CORRELATION BETWEEN FIRST TRIMESTER SERUM URIC ACID CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES MELLITUS

Dissertation submitted to

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In partial fulfillment for the award of the Degree of

M.S. OBSTETRICS AND GYNAECOLOGY

BRANCH II

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INSTITUTE OF OBSTETRICS AND GYNAECOLOGY,

GOVT WOMEN AND CHILDREN HOSPITAL,

MADRAS MEDICAL COLLEGE AND

RESEARCH INSTITUTE.

APRIL - 2017

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"CORRELATION BETWEEN FIRST TRIMESTER SERUM URIC ACID CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES MELLITUS"** is the bonafide work done by **Dr. P.Prasanna**, post graduate in the Department of Obstetrics and Gynaecology, Institute of Obstetrics and Gynaecology, Government Women and Children Hospital, Madras Medical College, Chennai, towards partial fulfillment of the requirements of The Tamil Nadu Dr.M.G.R University for the award of M.S Degree in Obstetrics and Gynaecology.

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DECLARATION

I, Dr. P. Prasanna, solemnly declare that the dissertation titled, **"CORRELATION BETWEEN FIRST TRIMESTER SERUM URIC ACID CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES MELLITUS"** has been done by me. I also declare that this bonafide work or part of this work was not submitted by me for any award, degree, diploma to any other university either in India or abroad.

This is submitted to The Tamil Nadu Dr.MGR medical University, Chennai in partial fulfillment of the rules and regulations for the award of M.S Degree (Obstetrics and Gynaecology) held in April 2017.

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CONTENTS

Introduction

INTRODUCTION

According to WHO guidelines Gestational diabetes mellitus is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.

It encompasses women whose glucose tolerance will return back to normal after pregnancy and those who develop type 2 diabetes with persistent glucose intolerence

Gestational diabetes affects three to ten percent of pregnant women. Due to increased prevalence of obesity and metabolic syndrome, GDM incidence increases many fold. Gestational diabetes presents with few symptoms and is most commonly picked only by screening .Risks associated with GDM are almost the same as those with pre-gestational diabetes. But Structural congenital anomalies seen in diabetes complicating pregnancy will not present in GDM because women will be normoglycemic at the time of conception.

High frequency of GDM among Indian women needs early diagnosis of GDM by means of glucose tolerance test between 24 and 28 week of gestational age,

Metzer Et al said that GDM can be found in forty to sixty percent of women.

There are no test available before this gestational age that can predict the development of GDM. There is also supportive evidence says that there is elevation of serum uric acid in non pregnant patient with diabetes-ADA

Normally in The first trimester there is elevation of glomerular filtration rate and there is decrease in serum uric acid . This is normal physiological change.

In the first trimester, it likely approximates preconception uric acid level and elevated levels may identify women who are predisposed to metabolic syndrome. This would be useful in predicting GDM at an earlier gestational age, thereby aiding in appropriate management of the same to prevent maternal and fetal morbidity and mortality.

Uric acid is the end product of the purine metabolism.it is metabolized by kidney. It has antioxidant properties and nearly sixty percent of Scavenging of free radicals in human serum is done by uric acid

The normal value of the serum uric acid is 2.1mg/dL and 7.2mg/dL. Normally in The first trimester there is elevation of glomerular filtration rate, and the renal plasma flow and there is decrease in serum uric acid.

At term, both are fifty to sixty percent higher than in the non-Pregnant state. Increases in blood volume and cardiac Output also seen in pregnancy. Increase in RPF and GFR leads to Increased creatinine clearance. Hence forty percent of blood urea and serum creatinine reduced [12].

In non pregnant women uric acid is associated with insulin resistance And it is independent risk factor for development of type two diabetes.

There are two proposed hypothesis by which uric acid can cause insulin resistance

First hypothesis, uric acid causes endothelial dysfunction and Decrease nitric oxide production by endothelial cells. Insulin mediates Glucose uptake into the cell (adipose tissue and skeletal muscle) depends on nitric oxide. Hence decrease in nitric oxide lead to decrease in glucose uptake and Development of insulin resistance.

Another mechanism by which uric acid causes insulin resistance is that uric acid causes inflammation and oxidative stress in adipocytes. Which contributes to metabolic syndrome in mice.

Gestational diabetes poses short term as well as long-term effects on the health of both the mother and the child. Hence early diagnosis and treatment is necessary to decrease the risks.

Aims & Objectives

AIM OF THE STUDY

- **TO STUDY THE CORRELATION BETWEEN FIRST TRIMESTER URIC ACID CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES.**

Review of Literature

REVIEW OF LITERATURE

GESTATIONAL DIABETES MELLITUS

It's defined as any degree of glucose intolerance with onset or first recognition during pregnancy (WHO, ACOG).

It encompasses women whose glucose tolerance will return back to normal after pregnancy and those who develop type 2 diabetes with persistent glucose intolerance

PATHOPHYSIOLOGY:

Effect of insulin on glucose uptake and metabolism.

