

ORIGINAL RESEARCH

Serum Triglyceride Level and Waist Circumference as Predictor of GDM in Later Pregnancy

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ABSTRACT

Background: The most frequently encountered medical disorder in pregnancy is gestational diabetes mellitus (GDM) which is multifactorial and no tool has been successful in predicting GDM in early pregnancy. In the modern era association of GDM with metabolic syndrome is coming to light. The clinical marker of visceral obesity which is now coined as hypertriglyceridemic waist phenotype is abdominal obesity in combination with hypertriglyceridemia. The purpose of this study was to find the association between the hypertriglyceridemic- waist phenotype in early pregnancy and glucose intolerance in later pregnancy. Not many studies have been done to show the association of increased waist circumference and elevated serum triglyceride leading to the development of GDM even though it is well known that the interrelation of these leads to subsequent development of Type 2 Diabetes Mellitus (T2DM).

Objective: To determine the association of elevated serum triglyceride level and waist circumference in early pregnancy with the development of GDM in later pregnancy

Materials and methods: It is an observational study where fasting serum triglyceride and waist circumference is measured in 270 consenting pregnant women between 11-14 weeks and followed up. Performance of 75 gm oral glucose tolerance test (OGTT) was done between 24-28 weeks and results were interpreted.

Results: In early pregnancy, a waist circumference of 96.4cm \pm 13.6 and a fasting serum triglyceride level of 147.8mg/dl \pm 74.8 are interrelated with the development of GDM in later pregnancy. There is 3 times increased chance of developing GDM with a waist circumference of >80cm and 9 times increased chance of developing GDM with a serum triglyceride level of >150mg/dl

Conclusion: In early pregnancy, the "Hypertriglyceridemic Waist Circumference" is associated with the subsequent development of GDM

Keywords: GDM, Waist Circumference, S. Triglyceride, OGTT

INTRODUCTION

Women with the Metabolic Syndrome (MS) are at high risk for GDM and have a high risk of developing metabolic syndrome and T2DM in later years.^[1] Impaired fasting glucose and pre-pregnancy obesity are the most significant risk factors among the components of MS.

Waist circumference has been reported as an index of abdominal visceral adiposity.^[2] In programming intrauterine foetal growth, the physiological hypertriglyceridemia of pregnancy is important and is emphasized by gestational and pre-existing non-insulin-dependent diabetes mellitus. In early pregnancy, waist circumference and TG measurement could potentially provide an early window for the screening of GDM. A simple easily available clinical marker of metabolic abnormalities is a condition called “hypertriglyceridemic waist,” that gives us a hint on which patient has to be screened early and can aid in primary prevention and earlier intervention, using lifestyle modification and also in preventing long term risk of developing type 2 diabetes and metabolic syndrome. The study aims to assess the range to which prediction of GDM can be done in the first trimester only which is usually diagnosed at 24-28 weeks. The correlation of increased waist circumference and elevated serum triglyceride with subsequent development of T2DM is well known, we attempt to see the correlation between these and the development of GDM.

OBJECTIVE

To determine the association of elevated serum triglyceride level and waist circumference in early pregnancy with the development of GDM in later pregnancy.

MATERIALS AND METHODS

This is an observational study conducted on pregnant women registering in the Obstetrics and Gynaecological department at Bangalore Baptist Hospital. Bangalore Baptist Hospital is a NABH-accredited tertiary care centre. 270 pregnant women between 11-14 weeks of gestation, with gestational age confirmed by scan and who gave consent participated in the study between July 2014 - April 2015. Women older than 40 years of age, women with pre-existing hyperlipidemia, Intractable Hyperemesis gravidarum, those with pre-existing type 1 and type 2 diabetes, and women with alcohol abuse / smoking, were not included in the study.

METHODS OF DATA COLLECTION

A proforma was filled after taking an informed consent from the women meeting the inclusion criteria. Women were asked to come in a fasting state for a minimum of 8 hours not exceeding 14 hours. 2 ml venous blood sample was drawn from the woman for serum triglyceride estimation.

Waist circumference will be measured at the midpoint between the last palpable rib margin and the top of the iliac crest at normal expiration, in a standing position, the tape being parallel to the floor after ensuring adequate privacy. Measurement of the waist circumference was done according to the (Stepwise Approach to Surveillance) STEPS protocol by WHO.

