

Associated Factors and Clinical Characteristics of Diabetes among Pregnant Women in Sulaimani City: A Cross-Sectional Study

Mohammed A. Majid ^{1,*}, Heshw K. Othman¹, Shaima Y. Mohammed Ali¹, Rozhan Y. Khalil²

¹ Department of Medical Sciences, College of Medicine, University of Sulaimani, Sulaimani 46001, Iraq.

² Department of Obstetrics and Gynecology, College of Medicine, University of Sulaimani, Sulaimani 46001, Iraq.

* Corresponding author: mohammed.05002124@univsul.edu.iq

Submission: March 10, 2026 Accepted: May 24, 2026 Published: June 30, 2026

Abstract

Background: Gestational diabetes mellitus (GDM) is associated with significant maternal and neonatal complications and represents an increasing public health concern worldwide. **Objectives:** To describe the clinical characteristics and maternal profiles of pregnant women with diabetes mellitus in Sulaimani City. **Materials and Methods:** A descriptive cross-sectional study was conducted from December 2023 to March 2024 at Sulaimani Maternity Hospital, Iraq. A total of 100 pregnant women diagnosed with diabetes during pregnancy (GDM, type 1, or type 2 diabetes) according to NICE criteria were recruited using convenience sampling. Data were collected through structured face-to-face interviews using a validated questionnaire assessing sociodemographic characteristics, obstetric history, lifestyle factors, body mass index (BMI), comorbidities, and awareness. Statistical analysis was performed using IBM SPSS Statistics version 22. Associations were examined using the chi-square test or Fisher's exact test where appropriate, with $p \leq 0.05$ considered statistically significant. **Results:** A total of 100 pregnant women were included in the study, with a mean age of 34.18 ± 5.76 years. Most participants were aged 26–35 years (45%) and 36–45 years (50%), were non-employed (84%), and belonged to the middle-income group (75%). The majority were Kurdish (97%) and multigravida (91%), with 72% in the third trimester of pregnancy. Regarding knowledge of diabetes risk factors, 11% reported good knowledge, 21% moderate knowledge, 38% limited knowledge, and 30% reported no knowledge. In terms of awareness, 39% were well aware, 45% somewhat aware, and 16% were not aware of diabetes-related risks. A significant association was observed between parity and type of diabetes ($p = 0.024$), while no significant associations were found with other maternal characteristics ($p > 0.05$). **Conclusion:** Among pregnant women with diabetes in Sulaimani City, overweight status, unhealthy dietary habits, limited awareness, and low physical activity were frequently observed characteristics. A statistically significant association was identified only between parity and type of diabetes. Strengthening educational programs and promoting healthy lifestyle practices during pregnancy may help improve maternal health outcomes.

Keyword: Gestational diabetes mellitus, Parity, Obesity, Lifestyle, Cross-sectional study.

Introduction

Diabetes mellitus is a chronic metabolic disorder resulting from inadequate insulin production by the pancreas or ineffective utilization of insulin by the body, leading to elevated blood glucose levels [1]. It includes several categories, such as type 1 diabetes mellitus, type 2 diabetes mellitus, maturity-onset diabetes of the young (MODY), gestational diabetes mellitus (GDM), and second-

dary forms associated with hormonal disorders or steroid use [2]. Diabetes is associated with increased morbidity and adverse health outcomes [3]. Improved education and awareness regarding diabetes management may help reduce complications and improve overall health outcomes among affected individuals [4]. Gestational diabetes mellitus is defined as glucose intolerance that develops or is first reco-

gnized during pregnancy [5]. GDM is associated with several maternal and neonatal complications, including increased infant birth weight, and is also recognized as a potential risk factor for future cardiovascular and metabolic disorders in both mothers and their offspring [6]. According to the International Diabetes Federation, GDM accounts for the majority of diabetes cases occurring during pregnancy [7,8]. Several maternal and lifestyle-related factors have been linked to GDM, including obesity, advanced maternal age, multiparity, family history of diabetes mellitus, certain ethnic backgrounds, and polycystic ovarian syndrome [8, 11–14]. Physical activity has been shown to reduce the likelihood of GDM, and regular moderate exercise during pregnancy is recommended by the American College of Obstetricians and Gynecologists [15,16]. The prevalence of GDM continues to increase globally, paralleling rising rates of maternal obesity, sedentary lifestyles, and delayed childbearing [17–20]. Previous studies have suggested that dietary habits and lifestyle behaviors before and during pregnancy may influence the occurrence of GDM; however, findings regarding preventive interventions have remained inconsistent [21]. In addition, variations in diagnostic criteria and screening approaches for GDM contribute to differences in reported prevalence rates across studies [22]. Despite ongoing efforts to improve maternal healthcare, gaps remain in understanding the clinical characteristics and maternal factors observed among pregnant women with diabetes in different populations. Therefore, this study aimed to evaluate the clinical characteristics and maternal profiles of pregnant women with diabetes mellitus in Sulaimani City.

