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Research Paper

Relation between Maternal Triglyceride, Cholesterol Levels and Amniotic Fluid Index in Women with Gestational Diabetes Mellitus to the Birth Weight of Newborn at Term

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ABSTRACT:

BACKGROUND:

In pregnant women with gestational diabetes mellitus, the insulin and lipids levels are altered indicating metabolicg changes that manifests during pregnancy.

OBJECTIVE:

To identify the relation of maternal triglyceride, cholesterol levels and amniotic fluid index to the newborn birth weight in the obstetric population with gestational diabetes mellitus.

METHODS:

A cross sectional study conducted at Obstetrics and Gynecology Department in Al-Elwyia Maternity Teaching Hospital in Baghdad, including 100 pregnant women (gestational age ≥ 37 weeks) having gestational diabetes mellitus. Serum total cholesterol, triglyceride, and glucose concentrations and amniotic fluid index were measured then neonatal birth weight was measured at labor.

RESULTS:

In this study, 12% of study patients had high cholesterol level and 47% had high Triglyceride level and 32% had high amniotic fluid index. Mean birth weight is reported to be higher in babies whose mothers have dyslipidemia when compared to those without dyslipidemia. A positive correlation was detected between birth weight and with both serum cholesterol , serum triglyceride. But no statistical significant correlation detected between amniotic fluid index and birth weight.

CONCLUSION:

Serum Cholesterol and triglyceride levels in gestational diabetes pregnant women could be significantly correlated with neonatal birth weight unlike the amniotic fluid index.

KEYWORDS: Gestational DM, triglyceride, cholesterol, AFI, birthweight.

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INTRODUCTION:

Gestational Diabetes is one of the most common endocrinopathies and metabolic diseases during pregnancy [(1)], diagnosed when abnormal glucose metabolism discovered for the first time during pregnancy[(2)] Prevalence of gestational diabetes is approximately 2-6% [(3)]. The rise in gestational diabetes is parallel with rise in obesity worldwide and it is of particular concern. Diabetes during pregnancy is associated with increase in maternal and perinatal morbidity and many unwanted other consequences, such as preeclampsia, fetal macrosomia, increased cesarean section rate, fetal death, shoulder dystocia, perinatal hypoglycemia, and respiratory distress. [(4)] Moreover, their offspring at an increased risk to have type 2 diabetes and obesity and vascular disorders later in life [(5)].

Normal pregnancy is blamed to induce changes in lipid, carbohydrate and protein metabolism [(6)]. Lipid abnormalities appear to cause elevation in triglycerides levels (TG) and same to LDL-cholesterol and total cholesterol concentrations in the blood. The most noticed change is the rise in fasting TG levels by four folds which may be due to increased hepatic production and reduced uptake in response to the effect of placental hormones [(7,8)]. Presence of active lipase activity in the placenta, enables the release of free fatty acids (FFAs) from

TG and with the help of fatty acid-binding proteins and receptors allow efficiently transport of free fatty acids from maternal to fetal side. It is proposed that the hydrolysis of maternal TG by placental lipoprotein lipase to FFAs beside the accelerated transport rate of fatty acids is partly responsible for the increased fetal body weight in those women with hypertriglyceridemia [(9)].

Amniotic fluid index (AFI): -

Amniotic fluid is the fluid that surrounds your baby in your uterus. It's very important for your baby's development. Measuring amniotic fluid volume is essential in pregnancy assessment[(10)]. the health care provider uses ultrasound to measure the amount of amniotic fluid. There are two ways to measure the fluid: amniotic fluid index (AFI) and maximum vertical pocket (MPV).

If the AFI is more than 24 centimeters, that is polyhydramnios. If the MPV is more than 8 centimeters that is polyhydramnios.

The study goal is to find possible relation of maternal triglyceride, cholesterol and amniotic fluid index values in obstetric population with gestational Diabetes mellitus to the birth weight of the newborn.

