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RELATIONSHIP BETWEEN GLUCOSE CHALLENGE TEST AND EARLY AND MID-PREGNANCY BODY MASS INDEX

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ABSTRACT

Objective: Early diagnosis of gestational diabetes, through evaluating risk factors associated with it, is very significant. The current study aimed to determine the correlation between glucose challenge tests and early and mid-pregnancy body mass index. **Methods**: This retrospective analytic study was carried out on 272 singleton pregnant women who referred to community oriented center in Kermanshah Medical sciences university during a year (2010- 2011). To this end, required information, including age, parity, early and mid-pregnancy body mass index, was gathered. The association between results of glucose challenge test and variables were analyzed by SPSS software and binary logistic regression statistically tests were used in this

research. **Results**: Statistical assessment according to Binary variable regression demonstrated that there is a significant correlation between early BMI and GCT impaired (P=0.007). Also, the results demonstrated that there are statistically significant correlation between mid-pregnancy BMI and GCT impaired (P= 0.01). **Conclusions**: Findings showed that higher pre-pregnancy body mass index leads to impaired glucose challenge test more than weight gain during pregnancy. Therefore, to achieve ideal weight pre-pregnancy, there is a need for designing appropriate strategies.

KEYWORDS: body mass index, pregnancy, glucose challenge test.

INTRODUCTION

Diabetes is the most common medical complication during pregnancy which complicates about 2 to 5 percent of all pregnancies in the USA.[1, 2] The gestational diabetes in different degrees is defined as intolerance to carbohydrate which is initiated or diagnosed for the first time during pregnancy.[3] The prevalence of gestational diabetes is not clearly specified; however, in various studies, depending on the population under study and diagnostic tests used, it is estimated to be between 1 to 14 percent.[4, 5] The possibility of gestational diabetes incidence has increased remarkably among non-white skinned ethnic groups, in the individuals with type 2 diabetes family history as well as women with more than 30 years or those who are overweight.[2] Moreover, among other risk factors of gestational diabetes, being American native Africans, south Asian and East South,being overweight, having prior gestational diabetes history or constant glucose, having history of neonate suffering macrosomia, abnormality or still-born, using especial drugs like B sympathetic imitator or corticosteroids chronically and having abortive pregnancy history can be mentioned.[1, 2] Despite improvements in the results of the women suffering from gestational diabetes and who were diabetic prior to the pregnancy, there is still a great threat toward some pregnancy conditions such as preterm delivery, infection condition, hydramnios as well as hypertension.[2] On the other hand, the women suffering from diabetes are at high risk of respiratory distress syndrome (RDS), metabolic disorders and fetal macrosomia, among which the macrosomia is a specific sign of the gestational diabetes (20-25%). Also, the focus on unfavorable effects of gestation diabetes on fetus growth has been changed.[1-4] The USA Gynecologists and Obstetricians College suggest that there is a great need for screening all pregnant woman for diagnosing gestational diabetes through patient record, clinical assessment of risk factors or laboratory screening studies. The screening should be

undertaken between 24 and 28 weeks of pregnancy; however, early screening for the women with considerable risk factors is highly recommended. The direct link between obesity and type 2 diabetes is well specified.[1] About 7 to 17% of the overweight women are exposed to gestational diabetes.[6] Recce, et al (2004) found that obesity and being overweight is accompanied with high risk of diabetes.[7] Moreover, the results of Hackmon, et al study (2007) pointed out that Body Mass Index (BMI) prior and mid-pregnancy increase impaired glucose challenge test.[8] Weijerns, et al (2002) reported that BMI prior to pregnancy is related to gestational diabetes.[5] Since, being overweight prior to pregnancy, as one of the known risk factors of gestational diabetes, and considering the weight gained during pregnancy, as a risk factor are really controversial. Hence, this study was carried out to investigate the association between early and mid-pregnancy BMI and glucose challenge test among pregnant women who referred to the medical community oriented clinic of Kermanshah city.

METHODS

This research is a retrospective analytic study carried out on 272 singleton pregnant women who referred to the Kermanshah medical community oriented clinic from June 21st, 2010 to June 21st, 2011. The BMI of the early pregnancy was measured by height and weight. At the first pregnancy checkup visit, the BMI was measured by formula of the weight in kg divided to the height square in meter. Also, the BMI of mid-pregnancy during 24-28 weeks of pregnancy was recorded through above mentioned formula by the center obstetricians. Then, the results of screening the glucose challenge test, which were routinely undertaken during 24-28 weeks of pregnancy, were recorded in the data collection sheets. During the test, the pregnant women were given 50 gram oral glucose, regardless of having breakfast or not, after which their fasting plasma glucose were measured. If the glucose challenge test is below 130 mg/deciliter, the result is natural. In this study, the women who were diabetic prior to the pregnancy or were under medicinal or food diet treatment were set aside. Cases such as age, parities, early pregnancy BMI, mid-pregnancy BMI as well as glucose challenge test were recorded in the data sheets. The data were analyzed using SPSS software (version 12) and applying descriptive statistical methods including average, standard deviation, ratios and relevant tables. To study the association between variables, binary logistic regression was applied.

