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Research Article

**INVESTIGATING THE RELATIONSHIP BETWEEN
HEMOGLOBIN IN THE FIRST THREE MONTHS OF
PREGNANCY AND GESTATIONAL DIABETES IN
PREGNANT WOMEN VISITING IMAM ALI HOSPITAL IN
ZAHEDAN**Halime Aali¹, Farahnaz Mir¹, Batul Shahraki Mojahed^{2*}¹Department of Internal Medicine, Amir Al-Momenin Hospital, Zabol University of Medical Sciences, Zabol, Iran.²Department Obstetrics and Gynecology, Maternal and Fetal Health Research Center, Zabol University of Medical Sciences, Zabol, Iran.**Abstract:**

Diabetes is the most common medical condition during pregnancy. It is highly important to diagnose patients suffering from diabetes, because effective treatment of the patient can minimize both maternal and embryonic complications. The present study aims at investigating the relationship between hemoglobin concentration in the first three months of pregnancy and gestational diabetes in the city of Zahedan in the years 2016. This retrospective study was conducted by studying the medical files of pregnant women who had visited Imam Ali Hospital in Zahedan during the year 2016. One hundred and fifty files in which information about the mothers had completely been recorded were selected. Information about the mothers was collected using a researcher-developed questionnaire. The collected data were analyzed in SPSS version 18 using chi square tests. $P < 0.05$ was considered to be significant. From the 150 cases investigated in this study, 78 patients were diagnosed and 72 patients were not diagnosed with gestational diabetes. The results showed that the ratio of calculated chance for hemoglobin in the first three months of pregnancy and having gestational diabetes is 3.012 with a confidence interval of 95% and a range of (1.614-5.718). The results of this study showed that there is significant relationship between high levels of hemoglobin in the first three months of pregnancy and having gestational diabetes, in a way that high levels of hemoglobin in the first three months of pregnancy is considered to be an important risk factor in relation with having gestational diabetes. It is suggested that pregnant women with high levels of hemoglobin in the first three months of pregnancy be considered women at risk and selective screening for the risk factor be done for them.

Key Words: Hemoglobin, Pregnancy, Gestational Diabetes, Zahedan.**Corresponding author:****Batul Shahraki Mojahed,**Department Obstetrics and Gynecology,
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INTRODUCTION:

Iran is a developing country with limited economic resources and a young population [1]. Eleven million people of the population are women at fertility ages who are exposed to the risk of diabetes, which is the most common medical condition during pregnancy [2]. The prevalence of gestational diabetes has been reported to be 1-14 percent in different parts of the world. Based on the 14 studies conducted in different cities in Iran, the prevalence of gestational diabetes has varied from 1.3 to 8.9 %. This disease leaves various effects on both the mother and the embryo, the most common ones being: fetal macrosomia, damages during labor, cesarean, polyhydramnios, preeclampsia, neonatal metabolic disorders (hypoglycemia, hyperglycemia, hyperbilirubinemia), respiratory distress syndrome, and finally late complications such as the mother having type 2 diabetes in postpartum period [3]. The risk factors identified for gestational diabetes are: age, obesity, family history of diabetes, first pregnancy, history of gestational diabetes, history of abortion, previous stillbirth due to unspecified reason, non-white race, having more than four children, neonatal death in the previous pregnancy, previous abnormal embryo or baby, history of type 2 diabetes before pregnancy, Asian race, and smoking. Since effective treatment can minimize both maternal and embryonic complications, it is highly important to diagnose gestational diabetes in pregnant women [4]. A major point of disagreement is over whether to use a universal or selective screening to identify mothers who are at risk of gestational diabetes. Based on the results of recent studies, high levels of hemoglobin and iron reserves in mothers in the first half of pregnancy have been mentioned as risk factors for gestational diabetes [5]. Therefore, the common administration of iron supplement in the second half of pregnancy can be risky for non-anemic mothers or mothers with adequate reserves of iron, especially because consuming vitamin C results in the expansion of free radicals, damages to lipid membrane, delayed growth, and increased carcinogenicity [6]. In addition to the items mentioned above, increased consumption of iron can affect the production and secretion of insulin and increase the oxidation of lipids, and consequently result in decreased glucose withdrawal and consumption in muscles, and increased production of glucose in liver, which results in resistance to insulin [7]. As a result of resistance to insulin, vulnerable people develop gestational diabetes. Since measuring the levels of hemoglobin in the first pregnancy examination is a standard practice, the results of this test can easily be used. In fact, ferritin serum levels correspond to iron reserves levels, so ferritin serum is the best laboratory index for estimating iron reserves. Given that measuring hemoglobin concentration levels is routinely done for all pregnant women in the first three months of pregnancy, the results of this