Materials and Methods

This descriptive cross-sectional study was conducted to evaluate the clinical characteristics

and maternal profiles of pregnant women with diabetes mellitus. The study was carried out between 16 December 2023 and 26 March 2024 at Sulaimani Maternity Hospital in Sulaimani City, Iraq. Sulaimani Maternity Hospital is one of the main specialized obstetric and gynecological centers in the region and provides antenatal, delivery, and postnatal healthcare services to a large population of pregnant women. The study population included pregnant women diagnosed with diabetes mellitus during pregnancy; including gestational diabetes mellitus (GDM) and pre-existing diabetes mellitus (type 1 and type 2 diabetes mellitus). GDM was diagnosed according to the National Institute for Health and Care Excellence (NICE) guidelines, defined as fasting plasma glucose ≥ 5.6 mmol/L or 2-hour plasma glucose ≥ 7.8 mmol/L following a 75-g oral glucose tolerance test. Type 1 and type 2 diabetes mellitus were identified based on documented previous physician diagnoses available in hospital medical records. The inclusion of gestational diabetes mellitus (GDM), type 1 diabetes mellitus, and type 2 diabetes mellitus was intended to reflect real-world obstetric practice and provide an overall assessment of diabetic pregnancies in the studied population. Although these conditions differ in pathophysiology and associated maternal factors, stratified analysis was limited by the relatively small sample size. Therefore, the findings were interpreted cautiously, and the potential heterogeneity among diabetes types has been acknowledged as a study limitation. A total of 100 eligible pregnant women were recruited using a convenience sampling technique during the study period. The sample size was based on the number of eligible pregnant women attending the hospital during the study period. The inclusion criteria comprised pregnant women aged 15–45 years who were diagnosed with diabetes mellitus during pregnancy, attended

Sulaimani Maternity Hospital during the study period, and agreed to participate in the study. Women who declined participation, had incomplete questionnaire responses, or had medical conditions preventing completion of the interview were excluded. Data were collected using a structured questionnaire developed under the supervision of academic faculty members to assess the clinical characteristics and maternal factors among pregnant women with diabetes mellitus. The questionnaire consisted of 29 items distributed across six domains: sociodemographic characteristics (7 items), obstetric history (4 items), diabetes history and diagnosis (4 items), lifestyle-related and maternal factors (5 items), comorbid conditions (7 items), and self-perceived knowledge and awareness regarding diabetes during pregnancy (2 items). Body mass index (BMI) before pregnancy was obtained from participants' hospital medical records. The questionnaire primarily consisted of closed-ended questions to facilitate statistical analysis. Participants' knowledge and awareness regarding diabetes during pregnancy were assessed based on self-reported perceptions during the interview. Participants were asked to subjectively describe their level of knowledge and awareness, which were subsequently categorized as good, moderate, limited, or none. To ensure content validity, the questionnaire was reviewed by academic supervisors and experts in obstetrics and community medicine to evaluate the clarity, relevance, and appropriateness of the included items. Prior to the main data collection phase, a pilot study was conducted among 10 pregnant women diagnosed with diabetes mellitus to assess the clarity and comprehensibility of the questionnaire items. Minor modifications were subsequently made to improve wording and organization. Data obtained from the pilot study were excluded from the final analysis. Data were collected

through face-to-face interviews conducted at the maternity hospital. Before each interview, participants received a clear explanation of the study objectives and questionnaire content. Interviews were administered directly by members of the research team to ensure consistent understanding of the questions and to minimize information bias. Completed questionnaires were reviewed for completeness and accuracy before data entry, and all collected data were coded to maintain confidentiality.