Women were followed up at 24-28 weeks of gestation when an OGTT with 75gm glucose is done according to IADPSG (International Association of Diabetes and Pregnancy Study Group) criteria.^[3] Samples for plasma glucose measurement, fasting, 1-hour, and 2-hour post glucose load were taken after 8 hours of overnight fasting.

STATISTICAL METHODS

The chi-square test was used to compare the proportion of pregnant ladies having elevated serum triglycerides among the GDM group and non-GDM group. Similarly, comparison of the proportion of pregnant ladies having greater waist circumference was done among the GDM group and non-GDM group.

RESULTS

	Parameter	Measure
Age, Year	Mean +/-SD	25.5 +/- 4.1
Parity (%)	Primigravida	67.4%
	Multigravida	32.6%
3	Prior GDM (%)	10.2%
4	Family History (%)	17.8%
Height(cms)	Mean +/-SD	155.2+/-6.9
Weight(kg)	Mean +/-SD	65.3+/-13.6
BMI%	Overweight	22.2%
	Obese	4.1%
Waist Circumference(cms)	Mean+/-SD	96.4+/-13.6
Serum Triglyceride,mg/dl	Mean +/-SD	147.8+/-74.8
	GDM%	13%

Table 1. Baseline Characteristics of Participants (n=270)

Variable	Group	Mean	SD	t-value	p-value
Age	GDM	27.66	3.869	3.490	0.001
	Non GDM	25.12	4.091		

Table 2. Age Distribution in Pregnant Women with GDM and without GDM

Variable	Group	Mean	SD	t-value	p-value
Weight	GDM	65.30	13.623	6.725	0.000
	Non GDM	53.66	8.921		

Table 3. Weight Distribution in Pregnant Women with GDM and Non-GDM

Variable	Group	Mean	SD	t-value	p-value
Waist Circumference	GDM	96.40	13.672	8.391	0.000
	Non GDM	81.84	8.943		

Table 4. Distribution of Waist Circumference in Pregnant Women with GDM and without GDM

Variable	Group	Mean	SD	t-value	p-value
Serum Triglyceride	GDM	147.8	74.86	6.432	0.000
	Non-GDM	97.6	36.62		

Table 5. Distribution of Serum Triglyceride in Pregnant Women with GDM and without GDM

There was a statistically significant difference between the mean age of pregnant women (Table II) who developed GDM (27.66) that was higher and who did not develop diabetes (25.12) (p=0.001).

The mean weight of pregnant women who did not develop GDM was 53.6 kg compared to those women Table III) who developed GDM which was 65.3 kg, and this was statistically significant (p= 0.000). The long proven risk factors for GDM are age and increased weight for height (overweight and obesity)

The mean waist circumference in pregnant women who developed GDM was higher (96.4cm) than those who did not develop GDM (81.8cm) (Table IV) and statistically significant. (p=0.000).

The mean serum triglyceride level in mg/dl in the pregnant women who did not develop GDM was 97.6 compared to those who did not develop GDM which was 147.8 (Table V) and was statistically significant. (p=0.000)

Waist Circumference	GDM	Non-GDM	Odd's Ratio	Confidence Interval
≤80Cm	6	96	3.4	1.39-8.67
>80Cm	30	138		

Table 6. Table Showing the Odds Ratio for Waist Circumference

S.TG	GDM	Non-GDM	Odds Ratio	Confidence Interval
<150mg/dl	20	216	9.6	4.2-21.6
≥150mg/dl	16	18		

Table 7. Table Showing Odds Ratio for Serum Triglyceride

Pregnant women with a waist circumference of >80 cm have 3 times greater chance of developing GDM in later pregnancy (OR-3.4) and women in early pregnancy with S.TG of ≥150mg/dl have 9 times higher chance of developing GDM in later pregnancy (Table VI and VII). At the end of the study, 13.3% (n=36) developed GDM and 86.7% (n=234) were non-diabetic.

DISCUSSION

The mean age of pregnant women who did not develop GDM was 25.1±4 years which was lower than women who developed GDM that was 27.6±3.4 years.

The association of waist circumference and fasting S.TG level in the early trimester with the development of GDM at around 24-28 weeks was the primary outcome that was measured. The cut-off for waist circumference was taken to be 80cm as per WHO guidelines for the Asian population and an S.TG level of 150 mg/dl as per WHO criteria for metabolic syndrome.