RESULTS

In this study, 272 women were studied by early pregnancy BMI, mid-pregnancy BMI, parity as well as age. The association of variables with glucose challenge test was measured. 206 women (75.7%) out of 272 subjects had non-impaired glucose challenge test and 66 women (24.3%) had impaired glucose challenge test (Table 1). The averages of their parity were 27.16 year and 1.84, respectively. The association between maternal age and glucose challenge tests (GCT) was divided into 3 groups. The results showed that the least amount of impaired GCT (13.9%) belonged to the age group of <20 year and the most belonged to age group of 35- 45 (38.46%). In other words, the likelihood of impaired GCT in the age group of 35-45was more (Table 1).According to the results of binary variable logistic regression, the prevalence of GCT for women with the age in the range of 25-35 year found to be 2.72 times (P=0.002) and for the age of 35-45 years 3.86 times (p=0.005) more compared with women younger than 25 years old. The results illustrated that the most amount of impaired GCT (38.1%) were seen in the women with the fourth or more pregnancy history, while the least impaired GCT (20.9%) were found in women who experienced their first pregnancy. Binary variable regression revealed that there is no significant correlation between parity and GCT impaired (P=0.352) (Table 2). Moreover, the results showed that the average early pregnancy BMI in the impaired GCT group was 28.1 and in non-impaired GCT group, it was 25.7, the difference of which is statistically significant (P= 0.001). Also, mid-pregnancy BMI in the impaired GCT was 30.07 and in non- impaired group, it was 27.6, the difference of which is statistically significant (P=0.001) (Table 3). Statistical assessment according to Binary variable regression demonstrated that there is a significant correlation between early BMI and GCT impaired(P=0.007). So we can say that the chances of impaired GCT in women with BMI less than 20 is about 0.19 times (OR=0.192, P=0.044), women with BMI=20-25 times around 0.28 (OR=0.28, P=0.002) about 0.376 times the women with BMI=25-30 less than women with BMI more than 30 kg/m^2 (Table 4). Also, the results demonstrate that there are statistically significant correlation between mid-pregnancy BMI and GCT impaired (P= 0.01), So we can say that the chances of impaired GCT in women with BMI=20-25kg/m^2 is about 0.29 times (OR=0.327, P=0.007). The results of the statistical tests demonstrated that there is a significant statistical correlation between mid-pregnancy BMI and impaired GCT (p= 0.01). In fact, the chance of impaired GCT in the group with BMI =20-25 kg/m^2 is about 0.29 time (OR=0.327, P=0.007) and for women with BMI =20-25 kg/m^2 is about 0.4 fold (OR=0.408, P=0.005) less than women with BMI>30 but no significant difference between

with BMI<20 and in women with a BMI>30 were observed which could be due to small sample size in women with BMI<20(Table 5).

Table (1): Frequency of Glucose Challenge Test Results according to Age of Pregnant Women.

GCT* / Age	Non – impaired		Impaired		Total	
	Number	Percent	Number	Percent	Number	Percent
Age<25	99	86.09	16	13.91	115	100
25-35	91	69.47	40	30.53	131	100
35-45	16	61.54	10	38.46	26	100
Total	206	75.47	66	24.26	272	100

***** Glucose Challenge Test

Table (2): Frequency of Glucose Challenge Test Results according to Parities of Pregnant Women.

(GCT)* / Parties	Non – impaired		Impaired		Total	
	Number	Percent	Number	Percent	Number	Percent
1	110	79.1	29	20.9	139	100
2	49	75.4	16	24.6	65	100
3	34	72.3	13	27.7	47	100
≥4	13	69.1	8	38.1	21	100
Total	206	75.7	66	24.3	272	100

***** Glucose Challenge Test

Table (3): Relationship between Body Mass Index in Early and Mid-Pregnancy and Glucose Challenge Test Results.

BMI[1]*	GCT[2]*	Number	Average	Standard Deviation	
Early Pregnancy BMI	Non – impaired	206	25.7	3.96	P=0.0003
	Impaired	66	28.1	5	
Middle of Pregnancy BMI	Non – impaired	206	27.6	3.99	
	Impaired	66	30.07	4.85	

[1]*Body Mass Index

[2]*Glucose Challenge Test

Table (4): Frequency of Body Mass Index in Early Pregnancy according to Glucose Challenge Test Results.

