



Study on Early Pregnancy Maternal Lipid Profile and Risk of Gestational Diabetes Mellitus in Relation to Waist Hip Ratio – A Prospective Cohort Study

¹Dr. Prathusha Nerella, Associate professor, Department of General Medicine, Surabhi Institute of Medical Sciences, Siddipeta, Telangana, India.

²Dr. Visala V. Nanduri, Associate professor General Medicine, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India.

³Dr. Shobha Mohammed, Professor Biochemistry, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India.

⁴Dr. Mujahid Mohammed, Professor Physiology, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India.

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Corresponding Author: Dr. Mujahid Mohammed, Professor Physiology, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India

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Abstract

Recent guidelines recommend testing at 24 to 28 weeks of gestational diabetes mellitus (GDM) as there are chances of high risk of type 2 diabetes. Evidence to support the early identification and treatment of gestational diabetes mellitus (GDM) is limited. However, we examined the waist hip ratio and lipid profile in early pregnancies to correlate GDM risk. Descriptive statistics was reported as Mean±SD for continuous variables, with 95% confidence interval (CI) at 80% power of the study. ANOVA was used to detect

the difference between the groups and multiple comparison was done by Tukey’s multiple comparison test. We estimated the relative risk of GDM. Statistical significance was measured at $p < 0.05$. Outcome of the study from 100 women with early pregnancy were classified as GDM and non-GDM group. 80% of them were turned to GDM with high lipid profile at early pregnancy with waist hip ratio more than 1. Estimation of lipid profile in early pregnancy may prove potential biomarker to identify the gestational diabetes (GDM)

and timely intervention with counselling and education regarding high risk of GDM later and role of medical nutritional (MNT) and life style modification (LSM) therapy may prevent woman not to fall in trap of GDM.

Key Words

Early pregnancy, Gestational Diabetes (GDM), Lipid profile, Waist hip ratio

Introduction

Gestational diabetes mellitus (GDM) is neglected threat to maternal and child health. The awareness among general public regarding GDM and associated maternal and foetal complications is very low in India. Pregnancy-related complications including high blood pressure, large birth weight babies and obstructed labour were found in many women with GDM. Approximately 50% of women with a history of GDM develop type2 diabetes within five to ten years after delivery. There are estimated 223 million women living with diabetes in the age groups of 20-79 years. This number may project to 343 million by 2045 as per WHO. 20 million of live births had some form of hyperglycemia related to pregnancy with an estimated 85% were due to GDM. One in six births was affected by GDM. Majority of cases of hyperglycemia in pregnancy were reported in developing and under developed countries. There are evidences that gestational diabetes mellitus (GDM) has various adverse effects on maternal and foetal out-come, increased risk of developing preeclampsia, foetal death, macrosomia, shoulder dystocia, perinatal hypoglycemia and respiratory distress [1,2]. Women with gestational diabetes are at increased risk of type2 diabetes mellitus and hypertension leads to cardiovascular diseases [3]. The etiology of GDM is not clear and it is thought to share pathophysiology with type2 diabetes, includes deficient insulin secretion and

insulin resistance being the main pathogenic mechanism responsible to GDM [4,5]. Few researchers have explored the association of lipid profile in early pregnancies with subsequent risk of GDM [6,7]. Maternal obesity is one of the risk factors of GDM and body mass index could affect the lipid profile [8,9]. However, most of the studies have been conducted on early pregnancy maternal lipid profile concentrations in relation with BMI on the risk of developing GDM, leaving the lacuna of waist hip ratio with lipid profile and GDM. We tried to explore the possibilities of association of waist-hip ratio, lipid profile in early pregnancy and the risk of gestational diabetes (GDM).

Materials and Methods

This prospective cohort study was conducted at department of gynecology and medicine at Surabhi institute of medical sciences and its tertiary hospital, Telangana from 2020 to 2021 in early pregnancy women 11-15 weeks of gestation.

Measurement of Waist Hip Ratio

The waist circumference was measured at the midpoint between the margin of the 12th rib and the top of iliac crest. Hip circumference was measured around the widest portion of the buttocks, individuals were made to stand feet closer and arms at the side, so body weight should evenly distribute with little clothing, according to the guide lines amended by World Health organization (WHO).

Laboratory Investigation

Fasting lipid profile was recommended to all the participants in an NABL accredited laboratory at 11 to 15 weeks of gestation. Maternal Triglyceride (TAG), Cholesterol, LDL and HDL (calculated) levels were measured by using autoanalyzer by turbidimetric method using Mindray, barcoded kits provided with the company under good laboratory practice (GLP) and

standard operating procedure (SOP) were followed. For GTT a 75 gm oral glucose tolerance test (OGTT) was carried out at 24 to 28 weeks of gestation in women not previously diagnosed with overt diabetes. A diagnosis of GDM was made when sample drawn at 2 hours after the ingestion of 75 gm of glucose and serum value ≥ 140 mg/dL was considered.

