Can we use waist circumference in the first trimester to screen for gestational diabetes?

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ABSTRACT

Maternal obesity is known to be associated with a higher risk of gestational diabetes mellitus and ad-verse perinatal outcomes. The aim of this study was to investigate whether waist circumference meas-urement is an alternative screening test for gestational diabetes. This is a prospective cohort study at a single clinic at Ondokuz Mayıs University Hospital in Samsun, Turkey, between January 2011 and September 2012. All subjects with a singleton pregnancy were eligible for the study at 11–14 weeks' gestation. After statistical evaluation of the data we have found out that wider waist circumference measurements in the first trimester leads to an impaired 50 g oral glucose tolerance test in the second trimester. In the end waist circumference measurement is a cheap screening tool to foresee a high-risk population under threat of gestational diabetes.

1. Introduction

Maternal obesity is associated with more undesirable perinatal outcomes (Solomon et al., 1997). It is highly likely to cause gestational diabetes mellitus (Ehrenberg et al., 2004; Surkan et al., 2004). Pregnancy diabetes (GDM) occurs first during pregnancy and returns to normal after birth. In pregnancy diabetes, glucose tolerance and carbohydrate intolerance cannot be altered (Wong et al., 2001). The incidence of gestational diabetes is 2 to 9 percent in all pregnancies and is associated with many complications (Hoffman et al., 1998). The babies of mothers with gestational diabetes face certain health risks. These are bad mind performance, the possibility of developing obesity afterwards, and impaired glucose tolerance (Petitt et al., 1985; Silverman et al., 1995).

GDM creates more risk factors and possibilities for pregnancy. It is associated with many unwanted complications related to pregnancy. It is known to be associated with diabetes. These complications are vasculopathy, polyhydramnios, intrauterine growth

retardation and macro-somia. Other complications are pre-eclampsia, urinary and genital tract infections, polyhydram-nios and sudden intra-uterine death (Ng et al., 1990; Wong et al., 2001). The main purpose of screening tests, early diagnosis and blood tests in GDM is to prevent its harmful effects as soon as possible like macrosomy, all other concerned complications. Therefore, it is important to predict deficiencies such as impaired fasting glucose and impaired glucose tolerance in order to prohibit these probable complications during pregnancy (Pridjian et al., 2010). It is important to identify a simple screening test that can be performed in the first trimester and seek patients at risk for developing GDM. The aim of our study was to search for an alternating and basic way to detect GDM.

2. Material and methods

Pregnant women with singleton pregnancies participating antenatal clinic who were not known to be diabetic were included in this present study. We completed a prospective cohort study on 148 patients at a single clinic at Ondokuz Mayıs University Hospital in Samsun, Turkey, between January 2011 and September 2012. Total 148 pregnant women of 11±14 weeks of gestation were including to the present study. Patients with type 1 or type 2 diabetes or other disorders known to affect glucose metabolism prior to pregnancy, women with a positive history of alcohol or drug abuse during their current pregnancy, women older than 40 years of age, and women with a previous history of GDM were excluded. Patients with type 1 or type 2 diabetes prior to pregnancy, those alcohol users in their current pregnancy, women with a history of drug addiction, women more than 40 years old, and women previously known to have a history of diabetes were excluded from this study. All participants signed the informed consent form. The Hospital Ethics Committee approved this study according to the Helsinki Declaration. Waist circumference measurement was performed 11–14 with respect to the standard procedures of the Airlie conference. The measurement was made at the mid-distance between the iliac crest and the final rib edge after a normal expiration while standing.