Data Analysis

The collected data were entered into Microsoft Excel for data entry, preliminary organization, and cleaning. Statistical analysis was subsequently performed using IBM SPSS Statistics software (version 22). Descriptive statistical analyses were conducted to summarize the characteristics of the study participants. Frequencies and percentages were used to describe categorical variables, while means and standard deviations were calculated for continuous variables. Inferential statistical analysis was performed to examine the associations between demographic and clinical characteristics and potential risk factors. The Chi-square test was used to determine the association between categorical variables. When the expected cell counts were less than five, Fisher's exact test was applied. A p-value of ≤ 0.05 was considered statistically significant.

Ethics approval

Ethical approval for the study was obtained from the Ethics Committee of the College of Medicine at University of Sulaimani (Approval No. 138). The study was conducted in accordance with international ethical standards and the principles of the Declaration of Helsinki. Participation in the study was voluntary, and informed consent was obtained from all participants prior to data

collection. Participants were assured that their information would remain confidential and would be used solely for research purposes.

Results

The present cross-sectional study included 100 pregnant women recruited from Sulaimani Maternity Hospital. The study participants were predominantly aged above 25 years, non-employed, and from a middle-income socioeconomic background. Most participants were of Kurdish ethnicity, and educational attainment varied, with higher education being the most widely reported level among participants (Table 1).

Table 1: Sociodemographic Characteristics of the Study Participants

Characteristic	Percentage
Age	
15–25	5
26–35	45
36–45	50
Occupation	
Employee	16
Non-employed	84
Ethnicity	
Kurd	97
Arab	3
Socioeconomic status	
Low income	15
Middle income	75
High income	10
Educational level	
None	10
Primary school	29
Secondary school	14
High school	10
Higher	37

Most participants were in the third trimester of pregnancy and were multigravida. The majority had two to three children, while abortion history varied among participants, with nearly half reporting no previous abortions (Table 2).

Table 2: Obstetric Characteristics of the Study Participants

Characteristics	Percentage
Trimester of Pregnancy	
First trimester	9
Second trimester	19
Third trimester	72
Gravida	
Primigravida	9
Multigravida	91
Number of Children	
None	15
One	9
Two to three	72
Four and More	4
Number of abortions	
None	46
One	33
Two or more	21

Participants reported generally low knowledge of diabetes risk factors, with only a small proportion reporting good knowledge. However, awareness levels were comparatively higher, with most participants reporting being somewhat or well aware of diabetes-related risks (Table 3).

Table 3: Participants' Knowledge and Awareness of Diabetes Risk Factors

Knowledge & Awareness	Percentage (%)
Knowledge about diabetes RF	
Good knowledge	11
Moderate knowledge	21

Majid et al.: Risk Factors of Diabetes in Pregnant Women

Limited knowledge	38
No knowledge	30
Awareness	
Well aware	39
Somewhat aware	45
Not aware	16

The mean age of participants was 34.18 ± 5.76 years, with a median of 35.5 years and a mode of 36 years (Table 4).

Table 4: Descriptive Statistics for Participants' Age

N	100
Mean	34.180
Median	35.500
Mode	36.0
Std. Deviation	5.7584
Sum	3418.0

A high proportion of participants had a positive family history of diabetes and reported dietary patterns high in sugar and fat. Nearly half were overweight, and a considerable proportion reported low to moderate physical activity levels. Most participants were non-smokers, and a notable proportion had a history of PCOS and previous gestational diabetes mellitus. Regarding diabetes management, various treatment modalities were reported, with oral medications being the most common. The majority had been diagnosed within the past year (Table 5).

Table 5: Distribution of Clinical and Lifestyle Characteristics Among Study Participants

Clinical and lifestyle characteristics	Percentage (%)
Family history	
Positive	65
Negative	35
BMI before pregnancy	

Normal weight	37
Overweight	49
Obese	14
Dietary habits	
Balanced and Healthy	24
High in sugar and fats	76
Physical activity	
Sedentary	27
Low activity	32
Moderate activity	38
High activity	3
Smoking status	
Never smoked	95
Smoked	5
PCOS before pregnancy	
Yes	20
No	80
History of GDM	
Yes	30
No	70
Diabetes medication	
Oral medication	50
Insulin injections	20
Combination therapy	25
None	5
Time since diagnosis	
Within 1 year	70
More than 1 year	30

A statistically significant association was observed between parity and type of diabetes ($p = 0.024$). No significant associations were found between diabetes type and other maternal characteristics, including socioeconomic status, residency, occupation, family history of diabetes mellitus, hypertension, pre-pregnancy BMI, pregnancy trimester, number of abortions, or gravidity (Table 6).