Insulin binds to cell membrane receptor , by binding to receptor it activates many protein cascade ,includes translocation of Glut 4 transporter to the plasma membrane and inturn it cause influx of glucose.

Insulin mediates glycogen formation, glycolysis and fattyacid formation.

Basic Mechanisms behind gestational diabetes remains unknown .As we know that insulin resistance is main cause for GDM.

Insulin action is affected by variety of hormone produced in pregnancyas insulin needed for entry of glucose into the cell, because of

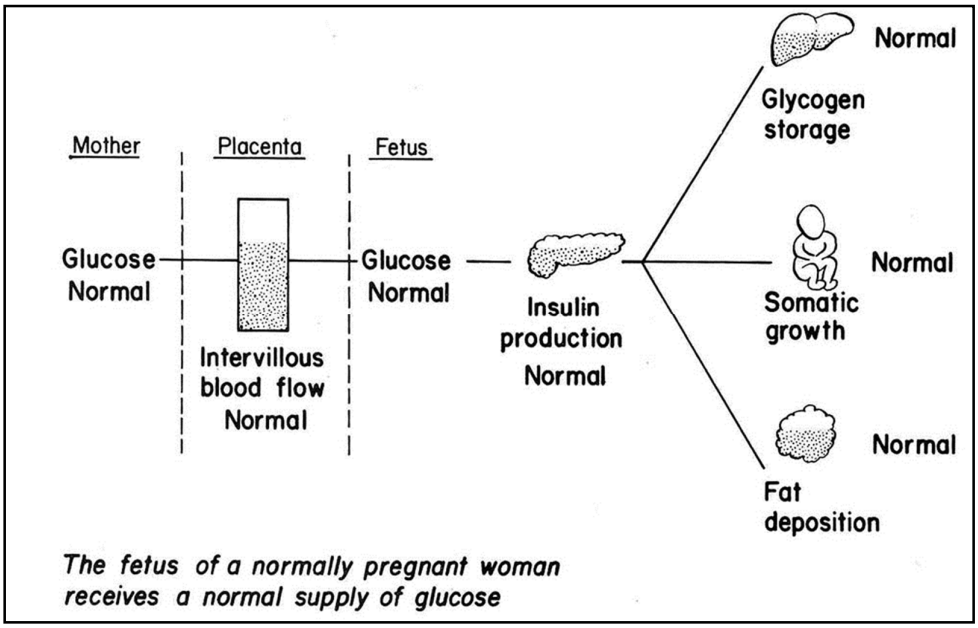
insulin resistance there is less glucose entry into cells,which leads onto increased blood glucose level, To compensate this more insulin is secreted in pregnancy

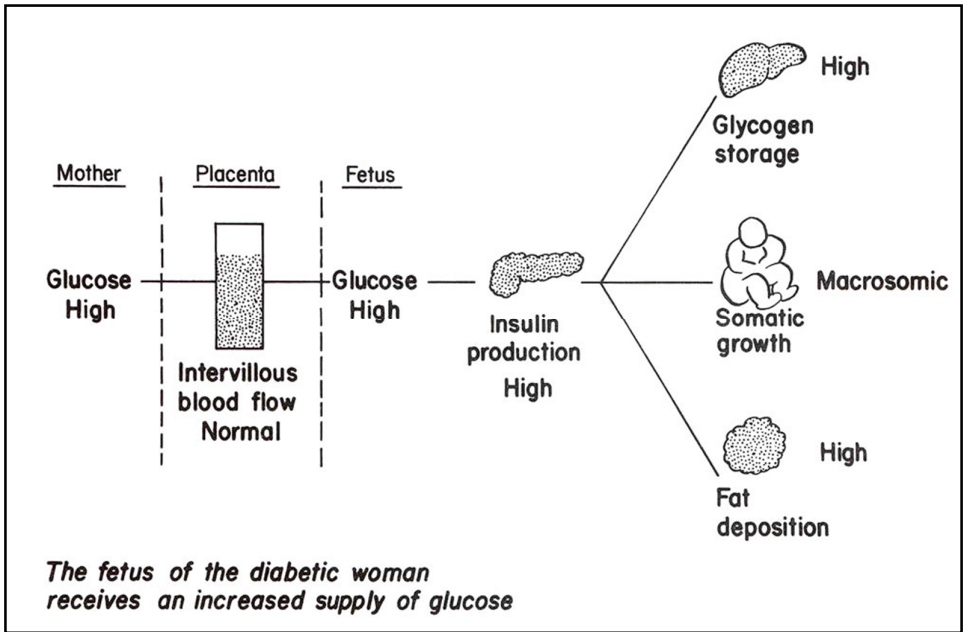
Insulin resistance is a normally occurs in the second trimester of pregnancy, which progress thereafter to levels seen in non pregnant patients with type two diabetes.

Women with GDM have an insulin resistance they cannot compensate with increased production in the beta cells of the pancreas. Placental hormones and to a lesser extent increased fat deposits during pregnancy, seems to mediate insulin resistance during pregnancy.

