Medical Laboratory Journal
Online ISSN: 2538-4449
Golestan University of Medical Sciences

Original Article

Comparison of Hematologic and Biochemical Factors between Women with Gestational Diabetes and Healthy Pregnant Women

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Received: 2021/05/02
Revised: 2021/05/03
Accepted: 2021/08/01

DOI: 10.29252/mlj.15.5.1

ABSTRACT

Background and objectives: Diagnosis glucose intolerance in pregnancy is very important in preventing maternal and fetal complications. In this study, we compared hematological and biochemical characteristics of healthy pregnant women and women with gestational diabetes mellitus (GDM) to find predisposing and prognostic variables of GDM.

Methods: In this study, 80 pregnant women (at 24-28 weeks of pregnancy) were divided into a GDM group and non-GDM group by performing oral glucose tolerance test using 75 g glucose according to the International Association of the Diabetes and Pregnancy Study Groups criteria.

Results: The mean age of women with GDM was significantly higher than those without GDM (p=0.048). Other variables including body mass index, gestational age and daily sleep duration did not differ significantly between the two groups (P>0.05). There was a significant association between family history of diabetes and incidence of GDM (p=0.040). In addition, the C-peptide level was significantly higher in pregnant women with GDM (p=0.004).

Conclusion: Considering the role of C-peptide in predicting metabolic syndrome, it is suggested to use this factor for identification of GDM patients.

Keywords: Gestational diabetes, C-peptide, c-reactive protein, Glucose Tolerance Test.

INTRODUCTION

Diabetes diagnosed for the first time during pregnancy is called gestational diabetes mellitus (GDM) (1),which has adverse effects on the mother and fetus(2). The prevalence of type 2 diabetes in women with a history of GDM is reported to be 3-65%. Children also suffer from complications of GDM such as obesity and diabetes in the future(3). Important maternal complications of GDM include preeclampsia, eclampsia, birth canal injuries, polyhydramnios and a higher risk of maternal bacterial infections. Increased size of the fetus can result in maternal injury and increase the risk of perinatal mortality (4). Glycemic control, screening mothers and timely diagnosis and treatment of GDM can significantly reduce the risk of these complications (5-7). In this study, we compare hematological and biochemical characteristics of healthy pregnant women and those with GDM to find predisposing and prognostic variables of GDM.

MATERIALS AND METHODS

The study was performed on 80 pregnant women with gestational age of 24 to 28 weeks who had been referred to the laboratories of Gorgan (Iran) for diabetes screening. The subjects were divided into two groups of GDM (n=40) and non-GDM (n=40) by performing oral glucose tolerance test using 75 g glucose according to the International Association of the Diabetes and Pregnancy Study Groups criteria.

Demographic data were collected using a 12-item questionnaire. The study was approved by the ethics committee of the Golestan University of Medical Sciences (ethics code: IR.GOUMS.REC.1400.043). Written informed consent was taken from the subjects prior to participation. Five ml of fasting blood were taken for biochemical tests. All patients were explained how to consume 75 g of glucose. Samples were also taken one hour and two hours after the first sampling for glucose tolerance test (GTT). Complete blood count (CBC) and erythrocyte sedimentation rate (ESR) tests were performed using ABACUSE-5 cell counter (Diatron, France) and Sedimex analyzer (Sedimex, USA), respectively. Fasting blood sugar (FBS), 1-hour GTT, 2-hour GTT, amylase, zinc and C-reactive protein (CRP) were analyzed using the HITACHI-911 autoanalyzer (HITACHI, Japan). Blood sugar was measured by Pars Azmoun kit (Iran) using the glucose oxidase method. C-peptide level was measured by ELISA using Monobind kit (USA) according to the kit manufacturer's protocol. The measurements were carried out using an ELISA reader (SYGMA Diagnostic, SYGMA, Australia). Based on the results glucose test, the subjects were divided into two groups of GDM and non-GDM. According to the International Association of the Diabetes and Pregnancy Study Groups criteria (8), presence of one or more of the following confirmed GDM: FBS ≥ 92 mg/dl, 1-hour GTT≥ 180 mg/dl, 2-hour GTT≥ 153 mg/dl. Results were presented as mean ± standard deviation. Data were analyzed using SPSS 16. The t-test was used for analyzing normal distributed independent samples and the Mann Whitney U test was used for analyzing non-normally distributed data. The Chi-square test was used for comparing categorical data. Significance level was set at 0.05 for all tests.

RESULTS

The mean age of pregnant women was 29.17 ± 5.6 years (range: 18-40 years). The mean gestational age was 25 ± 1.7 weeks (range: 24-28 weeks). The mean body mass index (BMI) and sleep duration were 27.4 ± 4.4 kg/m^2 (range: 17.7-40 kg/m^2) and 9.25 hours per day (range: 5-15 hours per day), respectively.

Of 80 participants, five (6.25%) had a history of diabetes, 35 (43.8%) had a family history of diabetes and 30 (37.5%) had consanguineous marriages. As shown in table 1, the mean age of patients with GDM was significantly higher than that of those without GDM (p=0.048). However, there was no significant difference between pregnant women with and without GDM in terms of BMI, gestational age and daily sleep duration. The results also showed no significant difference between the groups in terms of history of diabetes (P>0.05).