Table 6: Association between Maternal Characteristics and Type of Diabetes among Pregnant Women

Variable	Category	Type 1 (n)	Type 2 (n)	Gestational Diabetes (n)	P-value
Socioeconomic status	Low income	2	1	12	0.336
	Middle income	2	9	64	
	High income	1	2	7	
Residency	Inside city	4	8	60	0.847
	Outside city	1	4	23	
Occupation	Employee	0	0	16	0.142
	Housewife	5	12	67	
Family history of diabetes	Negative	0	3	30	0.204
	Positive	5	9	53	
Hypertension (HTN)	Yes	2	2	11	0.262
	No	3	10	72	
BMI before pregnancy	Normal weight	4	4	29	0.142
	Overweight	0	5	44	
	Obese	1	3	10	
Parity	Nulliparous	1	3	11	0.024*
	Primiparous	1	3	5	
	Multiparous	3	4	65	
	Grand multiparous	0	2	2	
Pregnancy Trimester	First trimester	1	3	5	0.119
	Second trimester	2	2	15	
	Third trimester	2	7	63	
Number of abortions	0	2	4	40	0.829
	1	2	6	25	
	≥2	1	2	18	
Gravida	Primigravida	1	2	6	0.383
	Multigravida	4	10	77	

Note: Values are presented as frequency (n). Associations between maternal characteristics and type of diabetes were analyzed using the Chi-square test or Fisher's Exact test where appropriate. Statistical significance was considered at $P < 0.05$.

Discussion

This study described the clinical and maternal characteristics of pregnant women with diabetes mellitus attending Sulaimani Maternity Hospital. Most participants were older than 25 years, multigravida, and from middle-income socioeconomic backgrounds. Overweight status, positive family history of diabetes mellitus, unhealthy dietary patterns, and limited self-reported knowledge regarding diabetes during pregnancy were prevalent among participants. A statistically significant association was identified only between parity and type of diabetes mellitus. The significant association observed between parity and diabetes type is consistent with findings reported in previous regional studies, including research conducted in Saudi Arabia, where higher parity was associated with gestational diabetes mellitus [23]. In contrast, no statistically significant associations were identified between diabetes type and other maternal characteristics, including occupation, residence, hypertension, family history of diabetes mellitus, or pre-pregnancy BMI. Most participants in this study were aged above 25 years, particularly within the 36–45-year age group. Similar observations have been reported in previous studies, where increasing maternal age was commonly observed among women diagnosed with diabetes during pregnancy [24]. A high proportion of participants reported a positive family history of diabetes mellitus, and many participants were overweight before pregnancy. Similar findings have been reported in studies from different populations, where overweight status and positive family history were also commonly identified among women with diabetes during pregnancy [25,27]. Although these variables were not significantly associated with diabetes type in the present study, previous literature has described obesity and family history as characteristics frequently noted among women

with gestational diabetes mellitus and impaired glucose metabolism during pregnancy. Several unfavorable lifestyle patterns were identified among participants. Most participants reported dietary patterns characterized by high sugar and fat intake, while low-to-moderate physical activity levels were common. Comparable findings have been reported in previous studies evaluating maternal lifestyle behaviors during pregnancy [28,30]. These observations support the importance of promoting healthy dietary habits and physical activity during antenatal care. However, due to the descriptive nature of the study, these findings should be interpreted cautiously and should not be considered evidence of causation. Many participants reported limited knowledge regarding diabetes during pregnancy. Similar findings have been described in previous studies evaluating awareness of gestational diabetes and preventive health behaviors among women of reproductive age [31]. Limited awareness regarding diabetes-related risks and healthy lifestyle practices may influence maternal health behaviors during pregnancy. These findings highlight the importance of strengthening educational and counseling programs during antenatal care visits to improve awareness regarding diabetes prevention and management. The findings of the present study should be interpreted in light of the following limitations.