test can be used as a diabetes screening test, too. The present study aims at investigating the relationship between hemoglobin concentration in the first three months of pregnancy and gestational diabetes in Zahedan in the year 2016.

MATERIALS AND METHODS:

This retrospective study was conducted by studying the medical files of pregnant women who had visited Imam Ali Hospital in Zahedan during the year 2016. One hundred and fifty files in which information on mothers (including demographic characteristics, requested test at the first prenatal visit and later visits) had completely been recorded were selected. A purpose-based sampling was employed. The criteria for being included in the study were: mothers pregnant with a live embryo for which FBS and Hb criteria for the first 14 weeks of pregnancy and also GCT levels for 24-28 weeks of pregnancy had completely been recorded in their files. Also, the criteria for being excluded from the study were: women with a medical condition, anemia, infections, and women whose first visit to the hospital was after 14 weeks from the beginning of their pregnancy. In fact, all the information about the patients, including age, height, weight, the number of pregnancies and labors, hemoglobin concentration levels in the mother, FBS at the first visit, and GCT levels during 24-28 weeks of pregnancy were collected using a researcher-developed questionnaire. The gathered data were analyzed in SPSS version 18 using chi-square tests [8-10]. Also, $P < 0.05$ was considered to be significant.

FINDING:

The results of the study showed that, from the 150 patients investigated in the study, 78 patients were diagnosed and 72 patients were not diagnosed with gestational diabetes. Regarding the demographic characteristics, the patients were divided into two groups: the women with gestational diabetes (the case group) and the women without gestational diabetes (the control group), with the mean age being 31.24 ± 4.15 for the group with gestational diabetes and 22.12 ± 4.36 for the group without gestational diabetes ($P < 0.05$). On average, the number of pregnancies was 2.10 ± 1.15 for the case group and 1.15 ± 0.75 for the control group ($P < 0.05$). In fact, there were significant differences between the two groups in terms of the mean values for mother's age, mother's weight, number of pregnancies and labors, and also the mean values for hemoglobin concentration in the first 14 weeks of pregnancy (Table 1) ($P < 0.05$). Also, the results from the logistic regression model for the risk factors showed that the ratio of the calculated chance for hemoglobin levels in the first three months of pregnancy and developing gestational diabetes was 3.012 with a confidence interval of 1.614-5.718 (Table 2).

Table 1: The characteristics of the mothers in the two groups with and without gestational diabetes

Variable	Number	With Gestational Diabetes	Number	Without Gestational Diabetes	T	P-value
		M±SD		M±SD		
Age	78	31.24 ± 4.15	72	22.12 ± 4.36	4.48	P<0.001
Number of Pregnancies	80	2.10 ± 1.15	74	1.15 ± 0.75	4.35	P<0.001
Number of Labors	80	1.5 ± 1.1	74	1.12 ± 0.54	5.26	P<0.001
Mother's Weight	78	70/24 ± 7/68	71	56.74 ± 10.5	2.18	P<0.001
Hb	79	13/26 ± 1/12	74	12.4 ± 1.87	2.24	P<0.001