Biochemical analysis

Participants were asked to fasting for 12 hours during the first three months of pregnancy (11-14 weeks of gestation). Pregnancy's haven't breakfast for this test. they did not eat the previous evening. Blood samples were taken from the antecubital vein the next day after fasting for one night at 08:00–09:00 hours. Plasma was separated immediately by centrifugation (2,000 rpm, 20 min, 4°C). Following centrifugation, plasma glucose concentrations were evaluated by the glucose oxidase method (YSI 2300-STAT; Yellow Springs Instrument, Yellow Springs, OH) immediately after blood was drawn. Plasma total triglyceride amounts using enzymatic hydrolysis, on

a Multiparity Analyzer CX7 (Beckman Instruments, Fullerton, USA). Then glucose tolerance tests were scheduled. Blood glucose levels were also screened at 0 and 60 minutes after a 12-hour fasting. 50 g oral glucose tolerance test performed at 24–28 weeks of gestation as designated by the American Diabetes Association in 2016.

Statistical analysis

Statistical analyses were conducted using SPSS for Windows, version 21.0 (Chicago, IL). Data are expressed as mean ± standard deviation and median. Correlations between variables were analyzed by Spearman correlation. To verify the model's statistical significance, analysis of variance, F test, was performed and the model was considered to be statistically significant with a p value of $p<0.05$, variables added to the model were also found to be statistically significant ($p<0.05$, t test). Model is found to be 54% explanatory. Waist girth and triglyceride concentrations of the participants were measured. The waist girth cut point of 85 cm was chosen based on the definition of the hyper triglyceridemic waist. Triglyceride concentrations cut point of was 200 mg/dl.

3. Results

The mean age, waist circumference and body mass index of the patients were 28.4, 87.7, and 24.9, respectively. The characteristics of the 148 participants included in the study are shown in Table 1. After statistical evaluation of the data, we have found out that there is positive correlation between glucose and triglycerides ($R:0.567$; $p<0.05$) and positive correlation between glucose and waist circumference ($R:0.465$; $p<0.05$) which shows us that wider waist circumference measurements in the first trimester leads to an impaired 50 g oral glucose tolerance test in the second trimester. The difference between each 2 variables was significant. We also found correlation between triglyceride and waist circumference. Likewise, increased triglycerides also impair glucose tolerance and as an added note. We have also observed a positive correlation between increased waist circumference and BMI ($R:0.411$; $p< 0.05$). Table 2 shows the correlations between these variables.

Table 1. Characteristics of patients (n:148).

	Mean (SD)	Median (range)
Age, (years)	28.4 (3.8)	28.1 (20–37)
Waist circumference, (cm)	87.7 (13.6)	86.3 (69–152)
Body mass index, (kg/m2)	24.9 (4.8)	23.9 (16.7–42.2)
Total triglycerides, (mg/dl)	102.6 (46.9)	97.3 (35.3-265.4)
*Glucose (mg/dl)	127 (50.89)	126 (70-182)

* Plasma glucose concentrations were also measured at 60 minutes after a 12-hour fasting 50-g oral glucose tolerance test.

Table 2. Correlations.

	Waist circumference (cm) *r P value	Glucose (mg/dl)	Total triglycerides (mg/dl)
Age (years)	r:0.396 p:0.700	r:-0.018 p:0.839	r:0.465 p:0.765
Total triglycerides (mg/dl)	r:0.417 p:0.000	r:0.567 p:0.000	
Glucose (mg/dl)	r:0.465 p:0.000		
BMI (kg/m²)	r:0.411 p:0000		

*r: Correlation coefficient

4. Discussion

GDM is one of the most important health problems. Pregnancy diabetes (GDM) represents a growing and urgent public health problem. It is the most common pregnancy complication affecting 7-17% of pregnancies worldwide. It may cause unwanted results in terms of mother and baby. These results can be seen in short or long term.

In addition, GDM is conventionally screened and diagnosed at the beginning of the third trimester. This situation increases the need for early detection of high-risk women for GDM (Guariguata et al., 2014; Zhu et al., 2016). Impaired glucose tolerance and fasting glucose can be classified as a metabolic disorder that exists between glucose tolerance and diabetes. Together, both are considered risk factors for the development of cardiovascular disease and diabetes. This risk factor, as written in the literature, can cause diabetes in life. The patient may have to live with diabetes (Giugliano et al., 2016).