Limitations of study

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design prevents establishing causal relationships between maternal characteristics and diabetes during pregnancy. Second, the use of convenience sampling from a single maternity hospital may limit the representativeness of the sample and reduce the generalizability

of the findings to other populations. Additionally, the relatively small sample size may have limited the statistical power to detect weaker associations between variables. The inclusion of different diabetes types (gestational diabetes mellitus, type 1 diabetes mellitus, and type 2 diabetes mellitus) may have introduced heterogeneity due to differences in underlying pathophysiology and clinical characteristics. In addition, only bivariate statistical analysis was performed, and no multivariable analysis was conducted to control for potential confounding factors. Finally, some information, particularly lifestyle behaviors and awareness levels, was self-reported and may therefore be subject to recall or reporting bias. Future multicenter studies with larger sample sizes and longitudinal designs are recommended to further evaluate maternal characteristics associated with diabetes during pregnancy.

Conclusion

This study described the maternal, clinical, and lifestyle-related characteristics of pregnant women with diabetes mellitus attending Sulaimani Maternity Hospital. Overweight status, positive family history of diabetes mellitus, unhealthy dietary patterns, and limited knowledge regarding diabetes during pregnancy were frequently observed among participants. A statistically significant association was identified only between parity and type of diabetes mellitus, while no significant associations were found with other maternal or clinical variables.

These findings highlight the importance of improving awareness of healthy lifestyle practices and diabetes during pregnancy. Further multicenter studies with larger sample sizes and multivariable analysis are recommended to better evaluate maternal characteristics associated with diabetes during pregnancy.

Acknowledgments

We extend our sincere appreciation to all the physicians in the fields of Community and Family Medicine for their invaluable contributions to the planning of this research and their generous assistance throughout its execution. Special recognition and gratitude are owed to Dr. Rozhan Yassin Khalil for providing guidance and supervision throughout the duration of our project. Additionally, we express our heartfelt thanks to Dr. Shahow Abdulrahman Ezzaddin for his pivotal role in the analysis of our research endeavor. The successful culmination of this project owes much to the participation and support of numerous individuals and colleagues, whose contributions, though too extensive to enumerate here, were indispensable to its realization.

Conflict of Interest

The authors affirm that they do not have any conflicts of interest.

References

- [1] World Health Organization. *Diabetes*. Geneva: WHO; 2023 Apr 5. Available from: <https://www.who.int/news-room/fact-sheets/detail/diabetes>
- [2] Sapra A, Bhandari P. Diabetes. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. PMID: 31855345.
- [3] Wubishet BL, Byles JE, Harris ML, Jagger C. Impact of diabetes on life and healthy life expectancy among older women. *J Gerontol A Biol Sci Med Sci*. 2021;76(5):914–921.
- [4] Nazar CMJ, Bojerenu MM, Safdar M, Marwat J. Effectiveness of diabetes education and awareness of diabetes mellitus in combating diabetes in the United Kingdom: a literature review. *J Nephropharmacol*. 2015;5(2):110–115.
- [5] Quintanilla Rodriguez BS, Mahdy H. Gestational diabetes. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. PMID: 31424780.
- [6] Sweeting A, Wong J, Murphy HR, Ross GP. A clinical update on gestational diabetes mellitus. *Endocr Rev*. 2022;43(5):763–793.
- [7] International Diabetes Federation. *IDF Diabetes Atlas*. 9th ed. Brussels: IDF; 2019. Available from: <https://diabetesatlas.org>
- [8] Chasan-Taber L, Schmidt MD, Pekow P, Sternfeld B, Manson JE, Solomon CG, et al. Physical activity and gestational diabetes mellitus among Hispanic women. *J Womens Health*. 2008;17(6):999–1008.
- [9] Leng J, Liu G, Zhang C, Xin S, Chen F, Li B, et al. Physical activity, sedentary behaviors and risk of gestational diabetes mellitus: a population-based cross-sectional study in Tianjin, China. *Eur J Endocrinol*. 2016;174(6):763–773.
- [10] Chen P, Wang S, Ji J, Ge A, Chen Y, Zhu Y, et al. Risk factors and management of gestational diabetes. *Cell Biochem Biophys*. 2015;71:689–694.
- [11] Morisset AS, St-Yves A, Veillette J, Weisnagel SJ, Tchernof A, Robitaille J. Prevention of gestational diabetes mellitus: a review of studies on weight management. *Diabetes Metab Res Rev*. 2010;26(1):17–25.
- [12] Teh WT, Teede HJ, Paul E, Harrison CL, Wallace EM, Allan C. Risk factors for gestational diabetes mellitus: implications for the application of screening guidelines. *Aust N Z J Obstet Gynaecol*. 2011;51(1):26–30.
- [13] Palomba S, de Wilde MA, Falbo A, Koster MP, La Sala GB, Fauser BC. Pregnancy complications in women with polycystic ovary syndrome. *Hum Reprod Update*. 2015; 21(5):575–592.