Statistical Analysis

Data collected was analysed by using Graphpad Prism (9.3) version, USA. Descriptive statistics was reported as Mean \pm SD for continuous variables, with 95% confidence interval (CI) at 80% power of the study. ANOVA was used to detect the difference between the groups, multiple comparison was done by Tukey's multiple comparison test. We estimated the relative risk of GDM among the groups. Statistical significance was measured at $p < 0.05$.

Result

One hundred women who underwent early pregnancy screening were enrolled for the study, who were visiting department of gynecology, Surabhi Institute of Medical Sciences, Telangana. As a part of screening, waist hip ratio was calculated after obtaining informed consent from the study participants. The study was conducted from 08-2020 to 05-21 till hundred early pregnancies were identified. As part of screening women with early pregnancy waist hip ratio more than 1 were included in the study. Women with diabetes and waist hip ratio less than 1 were excluded from the study. Out of 100 participants enrolled all of them were followed up to 24 to 28 weeks of pregnancy to estimate the OGTT levels at the end of 2 hours after ingestion of 75gm of glucose, in GDM group the levels were 155 ± 13

(95%CI 152-158) and in non-GDM group was 120 ± 7.3 (95% CI 117-123), early lipid profile was evaluated in all the participants. Out of 100 participants 80% of them have developed GDM and remaining 20% of them have not developed GDM and we confirmed it by calculating relative risk (41.75, $Z=2.6$ and $p=0.007$). The calculated waist hip ratio in GDM and non-GDM women were 1.3 ± 0.07 (95% CI 1.3-1.4) in early pregnancy. The values of Triglycerides (TAG) were 294 ± 33 (95% CI 286-301) GDM group and in non-GDM group 171 ± 15 , the levels of cholesterol in GDM group were 251 ± 16 (95% CI 138-141) and in non GDM group 187 ± 7.2 (95% CI 184-191). The levels of LDL in GDM group were 139 ± 7.5 (95% CI 138-141) and in non-GDM group was 109 ± 6.8 (95% CI 105-112). The levels of HDL in GDM group were 48 ± 19 (95% CI 44-52) and in non-GDM group was 49 ± 8.1 (95% CI 45-53). The levels of LDL/HDL ratio were 0.35 ± 0.15 (95% CI 0.32-0.38) and in non-GDM group was 2.2 ± 0.49 (95% CI 2.0-2.4). The levels of TG/HDL ratio in GDM group were 8.8 ± 8.9 (95% CI 6.8-11) and non-GDM group was 3.5 ± 0.5 (95% CI 3.3-3.8). Data presented as Mean \pm SD. One way ANOVA with F value 4167 and $P < 0.0001$ in GDM Group in between the columns and in F 2242 and $P < 0.0001$, in non-GDM Group which was statistically significant between columns by Tukey's multiple comparison test where p value was 0.0001. We analysed the waist hip ratio between two groups showed F value of 33.04 (1.009, 59.34) with Tukey's multiple comparison test and statistically significant between columns, p value < 0.01 (Table 1-2, Figure 1-4).

Table 1 - Waist hip ratio, Lipid profile and GTT Levels in early pregnancy (n 100)

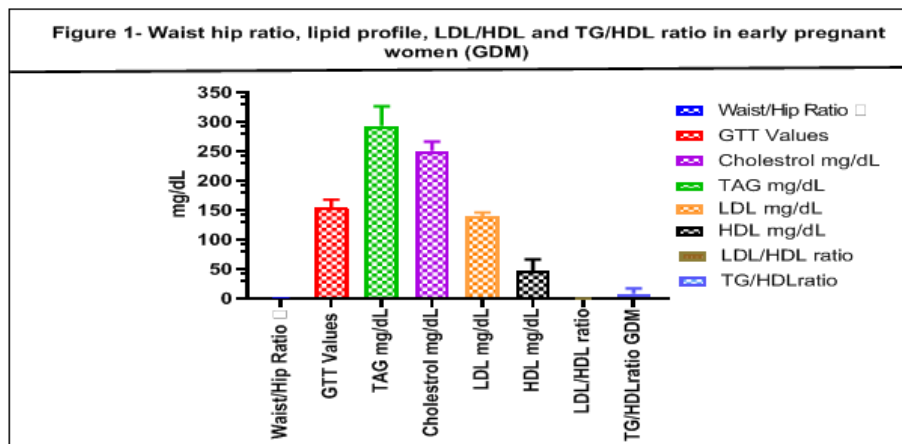
Parameters	GDM Mean±SD (n 80)	Non-GDM Mean±SD(n 20)
Waist/Hip Ratio	1.3±0.07****	1.3±0.07****
GTT Values	155±13****	120±7.3****
TAGmg/dL	294±33****	171±15****
Cholesterol mg/dL	251±16****	187±7.2****
LDL mg/dL	139±7.5****	109±6.8****
HDL mg/dL	48±19****	49±8.1****
LDL/HDL ratio	0.35±0.15****	2.2±0.49****
TG/HDL ratio	8.8±8.9****	3.5±0.53****
F value	4167	2242
P value	<0.0001	<0.0001

