

Research Article

THE IMPACT OF THYROID DYSFUNCTION ON THE DEVELOPMENT OF GESTATIONAL DIABETES MELLITUS AND PREGNANCY OUTCOMES: AN OBSERVATIONAL COHORT STUDY

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ABSTRACT

Background: Gestational Diabetes Mellitus(GDM) and thyroid dysfunction (TD) are the two most prevalent endocrinopathies during pregnancy.

Methods: The observational cross-sectional study was conducted in an outpatient clinic from May 2024 to May 2025. 72 patients with GDM (study group) and 40 volunteers (control group) were selected to participate in the study. Anthropometric data (body mass – BM, body mass index – BMI) and an oral glucose tolerance test were carried out for all participants during all three trimesters of pregnancy. Thyroid function (thyroid-stimulating hormone – TSH, thyroid antibodies) was assessed in the first trimester of pregnancy. A special structured questionnaire was developed for socio-economic and anamnesis data. Odds ratio (OR) and 95% Confidence intervals (95%CI) were assessed for factorial analysis.

Results: DM in the first trimester was manifested in 13 patients (18.1%), in the second trimester – in 42 patients (58.3%), in the third trimester – in 17 patients (23.6%). The presence of TD was a significant factor for GDM – the TD was revealed in 55 patients (76.4%) of the study group and 26 patients (54.2%) of the control group – OR = 2.74, 95%CI – 1.25-6.01, p=0.012. The percentage of patients with TSH more than 4 mcU/l was significantly higher in the study group compared to the control group (38.8% vs. 18.8%; OR=2.76, 95%CI – 1.16-6.56, p=0.022). It should also be noted that GDM in patients with TD was manifested significantly earlier than in patients without TD – 19.6±6.2 weeks vs. 24.8±4.4 weeks, t-test=3.21, p=0.002. Body mass gain at the end of the third trimester was also significantly higher in GD patients with TD compared to GDM patients without TD – 14.4±2.5 kg vs. 12.6±2.1 kg, t-test=2.69, p=0.009. The pregnancy in 30 patients (41.7%) with TD in the study group was achieved through IVF; IVF was used in 24 cases with TD (50.0%) in the control group. The difference was not significant. Therefore, the combination of IVF and TD cannot be considered a risk factor for GDM.

Conclusion: TD may be considered a noteworthy factor in the development of GDM. GDM may manifest earlier, and the patient’s body mass gain may be higher if TD is present during pregnancy. The combination of IVF and TD cannot be considered a risk factor for GDM.

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Keywords: gestational diabetes mellitus; in vitro fertilization; metabolic disorders; thyroid dysfunction; thyroid-stimulating hormone.

Introduction

Gestational Diabetes Mellitus (GDM) and thyroid dysfunction (TD) represent the two most common endocrine disorders complicating pregnancy. Both conditions are associated with significant short- and long-term maternal and fetal complications, including preeclampsia, cesarean delivery, macrosomia, and increased risk of future metabolic disease.¹⁻² Physiological changes during pregnancy profoundly influence both glucose metabolism and thyroid function. Thyroid hormones play a crucial role in regulating basal metabolic rate, insulin sensitivity, and pancreatic β -cell function. Even subtle alterations in thyroid function – particularly subclinical hypothyroidism and thyroid autoimmunity – have been linked to insulin resistance and impaired glucose tolerance.³⁻⁴ Recent studies suggest a growing interplay between thyroid function and glucose homeostasis during pregnancy. Thyroid dysfunction has been associated with an increased risk of gestational diabetes, possibly through mechanisms involving altered insulin signaling, chronic low-grade inflammation, and changes in adipokine regulation.^{5,6} Despite accumulating evidence, the strength and clinical relevance of the association between TD and GDM remain inconsistent across studies. Moreover, limited data exist regarding the influence of thyroid dysfunction on the timing of GDM onset and gestational weight gain – both of which are important determinants of pregnancy outcomes.⁷ Therefore, the aim of this study was to investigate the impact of thyroid dysfunction on the development of gestational diabetes, the timing of GDM onset, and selected clinical outcomes, including gestational weight gain.

Methods

Study Design and Population

This observational cohort cross-sectional study was conducted in an outpatient clinical setting between May 2024 and May 2025.

A total of 112 pregnant women were enrolled:

- 72 patients with gestational diabetes mellitus(study group)
- 40 healthy pregnant women (control group)

Inclusion criteria were:

- singleton pregnancy,
- age ≥ 18 years.

Exclusion criteria were:

- pre-existing diabetes,
- known thyroid disease under treatment,
- chronic systemic diseases.

Data Collection

Anthropometric measurements were obtained for all participants: body mass (BM), body mass index (BMI).

A structured questionnaire was used to collect:

- socio-demographic characteristics;
- medical and reproductive history (including IVF).

Laboratory Assessment

An Oral Glucose Tolerance Test (OGTT) was performed during all three trimesters:

- Thyroid function was assessed in the first trimester;
- Thyroid-stimulating hormone (TSH);
- Thyroid antibodies.