- [14] Berkowitz GS, Lapinski RH, Wein R, Lee D. Race/ethnicity and other risk factors for gestational diabetes. *Am J Epidemiol*. 1992;135(9):965–973.
- [15] Warburton DER, Bredin SSD. Health benefits of physical activity: a systematic review of current systematic reviews. *Curr Opin Cardiol*. 2017;32(5):541–556.
- [16] Melzer K, Schutz Y, Boulvain M, Kayser B. Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. *Sports Med*. 2010;40(6):493–507.
- [17] Shirazian N, Emdadi R, Mahboubi M, Motevallian A, Fazel-Sarjuei Z, Sedighpour N, et al. Screening for gestational diabetes: usefulness of clinical risk factors. *Arch Gynecol Obstet*. 2009;280:933–937.
- [18] Nelson F, Nyarko K, Binka F. Prevalence of risk factors for non-communicable diseases for new patients reporting to Korle-Bu Teaching Hospital. *Ghana Med J*. 2015;49(1):12–18.
- [19] Pinillos-Patino Y, Herazo-Beltran Y, Mendoza-Charris H, Kuzmar I, Galeano-Munoz L. Relationship between physical activity during pregnancy and gestational diabetes: a cross-sectional study. 2017.
- [20] Bottalico JN. Recurrent gestational diabetes: risk factors, diagnosis, management, and implications. *Semin Perinatol*. 2007;31(3):176–184.
- [21] Zhang C, Rawal S, Chong YS. Risk factors for gestational diabetes: is prevention possible? *Diabetologia*. 2016;59(7):1385–1390.
- [22] Behboudi-Gandevani S, Amiri M, Bidhendi Yarandi R, Ramezani Tehrani F. The impact of diagnostic criteria for gestational diabetes on its prevalence: a systematic review and meta-analysis. *Diabetol Metab Syndr*. 2019;11:11.
- [23] Abualhamael S, Mosli H, Baig M, Noor AM, Alshehri FM. Prevalence and associated risk factors of gestational diabetes mellitus at a university hospital in Saudi Arabia. *Pak J Med Sci*. 2019;35(2):325–329.
- [24] Rajput R, Yadav Y, Nanda S, Rajput M. Prevalence of gestational diabetes mellitus and associated risk factors at a tertiary care hospital in Haryana. *Indian J Med Res*. 2013;137(4):728–733.
- [25] Leng J, Shao P, Zhang C, Tian H, Zhang F, Zhang S, et al. Prevalence of gestational diabetes mellitus and its risk factors in Chinese pregnant women: a prospective population-based study in Tianjin, China. *PLoS One*. 2015;10(3):e0121029.
- [26] Duman NB. Frequency of gestational diabetes mellitus and the associated risk factors. *Pak J Med Sci*. 2015;31(1):194–197.
- [27] Boadu WIO, Kugblenu P, Senu E, Opoku S, Anto EO. Prevalence and risk factors associated with gestational diabetes mellitus among pregnant women: a cross-sectional study in Ghana. *Front Clin Diabetes Healthc*. 2022;3:854332.
- [28] Barakat R, Pelaez M, Lopez C, Lucia A, Ruiz JR. Exercise during pregnancy and gestational diabetes-related adverse effects: a randomised controlled trial. *Br J Sports Med*. 2013;47(10):630–636.
- [29] Singh N, Madhu M, Vanamail P, Malik N, Kumar S. Efficacy of metformin in improving glycaemic control and perinatal outcome in gestational diabetes mellitus: a non-randomized study. *Indian J Med Res*. 2017;145(5):623–628.
- [30] Hwang YJ, Park BK, Park S, Kim SH. A comparative study of eating habits and food intake in women with gestational diabetes according to early postpartum glucose

tolerance status. *Diabetes Metab J.* 2011;35(4):354–363.

- [31] Rivas A, Landon M, Gaillard T, Schuster D, Osei K. Awareness of risk factors for type 2 diabetes in women with current and former gestational diabetes mellitus (GDM): implications for future primary diabetes prevention. *Diabetes Metab Syndr Clin Res Rev.* 2010;4(2):89–94.