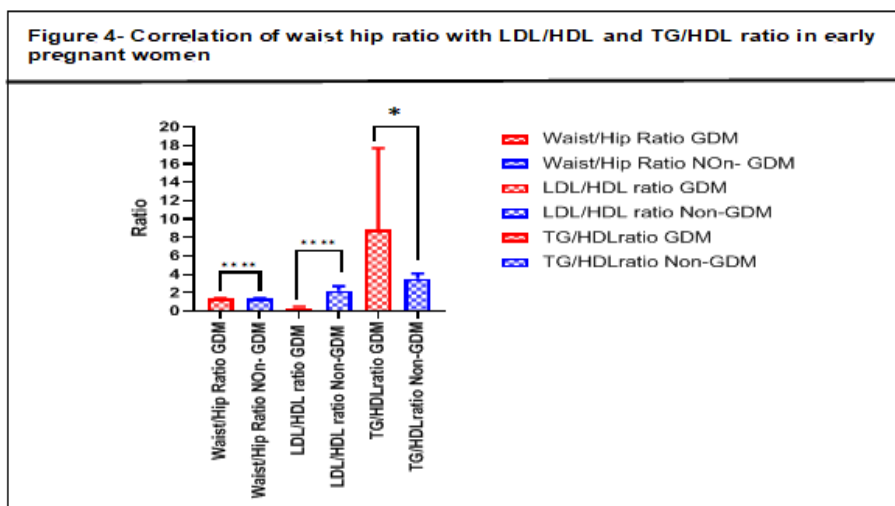
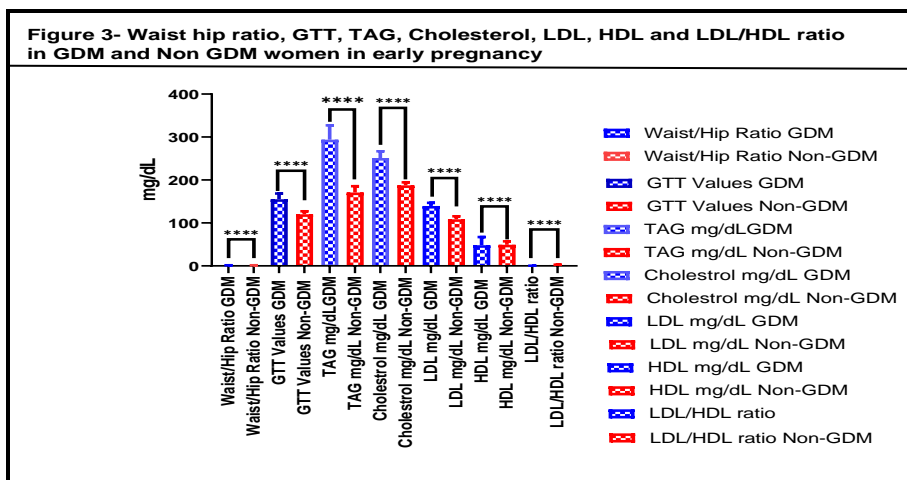
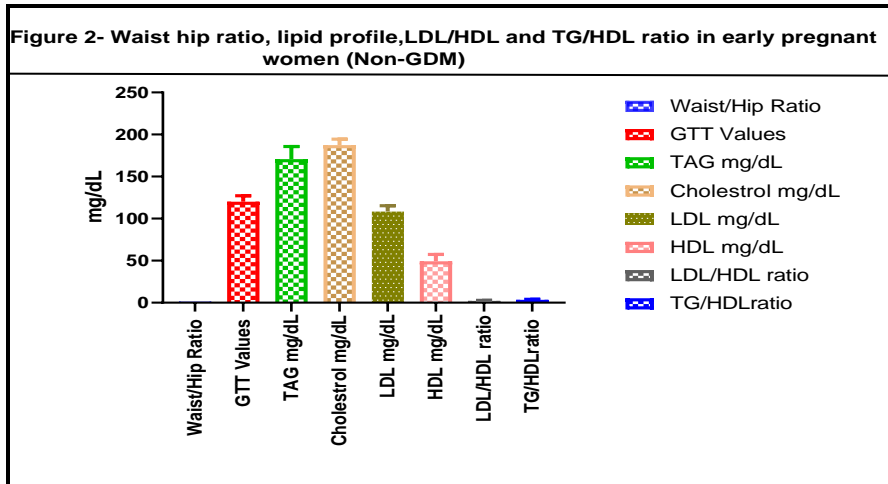
Data presented as Mean±SD. One way ANOVA with F 4167, 2242value. P<0.0001.
 * Statistically significant between columns with Tukey's multiple comparison test.
 Waist hip ratio F= 33.04, p<0.0001 with Tukey's multiple comparison test.