(GCT) 1* / Early Pregnancy BMI2*	Non – impaired		Impaired		Total	
	Number	Percent	Number	Percent	Number	Percent
<20	13	86.7	2	13.3	15	100
20-25	76	81.7	17	18.3	93	100
25-30	92	77.3	27	22.7	119	100
>30	25	55.6	20	44.4	45	100
Total	206	75.7	66	24.3	272	100

1*Glucose Challenge Test

2*Body Mass Index

Table (5): Frequency of Body Mass Index in middle of Pregnancy according to Glucose Challenge Test Results

(GCT) / Middle-Pregnancy BMI	Non – impaired		Impaired		Total	
	Number	Percent	Number	Percent	Number	Percent
<20	5	83.3	1	16.7	6	100
20-25	44	84.6	8	15.4	52	100
25-30	108	80	27	20	135	100
>30	49	62	30	38	79	100
Total	206	75.7	66	24.3	272	100

DISCUSSION

This study showed that regarding impaired GCT over 130 mg/dl, the prevalence of impaired GCT was 24%, while the prevalence of impaired GCT in other studies in which impaired GCT was regarded over 140 mg/dl is not in line with this finding. The results of Shi, et al (2003) study showed that the prevalence of gestational diabetes, regarding impaired GCT over 140 mg/dl, was 25.2%. When the impaired GCT was considered more than 130 mg/dl, the incidence of gestational diabetes increased to 36.5%.[9] In one study, incidence of impaired GCT (<130 mg/dl) was 11.9%, of which 3.43% suffered from gestational diabetes.[10] In Rob, et al study, prevalence of impaired GCT (<140 mg/dl) was 13.5%, of which 6.9% suffered from gestational diabetes.[5] Mirfaizy, et al (2009), also considering impaired GCT more than 135 mg/dl, reported the incidence of gestational diabetes 18.6%.[3] This study illustrated that early and mid-pregnancy BMI both are related to impaired GCT increase. In the group with BMI >30, this was increased about two times, which is

considerable. Numerous studies have surveyed the high BMI effect on gestational diabetes.[8-14] In Hackmon study, the authors concluded that the effect of > 30 BMI in early and mid-pregnancy increased the likelihood of impaired GCT.[8] A meta–analysis study have investigated BMI effect prior to the pregnancy on gestational diabetes in which in lieu of each BMI increase unit, 0.92% increase of gestational diabetes incidence was reported.[13] Shi, et al also found out that when BMI during 24- 28 weeks of pregnancy is more than 27.8 kg/m^2, the impaired GCT and prevalence of gestational diabetes is more.[9] Most studies have stressed on BMI effect prior and early pregnancy of gestational diabetes [13, 16, 17, 18], while few studies have considered the BMI effect in mid pregnancy. In these studies, like the present study, the effect of BMI in mid pregnancy is similar to the early pregnancy.[8-9] In the current study, the association between BMI in early pregnancy and impaired GCT was a little bit more than that of BMI in mid pregnancy and impaired GCT (22% in comparison with 21% which the difference statistically is not meaningful). In Mirfaizy, et al study (2009) also >30 year maternal age was recognized as one of the most important risk factors to gestational diabetes.[3] Weijers, et al (2002) also reported that maternal age is related to both gestational diabetes and slight hyperglycemia during pregnancy.[5] In Rahimi study (2004), due to increase of maternal age, also a significant statistical association was found between gestational diabetes and impaired GCT ($p<0.05$).[4] In the present study, no significant statistical correlation was found between parities and impaired GCT (P=0.352). It seems that other important factors except parities effect GCT, in a way that Gao, et al (2009), out of 16 risk factors, just referred to few major factors effecting gestational diabetes including BMI ≥24 kg/m^2, age > 30 year and family history of diabetes mellitus.[15] In fact, the parity is a factor which together with other factors can over shadow the pregnancy. Also, in this study, it was shown that ≥year can increase the likelihood of impaired GCT, 3 times more which is a statistically significant association (P=0.003). Also, the most incidence of impaired GCT was seen in age group of 30-40. The results of Hackmon, et al study (2007) were similar to the present study results. As it was shown in their study, there was a statistical significant association between maternal age and impaired GCT ($p<0.05$). In fact, they found out that ≥32 maternal age together with high BMI prior to pregnancy is one of the most important predictor of impaired GCT.[8]

CONCLUSIONS

Based on the results of this study, early and mid-pregnancy high BMI is a risk factor for impaired GCT.So, we should apply a proper approach to gain an ideal weight prior to the

pregnancy. This can be performed well by consulting prior to the pregnancy and applying appropriate training programs. Prevention of BMI increase among the girls is essential, since adolescence should be considered as one of the major objectives in health reproductive. Also, gestational diabetes is a condition in which consulting prior to the pregnancy would be helpful in decreasing its incidence during all the stages of pregnancy. In this way, the women are recommended to alter their life style, weight decrease and regular exercise to prevent diabetes.

AUTHORS' CONTRIBUTIONS

MZ and MK designed and gave a critical view of manuscript writing. BE and FV and NR helped in collection of data. FV, BE and MB gave a critical view of manuscript writing and participated in data analysis. And AA participated in data statistical analysis. MZ and MK reviewed the final manuscript and made critical amendments in the data presentation. All authors read and approved the final manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

ABBREVIATIONS

BMI: Body Mass Index

GCT: Glucose Challenge Test

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