In early pregnancy, a WC of 96.4cm±SD 13.6 was associated with the development of GDM and there was 3 times higher chance of developing GDM (OR-3.3) in case of women with WC >80cm in our study. A serum triglyceride level of 147.8mg/dl±SD 74.8 in women in early pregnancy was in relation with the development of GDM and women with S.TG level of ≥150mg/dl have a 9 times higher chance of developing GDM. The combination of waist circumference and serum triglyceride is called a “hypertriglyceridemic waist”.

Our results correlate with those of Martin and colleagues,^[4] who showed the measurement of visceral adiposity in early pregnancy to be associated with gestational glucose intolerance.

Ultrasonography which is not easily accessible especially at the beginning of pregnancy when follow-up often takes place in small obstetrics and general practice clinics was used to measure visceral adiposity. The use of USG for measuring abdominal obesity is clinically not practical for the Indian setup. There is a benefit of suggesting an alternative simple, readily available and inexpensive method in our results. Brisson and colleagues^[5] found that women with increased waist circumference and serum triglyceride in the first trimester had a significant 6.1-fold increased risk of having a fasting glucose level of 7.8mmol/l. or above.

Studies	Waist Circumference	S. Triglyceride
Enquobahrie DA et al ^[6]		OR-3.5 for level>137mg/dl
Eliana MDR, Duncan et al ^[3]	Mean=82cm Sensitivity of 63% and specificity of 53%	
Diane Brisson, Patrice Perron et al ^[5]	Mean =85cm OR= 4.7	Mean= 1.7mmol/l OR= 4.2
Bolognani CV et al ^[7]	Mean=86-88cm OR-4.02	
Present Study	Mean =96 cm	Mean S.TG=147 mg/dl

	OR-3.3	OR-9.6
Table 8. Comparison with other studies		

Compared to the above studies our study showed that pregnant women with increasing waist circumference $>80\text{cm}$, have 3 times increased risk of development of GDM. And pregnant women with S.TG of ≥ 150 have 9 times increased risk of developing GDM, which is significantly higher compared to the above studies.

This difference can be due to the unadjusted OR'S and the cumulative effects of age, Waist Circumference, and BMI on S.TG has not been separated. 30% of overweight and 81.8% of obese women in early pregnancy developed GDM, thus also showing the impact of BMI on GDM. The mean weight of pregnant women in early pregnancy who developed GDM is $65\text{kg}\pm 13.6$.

Susan Y Chu, William M Callaghan et al, in their study in 2007, a meta-analysis which included a total of 20 studies, concluded that the risk of developing gestational diabetes is two, four and eight times higher in overweight, obese and severely obese women respectively compared to normal pregnant women.^[8]

There is a strong correlation between increasing maternal age and BMI which varied according to race, with the development of GDM as per the study by Savvidou M, Makgoba M et al between 1988 and 2000.

When compared to Hispanic, non-hispanic white and African American women, Hedderson et al explained that Asian and Filipino women had a prevalence of 9.9 and 8.5% respectively at a higher BMI of 22-24.9

STRENGTHS AND LIMITATIONS

The strength of our study is that the values are easily reproducible and the tools are easily accessible. Our results help in determining the individual risk and aid in improved monitoring on an individual basis.

Smaller sample size was the limitation of our study. There would be identification of optimal waist girth and plasma triglyceride concentration cut-off points for this population in case of a larger sample.

This is an observational study. Further case-control studies are required to determine the risk ratio and the extent to which it can be used as a tool for the prediction of GDM.

Follow-up of patients was only up to 24-28 weeks. There would be an association with pre-eclampsia, neonatal birth weight and risk of type 2 diabetes at 6 weeks post-partum, by the follow-up as all these conditions have the same risk factors.

CONCLUSION

Measurement of mean waist circumference of $96.4\text{cm}\pm\text{SD}13.6$ done between 11-14 weeks was associated with the subsequent development of GDM in pregnant women. There was an association of mean serum triglyceride of $147.8\text{mg/dl}\pm\text{SD}74.8$ that was measured between 11-14 weeks with subsequent development of GDM in pregnant women. Pregnant women with a waist circumference of $>80\text{cm}$ in early pregnancy have a 3 times more chance of developing GDM than pregnant women with a waist circumference of $\leq 80\text{cm}$ (OR-3.3). Pregnant women with a serum triglyceride level of $\geq 150\text{mg/dl}$ in early pregnancy have a 9 times higher chance of developing GDM than pregnant women with S.TG of $<150\text{mg/dl}$ (OR-9.6).

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