Table 2- comparison of Waist hip ratio with LDL/HDL ration and TG/HDL ratio in early pregnancy (n 100)

Parameters	GDM Mean±SD (n 80)	Non-GDM Mean±SD(n 20)
Waist/Hip Ratio	1.3±0.07****	1.3±0.07****
LDL/HDL ratio	0.35±0.15****	2.2±0.49****
TG/HDL ratio	8.8±8.9****	3.5±0.53****

Data presented as Mean±SD.
 Waist hip ratio F= 33.04, p<0.0001 with Tukey's multiple comparison test.
 *Statistically significant between columns with Tukey's multiple comparison test.





Discussion

The present study declared that 80% of the women who developed GDM have significantly high levels of TAG, Cholesterol, LDL and LDL/HDL ratio and very less change in HDL levels with waist and hip ratio more than 1 in early pregnancy compared to non-GDM group. In 20% of the women TAG, Cholesterol, LDL, HDL and LDL/HDL were at the border line has not developed gestational diabetes in our study. Women with normal levels of TAG and more levels of HDL may be the cause of not developing GDM in 20% of women which is in contrast to other studies. Savvidou et.al; stated that the women who had higher levels TAG, Cholesterol, LDL levels and lower levels of HDL has developed GDM. This study is in agreement to our study and showed a significant correlation [10]. Bower et.al; found a higher concentration of TAG and low concentration HDL in women with GDM [11] as the relation between TAG and HDL is inversely proportional. We also found the same relation in GDM group when compared to non-GDM group. Emet et.al; related positive association between GDM and lipid profile changes, but in patients with glucose intolerance they found decrease in Cholesterol and LDL levels which is in contrast with our studies [7]. Some case- control and prospective studies showed an association between increased TAG and GDM risk [10,12,13]. Other studies hypothesized that there was no change in lipid profile in first trimester but they have related with waist hip ratio [16,17]. We performed the waist hip ratio analysis and correlated the lipid profile and found the trend of increase risk of GDM whose lipid profile is increased in early pregnancy. 80% of them in our study found to be diagnosed with GDM at the end of 24 to 28 weeks of gestation. Interestingly we found the decreased levels of

HDL may have contributed GDM in women. The mechanism by which obesity may partially offsets the protective function of HDL on carbohydrate metabolism by variety of mechanisms such as insulin secretion from pancreatic beta cells and insulin dependent and insulin independent glucose uptake and utilisation by the tissues. Several studies proved that CHO metabolism/lipoprotein fractions may play key roles in the progression of β -cell failure and these effects are mediated by c-Jun N-terminal kinase and caspase-3 pathways [18]. Some investigators highlighted the fact of oxidative distress due to dyslipidemia and increased TAG and small density LDL, may contribute to the elevated oxidative stress and endothelial failure that occurs in preeclampsia and also insulin resistance [19]. Conflicts among the other studies referred in the text may be due to variety of reasons including sample size, study design, cofounders, population characteristics and diagnostic criteria of GDM. To our knowledge this is a typical study where waist hip ratio was correlated with lipid profile in early pregnancy and risk of GDM. 80% of participants with early pregnancy have showed an increase of lipid profile and all of them have showed an increased glucose levels with OGTT at 24 to 28 weeks of gestation.

Conclusion

Estimation of lipid profile in early pregnancy may prove potential biomarker to identify the gestational diabetes (GDM) and timely intervention with counselling and education regarding high risk of GDM later and role of medical nutritional therapy (MNT) and life style modification (LSM) may prevent woman not to fall in trap of GDM. However, our study has some potential limitations such as low sample size

more studies are warranted with cluster-based sampling method with larger sample size.

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