Methodology

A cross sectional study conducted at Obstetrics and Gynecology Department in Al-Elwyia Maternity Teaching Hospital in Baghdad.

One hundred pregnant women who are diagnosed to have gestational diabetes were recruited for the study. Diagnosis of diabetes is made according to the recent WHO recommendation by using (75 gm OGTT) at gestational age 24 - 28 weeks, fasting 1 hr. and 2 hrs. Post prandial blood sugar test at gestational age at 24 - 28 weeks. A single increased value was sufficient for the diagnosis or when the blood sugar level was taken more than target value of control (FBS<95mg/dl, 1hr RBS<140mg/dl, 2hr RBS<120mg/dl)

The participants included were at gestational age ≥ 37 weeks, blood samples were taken from them in the outpatient clinic after 10-12 hrs. of fasting. Cholesterol, triglyceride, and glucose levels were assessed using an automatic biochemical analyzer by well-trained person. Measurement of amniotic fluid index done by ultrasound. According to results, they were arranged into two groups:

- First group included, pregnant women who are well controlled for GDM (42 patients).
- Second group included, pregnant women that showed uncontrolled blood sugar (58 patient)

Both groups were followed up till delivery and the birth weight of their neonates was assessed.

- **Inclusion criteria**
  - ✓ Singleton pregnancy
  - ✓ having a medical record.
  - ✓ Gestational age ≥ 37 weeks.
- **Exclusion criteria**
  - Known cases of diabetes mellitus before pregnancy.
  - Presence of metabolic disorders like (familial hypercholesterolemia)
  - Presence of liver or Thyroid disease before pregnancy.
  - Using medications that affect lipid metabolism like steroids, antipsychotic medication and antiepileptic medication.
  - Other causes of the polyhydramnios.
  - Intrauterine fetal death.

Data collection

A questionnaire was applied to the participants including:

- ❖ Demographic data (Age, occupation, and family history of DM).
- ❖ Obstetrical history: (Gravity, parity, GA, history of abortion, and mode of delivery, history of macrosomic baby, and history of still birth or intrauterine death).
- ❖ Past medical history
- ❖ Past surgical history
- ❖ Medication (That may affect lipid profile).
- ❖ Type of treatment (diet, insulin, Glucophage tab)
- ❖ Investigation (the recent RBS, s. cholesterol, and s. triglyceride).
- ❖ Amniotic Fluid Index by U/S.

Ethical consideration

The Council of Iraqi board of Medical Specialization, the hospital administration and the scientific committee approved the study. Verbal consent of the participants was taken after explaining the purpose of the study and reassuring them that data will remain confidential.

Statistics

The data is presented as mean, standard deviation and ranges by using Statistical Package for Social Sciences (SPSS) version 25. The Categorical data presented by frequencies and percentages. Independent t-test is used to compare the birthweight accordingly. Pearson's correlation test (r) was used to measure correlation of birthweight with other variables accordingly. P value|< 0.05 is considered significant.

RESULTS:

One hundred term pregnant women diagnosed having gestational diabetes were included in the study. More than half of participants (56%) are 25-34 years old, while only 30% are 35 years and above. Most of them are housewives (62%).

Regarding general characteristics, 64% had more than two children; 35% had previous miscarriage.

Regarding previous history, 35% had delivery of macrosomic babies; 20% of them were delivered babies with congenital abnormality; and 34% had previous history of fetal death. Family history of GDM was positive in 13% of them and 58% of study patients were uncontrolled for GDM.

Table 1: Distribution of patients by general characteristics.