Table 1– Demographic information of pregnant women with and without GDM

	GDM		
Variable	**Yes**	**No**	**P-value**
Age (years)	**30.7±5.1**	**27.7±5.8**	**0.48**
BMI (kg/m^2)	**29.4±4.0**	**27.4±4.7**	**0.089**
Gestation Age (weeks)	**26.3±1.6**	**27.8±1.7**	**0.479**
Sleep duration (hours/day)	**9.4±1.8**	**10.9±2.1**	**0.652**

There was no significant relationship between history of consanguineous marriage and the incidence of GDM (p=0.617). The C-peptide level was significantly higher in the GDM group compared with the non-GDM group (p=0.004). However, there was no significant difference between the two groups in terms of other variables (Table 2).

Table 2– Comparison of laboratory findings between pregnant women with and without GDM

	GDM				
Variable	**No**		**Yes**		**P-value**
	Mean	**SD**	**Mean**	**SD**	
FBS (mg/dl)	**82.93**	**4.294**	**98.08**	**8.442**	**0.000**
BS.1hPP(mg/dl)	**115.5**	**26.806**	**146.92**	**28.135**	**0.000**
BS.2hPP (mg/dl)	**97.25**	**17.612**	**116.88**	**23.043**	**0.000**
Hemoglobin (g/dl)	**11.286**	**0.7595**	**11.277**	**0.9526**	**0.340**
ESR (mm/hr)	**28.25**	**17.591**	**29.23**	**13.444**	**0.82**
Amylase (IU/ml)	**61.29**	**23.431**	**64.08**	**28.705**	**0.696**
CRP (mg/dl)	**8.94**	**6.154**	**7.71**	**4.668**	**0.415**
Zinc (mg/dl)	**47.2**	**20.916**	**48.354**	**20.633**	**0.839**
C-peptide(IU/ml)	**1.207**	**0.4891**	**2.438**	**1.9586**	**0.004**

BS.1hPP: 1 hour post prandial
BS.2hPP: 2 hour post prandial

DISCUSSION

The present study compared demographic, hematological and biochemical characteristics of pregnant women with and without GDM. The mean age of women with GDM group was significantly higher than that in the non-GDM group, indicating that the risk of GDM increases with the age. Based on previous studies, age, obesity and family history of diabetes are important risk factors of GDM (9-16). In our study, there was a significant relationship between GDM and family history of diabetes. However, no such relationship was observed in studies in Nigeria(17), Sri Lanka (18) and Iran (19). Growing evidence suggests that poor sleep may contribute to the development of GDM (20-22). Many studies have examined the effect of sleep duration on incidence of GDM. Jahanpak et al. reported that the daily sleep duration changes in pregnancy are associated with impaired glucose metabolism (23). In another study, Cai et al. reported that poor sleep quality or short nocturnal sleep during pregnancy contributed to abnormal glucose regulation, and treating sleep problems could potentially reduce the risk and burden of GDM(24). One of the primary outcomes of poor sleep quality is glucose intolerance, which is defined as the inability to maintain euglycemia by metabolizing exogenous glucose via insulin-dependent and non-insulin-dependent mechanisms(25). However, in our study, we observed no significant relationship between sleep duration and GDM.

The C-peptide is a useful marker of beta-cell function and endogenous insulin secretion since it is produced in equal amounts to insulin (26). A study by Yin et al. found a positive association between serum C-peptide levels and the risk of diabetes and pre-diabetes among Chinese women with a history of GDM (27). In a study by Homko et al., women with GDM had a major β-cell defect and increased level of insulin resistance, which occurred during late pregnancy (28). Similarly, Fatima et al. introduced C-peptide as a predictive factor for GDM (29).

We found no significant difference between the two groups in terms of plasma zinc level. Inconsistent with this finding, previous studies reported that pregnant women with GDM have significantly lower plasma zinc level compared to non-GDM counterparts (30-32).

As an inflammatory marker, serum CRP level can be associated with an increased risk of diabetes (33). In our study, serum CRP level did not differ significantly between the two groups, which is in line with findings of D'Anna et al. (34). However, other studies have reported CRP as an important predictor

of GDM (35, 36). Amylase is an enzyme secreted by the pancreas that increases in pancreatitis (37). The amylase level did not differ significantly between pregnant women with and without GDM, which is consistent with findings of a study by Khosrowbeygi et al. (38). However, a previous study reported that patients with GDM had significantly lower levels of serum amylase than those without GDM (39). In another study, Yu et al. reported that pregnant women with GDM had higher plasma amylase level compared to healthy pregnant women (40).

Results of studies on the relationship of hematological indicators and complications of pregnancy have been contradictory (41). In this regard, a study by Zafari et al. reported no significant difference in hemoglobin levels between the GDM and non-GDM groups (42), which were consistent with our results. In a study by Lao et al. (43), hemoglobin level of more than 13 g/dl was found as effective factor in the development of GDM, which can be due to increased iron intake. In line with this finding, Helin et al. claimed that unnecessary iron intake in the first trimester of pregnancy is associated with an increased risk of GDM (44).

CONCLUSION

Given the importance of GDM and its complications, it is essential to find predictive markers for early diagnosis of the condition. Based on the results, it is suggested to use C-peptide as an important factor for identifying GDM during pregnancy.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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How to Cite:
Ahmadi A, Ghasemian M, Ayatollahi AA, Al-Khabori M, hosseini alarzi SS, Hojjati MT [Safety Assessment of *Lactobacillus paracasei* IBRC-M 11110 in Wistar Rats: A Subacute 28-Day Toxicity Study]. mljgoums. 2021; 15(5): 1-6 DOI: 10.29252/mlj.15.5.1