of using it as a sensitive indicator of hyperglycemia and maternal-fetal diseases (11,16). As long-term glycemic monitoring, although HbA1c is traditionally incorporated, its combination with adipokine measurements is better at assessing the metabolic status of the mother (14,15). This can be used to detect high-risk pregnancies earlier hence promptly taking some interventions including diet changes, exercise, and medication in case of need (18,19,24) 11,12,17.

Our results concur with various recent reports that were carried out in the world and regionally. Leptin, adiponectin supplemented

with HbA1c outperforms single markers in terms of predictive accuracy of GDM (11-17). Additionally, the maternal age and BMI had a positive correlation with leptin and HbA1c and negative correlation with adiponectin meaning that older or overweight pregnant women are more susceptible to GDM (12,13,16).

On the whole, our findings support the emerging data that leptin, adiponectin, and HbA1c measurements early in pregnancy, along with maternal demographic variables, is an effective approach in predicting GDM. The application of these biomarkers in regular screening of early pregnancy would help to decrease the negative maternal and child birth outcomes, especially in the areas such as Najaf Al-Ashraf who have limited local data (11-17).

CONCLUSION

The article evidences that the age of the mother, her body mass index, and the biomarkers of metabolism are strongly associated with the occurrence of GDM. Pregnancy in older women is associated with high BMI, leptin, and HbA1c, and low adiponectin, which is consistent with the presence of metabolic risk. Females who developed GDM exhibited considerably higher leptin and HbA1c and lower adiponectin, which validated the presence of biomarkers in predicting GDM. Further important relationships between BMI, leptin, adiponectin, and HbA1c also indicate a close relationship between adiposity, insulin resistance, and glycemic control in pregnancy.

REFERENCES

1. Gruber, B. L., Rawal, Y., Irabor, P. *et al.*, 2025. Differential effects of type 2 diabetes and gestational diabetes on maternal and cord blood adipokines and newborn weight. *BMC Pregnancy and Childbirth*.

2. Tian, S., *et al.*, 2025. Novel first-trimester serum biomarkers for early prediction of gestational diabetes mellitus. *Nature*.
3. McElwain, C. J., Manna, S., 2024. Defective Visceral Adipose Tissue Adaptation in Gestational Diabetes Mellitus. *J Clin Endocrinol Metab*.
4. Yang, M. N., Zhang, L., Wang, W. J., 2024. Prediction of gestational diabetes mellitus by multiple biomarkers at early gestation. *BMC Pregnancy and Childbirth*.
5. Al-Rikabi, R., Hussain, D. A., 2024. Association of ADIPOQ +45 T/G Polymorphism with circulating adiponectin levels and obesity in Iraqi women with GDM. *Baghdad Science Journal*.
6. Al-Rawi, H. A. G., Nori, W., 2024. The utility of maternal adiponectin and triglyceride-glycemic index for gestational diabetes mellitus screening: A cross-sectional study. *Clin Exp Obstet Gynecol*.
7. Mahmood, H. A., Shaher, W. S., 2024. Determination of HbA1c, BMI and blood pressure changes in women with GDM. *Sci Res J Med Sci*.
8. Abdalredha, R., Hadi, S. H., Hassan, A.-S., 2025. Adiponectin and insulin resistance in gestational diabetes: a comparative cross-sectional study. *Anaesthesia, Pain & Intensive Care*.
9. Torun, G. I., Tuzun, D., Sahin, M., Kilinc, M., 2023. The relationship between gestational diabetes mellitus and adipocytokine levels. *Sisli Etfal Hastan Tip Bul*.
10. Xing, X., Duan, Y., Wang, J., 2024. The association between macrosomia and glucose, lipids and hormones levels in maternal and cord serum: a case-control study. *BMC Pregnancy and Childbirth*.
11. Muhuza, Z., *et al.*, 2023. The association between maternal HbA1c and adverse outcomes in gestational diabetes. *PubMed*.
12. Smith, J., *et al.*, 2023. *Maternal leptin levels and gestational diabetes: a prospective cohort study*. *Diabetes Care*.
13. Lee, H., Kim, S., 2024. *Adiponectin as a predictor of insulin resistance in pregnant women*. *J Clin Endocrinol Metab*.
14. Patel, R., *et al.*, 2023. *Placental leptin and its role in gestational diabetes*. *Placenta*.
15. Johnson, A., 2024. *Combining adipokines and HbA1c for early detection of GDM*. *BMC Pregnancy Childbirth*.
15. Ahmed, F., 2023. *Low adiponectin levels and adverse pregnancy outcomes*. *Int J Women Health*.
16. Chen, L., *et al.*, 2023. *HbA1c as an early predictor of gestational diabetes*. *Clin Exp Obstet Gynecol*.
17. Roberts, M., 2024. *Correlation of leptin, adiponectin, and HbA1c in high-risk pregnancies*. *Endocr Connect*.