Variable	No. (n= 100)	Percentage (%)
Number of children		
No children	12	12.0
1 – 2	24	24.0
≥ 3	64	64.0
Previous miscarriage		
Yes	35	35.0
No	65	65.0
Previous history		
Previous delivery of macrosomic baby	35	35.0
Previous delivery of baby with congenital anomaly	20	20.0
Previous history of fetal death	34	34.0
No	38	38.0
Family history of GDM		
Yes	13	13.0
No	87	87.0
GDM Control		
Controlled	42	42.0
Uncontrolled	58	58.0
AFI		
Increased	32	32.0
Normal	68	68.0

**AFI normal value 10–23 cm , if polyhydramnios AFI > 25cm[(10)]*

Lipid profile

Results of lipid profile, 12% of study patients had high cholesterol level and 47% had high TG level.

Regarding dyslipidemia, 55% of study patients complained from dyslipidemia.

Table 2: Distribution of patients by presence of dyslipidemia.

Variable	No. (n= 100)	Percentage (%)
Total S. Cholesterol Level		
High	12	12.0
Normal	88	88.0
S. TG		
High	47	47.0
Normal	53	53.0
Dyslipidemia		
Yes	55	55.0
No	45	45.0

Comparison in BW according to dyslipidemia and AFI

The comparison in BW according to dyslipidemia and AFI in all study patients is shown in table (3). Weight of babies was from 2500 to 5100 gms with a mean of 3898.0 gms and SD of ± 627.9 gms. More than half of babies (53%) were weighing < 4000 gms.

Mean of BW is much higher in babies delivered for women with dyslipidemia than that in those without dyslipidemia (4129.1 versus 3662.2 gms, P = 0.001).

No statistical difference is seen in the mean of BW (P = 0.08) between patients with high AFI and those with normal AFI.

Table 3: Comparison in BW according to dyslipidemia and AFI in all study patients.

Variable	Birth weight (gm) Mean ± SD	P - Value
Dyslipidemia		
Yes	4129.1 ± 563.4	**0.001**
No	3662.2 ± 600.1	
AFI		
High	3631.6 ± 799.4	**0.08**
Normal	3986.4 ± 558.5	

According to insulin use (Controlling of GDM)

Table 4, shows the comparison in BW according to dyslipidemia and AFI in controlled and uncontrolled GDM (Received insulin or not). In women with uncontrolled Diabetes

and in those with controlled Diabetes Mellitus mean of BW was noticably higher in babies whose mothers having dyslipidemia than that in those without dyslipidemia (4320.6 versus 3904.2 gms, P= 0.003; and 3819.0 versus 3385.7 gms., P= 0.015 respectively).

No statistical significant difference in BW (P ≥ 0.05) is seen between the pregnant women with high AFI and those with normal AFI in both who received insulin and those who didn't.

Table 4: Comparison in BW according to dyslipidemia and AFI.

Variable	Birth weight (gm) Mean ± SD	P - Value
Patients with poor glyceamic control		
Dyslipidemia	4320.6 ± 482.2	**0.003**
Normal lipid profile	3904.2 ± 548.9	
High AFI	4054.5 ± 651.7	**0.593**
Normal AFI	4170.2 ± 524.9	
Patients good gltceamic control		
Dyslipidemia	3819.0 ± 557.3	**0.015**
Normal lipid profile	3385.7 ± 543.4	
High AFI	3250.0 ± 607.1	**0.213**
Normal AFI	3532.4 ± 507.3	

Correlations between BW and AFI, S. cholesterol and S. TG are shown in table (3.5) and figures (3.2 and 3.3). Positive correlations are seen between S. cholesterol and BW (r= 0.431, P= 0.001). A weak positive relation is detected between S. TG and BW (r= 0.299, P= 0.003). No statistical significant correlation detected between AFI and BW (P= 0.08).

Table 5: Correlations between BW and AFI, S. cholesterol and S. TG.