Several attempts have been made to find an early screening test to facilitate the diagnosis of gestational diabetes and to make an early diagnosis. However, it has not yet identified a practical method for performing an easily accessible screening for the diagnosis of gestational diabetes in a very short time. Current studies show that positive and negative predictive values for first trimester fasting glucose and insulin have been determined for the detection of diabetes in the next pregnancy. Studies have been continuing on this subject (Riskin et al., 2009; Hao et al., 2017).

Most of these studies have been performed among women at risk for pregnancy diabetes. However, these screening tests and studies should be performed in women population with different risk factors for gestational diabetes and repeated. Aside from pregnancy, a person with normal fasting glucose should be informed about glucose intolerance or diabetes criteria during an oral glucose tolerance test. Moreover, there is no specificity of the instruments used to measure adipose tissue. There are several differences between the studies performed about this subject (Gur et al., 2014; Shinar et al., 2019).

A present study in the literature showed that abdominal visceral adiposity, especially in pregnant women, is associated with the risk of developing gestational diabetes in early pregnancy (De Souza et al., 2014). In addition to ultrasonography, there are various tools for measuring adipose tissue. Ever Since 1990, Nowadays, computed tomography is accepted as one of the gold standard methods used to measure the thickness of adipose tissue. Riberio et al. evaluated computed tomography as a better option to measure adipose tissue rather than ultrasonography (Ribero, 2003). Then, both ultrasound and computed tomography compared to assess visceral obesity in a non-pregnant population to predict cardiovascular risk ingratiation's associated with abdominal obesity. Martin et al. reported that ultrasonographic measurement of abdominal adipose tissue thickness in 64 pregnant women in the first trimester was associated with obesity in early pregnancy and impaired glucose tolerance in subsequent pregnancies (Martin, 2009). Unlike our study, Soo Lim et al. utilized computerized tomography (CT) to compare insulin sensitivity in women with past GDM history and measure visceral adipose tissue (Lim et al., 2007). In our work group, we preferred a different approach rather than these two methods. We utilized Airlie conference standardized procedures to evaluate the waist circumference, using an extremely basic and inexpensive measure method. Similar to our results, in their study , Lemieux et al. stated that the waist circumference is a simple feasible screening method to foresee high-risk population under atherogenic risk factors such as smoking, hypertension, hypercholesterolemia, diabetes mellitus, hyperlipidemia, hyperinsulinemia and previously coronary heart disease (Lemieux et al., 2000). Contrary to our study, in predicting GDM, Pontual et al. did not find waist circumference better than pre-pregnancy BMI measurement (Pontual et al., 2016).

In our study, we have found out that there is positive correlation between glucose andtriglycerides and positive correlation between glucose and waist circumference. We have also observed that increased waist circumference and triglyceride measurements in the first trimester increases 50 g glucose intolerance in later pregnancy. Our findings were in similar range with (Martin et al., 2009; Brisson et al., 2010; Lemieux et al., 2010).

In present study, we observed that the presence of raised waist circumference and hyper-triglyceridemia in the first trimester was associated with a significantly increased risk for subsequent glucose intolerance of the pregnant woman. In addition to, the raised waist circumference also positively correlates with BMI and age.

As a result, we found that first trimester waist circumference measurement is a method that can be applied without the need for expert staff. It is also

inexpensive, easy, effortless, non-invasive, functional method to evaluate impaired glucose tolerance. We are aware of some limitations of our study. The present study reported herein should be considered in the light of some limitations. Small sample sizes and the heterogeneity of the studies are the main limitations. The results of this study were limited by its comparatively small sample size. The lack of previous research studies on the subject is another limitation.

Therefore, comprehensive, prospective and large-scale randomized controlled studies are needed to accept waist circumference measurement as a screening method in GDM.

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