Definitions

Thyroid dysfunction (TD): defined based on elevated TSH (>4 mcU/L) and/or presence of thyroid antibodies.

Statistical Analysis

Statistical analysis was performed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation (SD). The normality of data distribution was assessed using the Shapiro – Wilk test. For normally distributed variables, differences between groups were evaluated using the independent samples t-test or analysis of variance (ANOVA), as appropriate. Categorical variables were compared using Pearson’s chi-square test or Fisher’s exact test. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated where applicable. Correlations between variables were assessed using the Pearson correlation coefficient (r). A p-value < 0.05 was considered statistically significant.

Results

Timing of Gestational Diabetes Diagnosis

GDM was diagnosed:

- First trimester: 13 patients (18.1%);
- Second trimester: 42 patients (58.3%);
- Third trimester: 17 patients (23.6%).

The Association between thyroid dysfunction and GDM shows that thyroid dysfunction was significantly more prevalent in the GDM group than in controls: 76.4% vs. 54.2%, respectively (OR = 2.74, 95% CI: 1.25-6.01, p = 0.012).

Table 1 shows the values of thyroid function parameters in the study GDM group and controls without GDM.

Table 1. Thyroid function parameters in the study GD group and controls.

Parameter	GDM group	Controls
	Mean ± SD	Mean ± SD
TSH, mcU/l	3.6 ± 2.5	2.7 ± 1.3
	t-test = 2.294, p = 0.024	
FT4, mcU/l	13.2 ± 2.0	13.4 ± 2.6
	t-test = 0.475, p = 0.636	
TG Dysfunction	GDM Group – n(%)	Controls – n(%)
Anti-Tg	22 (30.6%)	19 (39.6%)
	Chi2-test = 1.035, p = 0.309	
Anti-TPO	39 (54.2%)	28 (58.3%)
	Chi2-test = 0.201, p = 0.654	

Source:

Elevated TSH (>4 mcU/L) was also significantly associated with GDM: 38.8% in the GDM group vs. 18.8% in controls (OR = 2.76; 95% CI: 1.16-6.56, p = 0.022).

Impact on timing of GDM onset showed that GDM developed significantly earlier in patients with TD: 19.6 ± 6.2 weeks vs. 24.8 ± 4.4 weeks, respectively (t = 3.21, p = 0.002)

Patients with both GDM and TD had significantly higher weight gain: 14.4 ± 2.5 kg vs. 12.6 ± 2.1 kg (t = 2.69, p = 0.009).

IVF was used in:

- 41.7% of GDM patients with TD
- 50.0% of control patients with TD

No statistically significant difference was observed.

Discussion

This study demonstrates a significant association between thyroid dysfunction and the development of gestational diabetes. Women with TD had nearly a threefold increased risk of GDM, which is consistent with previous observational studies and meta-analyses reporting a positive association between elevated TSH levels and impaired glucose metabolism during pregnancy.^{5,8} One of the key findings of this study is that GDM occurred significantly earlier in women with TD. This observation suggests that thyroid dysfunction may accelerate the pathophysiological processes leading to insulin resistance. From a mechanistic perspective, hypothyroidism has been associated with reduced glucose uptake in peripheral tissues, increased hepatic glucose production, and dysregulation of lipid metabolism, all of which contribute to insulin resistance.^{3,9} Additionally, the greater gestational weight gain observed in women with TD may reflect underlying metabolic dysregulation. Thyroid hormones are known to influence energy expenditure and fat accumulation, and their deficiency may promote excessive weight gain during pregnancy. This is clinically relevant, as excessive gestational weight gain is independently associated with adverse maternal and neonatal outcomes.^{2,10} Interestingly, the combination of in vitro fertilization (IVF) and thyroid dysfunction was not associated with an increased risk of GDM in our study. This finding suggests that thyroid dysfunction itself may be a more critical determinant of metabolic disturbances than assisted

reproductive technologies. However, further studies with larger sample sizes are needed to confirm this observation.¹¹

From a clinical perspective, our findings support the importance of early screening for thyroid dysfunction in pregnancy. Identifying women with TD may allow for closer metabolic monitoring and timely implementation of preventive strategies aimed at reducing the risk of GDM and its complications.^{6,12}

Clinical Implications

- Early screening for thyroid dysfunction in pregnancy may help identify women at higher risk of GDM
- Closer metabolic monitoring may be warranted in patients with TD
- Preventive strategies could be implemented earlier in pregnancy

Limitations

Despite its high clinical importance, our study has several limitations. Among them are a relatively small sample size, a single-center design, a lack of stratification by type of thyroid dysfunction (subclinical vs. overt), and no adjustment for potential confounders (e.g., age, BMI, parity)

Conclusion

Thyroid dysfunction represents a significant risk factor for the development of gestational diabetes. It is associated with the earlier onset of GDM and increased gestational weight gain. These findings highlight the importance of early assessment of thyroid function during pregnancy and suggest a potential role for integrated endocrine screening strategies.

Declarations

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Conflict of Interest: The authors declare no competing interests.

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