Variable	Birthweight (gms)	
	r	P - Value
S. Cholesterol (mg/dl)	**0.431**	**0.001**
S. TG (mg/dl)	**0.299**	**0.003**
AFI	**0.173**	**0.08**

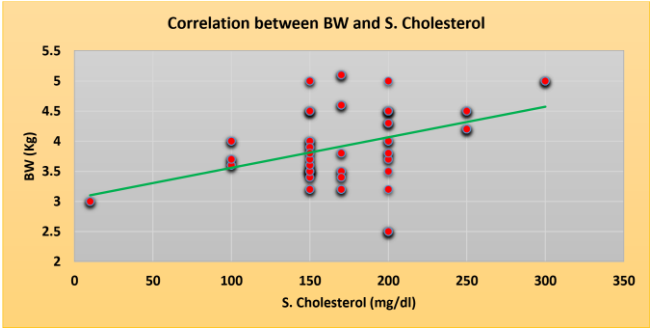

Figure 1: Correlation between BW and S. cholesterol.

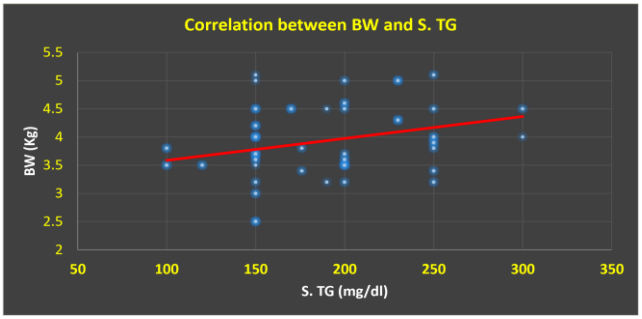

Figure 2: Correlation between BW and S. TG.

DISCUSSION:

Gestational diabetes mellitus is a state of insulin resistance which diagnosed during pregnancy for the first time.[11] Many studies report an increased levels of triglycerides, LDL-C and total cholesterol and lower levels of HDL-C in those women but these findings are generally inconsistent [12].

The current study is mainly considered plasma lipids in third trimester in pregnant women having GDM. It show that S. cholesterol was high (12%) and S.TG was high 47%. And these lipid parameters were found to be important predictors for macrosomia. The results are in accordance with Kitajima et al.[13], who reported elevated maternal TG levels (45%) and also regard it as a predict of the macrosomia .

Regarding dyslipidemia, 55% of the study patients complained from dyslipide-mias. Showing that mean of birth weight is noticeably higher in babies of women with dyslipidemia when compared to those without dyslipidemia (4129.1 versus 3662.2 gms. P= 0.001).

Herrera et al. have shown that an increase in birth weight was positively correlated to dyslipidemia [14]. Increase in the neonatal birth weight is seen positively correlats to S. cholesterol, (r =0.431, p =0.001) which goes with study of Schaefer et al. [15], they reported a positive correlation between the neonatal birth weight and the maternal cholesterol levels at third trimester.

Also we found that the increase of neonatal birth weight is in weak positive correlation to Serum triglycerides (r=0.299, p=0.003). Liang-Dar Hwang et al. suggested that elevation of maternal triglyceride plays a limited role in offspring birthweight (p=0.014).[16]

In those women with dyslipidemia and poor glycaemia control, the mean BW of their babies is found much higher than those without dyslipidemia (4320.6 versus 3904.2 gms, P= 0.003) Again, those with good glycaemia control, the mean of BW of babies is found to be higher in babies delivered for women with dyslipidemia than those without dyslipidemia (3819.0 versus 3385.7 gms., P= 0.015).

But, no significant difference in BW ($P \geq 0.05$) between patients with high AFI and those with normal AFI in both those who received insulin and didn't receive.

Our study has shown that AFI measurement was high in (32%) of study patients but there was no significantly correlated to the neonatal birth weight (p.0.08).

In contrast to Varma et al.[17] reported that the increase in amniotic fluid volume was related to neonatal birth weight.

Kofinas et al. mentioned that AFI is noticeably correlates to neonatal birth weight in women with diabetes mellitus[18].

CONCLUSION:

S. Cholesterol and triglyceride levels in gestational diabetes pregnant women correlate with neonatal birth weight while amniotic fluid index doesn't correlate.

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