Table 2: Risk factors for gestational diabetes based on logistic regression model

Risk factor	OR	CI	P-value
Body mass index before pregnancy (kg/m ²)	0.958	1.098 ± 0.785	0.009
Fasting blood glucose in the first three months (mg/cc)	1.044	1.44 ± 0.955	0.007
Hemoglobin in the first three months	3.018	8.718 ± 1.614	0.001

DISCUSSION:

Gestational diabetes refers to any amount of glucose intolerance that is developed or diagnosed for the first time during pregnancy, which was first described about half a century ago [11]. In fact, gestational diabetes is the most common metabolic disorder during pregnancy [12], which can lead to irremediable complications in patients. Fetal macrosomia, damages during labor, cesarean, polyhydramnios, preeclampsia, neonatal metabolic disorders and late complications such as the mother having type 2 diabetes in postpartum period are among the most common complications caused by gestational diabetes [13]. In the present study, the relationship between hemoglobin levels in the first three months of pregnancy and gestational diabetes was investigated in pregnant women who

visited Imam Ali Hospital in Zahedan during the year 2016. The results of the study indicated that high levels of hemoglobin were significantly related to gestational diabetes. These results are in line with the results reported in Phaloprakan et al, 2008, while no significant relationship was found between high levels of hemoglobin in the first three months of pregnancy and gestational diabetes in Gungor et al, 2007 [14, 15]. In Gungor's study, many of the intervening variables had not been controlled and hemoglobin had been measured during the 28-30 weeks of pregnancy, and probably the real difference in the levels of hemoglobin between the two groups was not identified due to receiving iron supplements in the second half of pregnancy. In previous studies, hemoglobin concentration and number of red blood cells (RBC) were reported to be related to diabetes

mellitus, and there was a significant relationship between high levels of hemoglobin and fasting glucose and glucose intolerance in non-pregnant populations. Therefore, the relationship between high levels of hemoglobin and glucose intolerance can indicate a general process that is independent of pregnancy. In non-pregnant women, the relationship between high levels of hemoglobin and a high number of red blood cells with developing diabetes mellitus is attributed to the increased amount of the glycosylated hemoglobin part in people suffering from diabetes mellitus, since glycosylated hemoglobin increases the dependency of oxygen on RBC, and high levels of glycosylated hemoglobin can result in hypoxia tissue, which in turn, can increase the number of red blood cells and increase the concentration of hemoglobin. Also, the results from previous studies indicated that mothers with highest levels of hemoglobin had high concentration levels of iron and ferritin serum. Therefore, the relationship between hemoglobin concentration and the increased chances of developing gestational diabetes can be a reflection of the relationship between increased maternal iron and developing gestational diabetes. A possible mechanism for the relationship between high levels of hemoglobin and increased chances of developing gestational diabetes is that an increase in iron can affect the production and secretion of insulin and increase the oxidation of lipids, and as a result, decrease the withdrawal and consumption of glucose in muscles and increase the production of glucose in the liver. As a result of this, resistance to insulin is created and makes the person susceptible to gestational diabetes. Lao et al, 2002, stated that the average MCV level for the patients at their first prenatal care visit was higher in mothers with gestational diabetes than healthy mothers, a finding confirming the results of the present study [16]. The main limitation of this study was that, due to its case-control and retrospective design, it used hemoglobin levels, mean volume of red blood cells and blood glucose in the routine tests during the first three months of pregnancy for the cases investigated in the study.

CONCLUSION:

The results of the study showed that there is a direct relationship between high levels of hemoglobin during the first three months of pregnancy and developing gestational diabetes, in a way that the existence of high levels of hemoglobin during the first three months of pregnancy is considered to be an important risk factor for developing gestational diabetes. It is suggested that women with high levels of hemoglobin be considered women at risk and selective screening for the risk factor be done for them. Also, excessive administration of iron supplement for all women should be avoided, and supplements should be prescribed only for those women who need it.

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