Mainly Cortisol and progesterone , human placental lactogen, prolactin and estradiol contribute to lesser extent.

Even though there is number of explanation its very unclear why some patients alone developing GDM.





Pedersen proposed the theory of hyperglycemic- hyperinsulinism. According to this maternal hyperglycemia, increased blood glucose in mother induces fetal hyperglycemia lead on to fetal pancreatic beta cells hypertrophy leading to fetal hyperinsulinemia. Fetal hyperinsulinemia is

responsible for the increased fat deposition and macrosomia, organomegaly, increased erythropoietin production and decreased surfactant production. As a result fetuses are increased risk of birth trauma and intrapartum asphyxia, respiratory distress syndrome and polycythemia in the newborn.

SCREENING AND DIAGNOSIS OF GESTATIONAL DIABETES MELLITUS

However controversy continues whether we need selective screening or universal screening based on risk factors.

ADA in 1977 recommended that selective screening.

Women belonging to high risk racial group like Indian warrant universal screening.

ACOG (2011) suggests that universal screening by patient history, clinical risk factor, random blood glucose test (at booking visit), oral glucose challenge test (24-28 weeks of gestation) . GDM is diagnosed based on 100gm 3 hour OGTT (diagnosed as GDM if pt having two or more positive values).

ACOG recommends two step approach, 50gm glucose challenge test (O Sullivan test) is performed, if its positive, confirmed by an OGTT.

GLUCOSE CHALLENGE TEST:

It is done at twenty four to twenty eight weeks. Oral glucose of 50 gm is given and Venus blood glucose measured 1 hour later.

Sensitivity of the test depends on the cut off value of the test. When 130 mg is used as the upper limit, the sensitivity of the test is 90 % which falls to 80 % if cutoff limit is increased to 140 mg. Thus, a large number of populations subjected to OGTT unnecessarily.

To overcome the limitations of O' Sullivan's test, American Diabetic Association (ADA) and the IADPSG (2011) recommended one step diagnostic 75gm 2 hour OGTT (diagnosed as GDM, if any one of the three values is exceeded)

- FBS≥ 92mg/dl
- Post 1 hour ≥ 180mg/dl
- Post 2 hour ≥153 mg/dl

These cut offs are lower than the traditional values. The results are based on the HAPO study (hyperglycemia and pregnancy outcome study) which suggested increased complications occur even below the traditional cut offs used for diagnosis of GDM.

Following algorithm was suggested combining the recommendations of ADA and IADPSG in 2011

- Testing of all women at the first antenatal visit < 13 weeks(early detection reduces complications
- Test women who have any of the following risk factor Non-Caucasian
- BMI>25
- History of GDM or prediabetes,
- Unexplained still birth,
- Malformed infant
- Previous baby 4000gm or more
- First-degree relative with diabetes mellitus
- Glycosuria
- Drug intake that raise glucose (steroids, betamimetics, atypicalAntipsychotics)
- Polycystic ovarian syndrome,
- Cardiovasculardisease, hypertension, hyperlipidemia.

Criteria for diagnosis of overt diabetes include any one of the following:

- FPG≥126mg/dl
- RPG≥200mg/dl

- HBA1c ≥ 6.5%

Criteria for diagnosis of GDM:

- HBA1C<5.7 to 6.4 %
- FPG≥ 92 to < 126

Seshiah et al has debated ADA&IADPSE suggestion has certain disadvantage:

The Hapo study was essentially conducted in the Caucasian population except Bangkok and Hongkong.

For antenatal visit, mostly they not in fasting, the dropout rate is very high when is asked to come for an OGTT especially in developing countries where the number of antenatal visit are less.

Glycosylated Hb is not possible in low resource settings because of its cost and lack of technically qualified staff.

To overcome these problems in developing countries, the diabetics in pregnancy study group India (DIPSI) recommended a single step diagnostic procedure for all patients. The pregnant women are given 75 gm glucose orally irrespective of her fasting status or timing of previous meal. Post 2 hour blood glucose value is taken, if it is more than or equal to 140 mg/dl

diagnosed as GDM. It is approved by ministry of health, Government of India and WHO.

Advantages of DIPSI by Seshiah et al:

- No need of fasting, it can be performed at the first visit itself.
- It is both screening as well as diagnostic procedure.
- It can be repeated again in 2^{nd} and 3^{rd} trimester.

2006 WHO diabetes Criteria:

Condition	2 hour glucose	Fasting glucose
	>140 (mg/dl)	126 (mg/dl)
Normal	<7.8 (<140)	<6.1(<110)
Impaired fasting glycaemia	<7.8 (<140)	≥6.1(≥110)&<7.0(<126)
Impaired glucose tolerance	≥7.8(≥140)	<7.0(<126)
Diabetes mellitus	≥11.1(≥200)	≥7.0(≥126)

ORAL GLUCOSE TOLERANCE TEST:

It's done in the morning,, it needs at least overnight fasting of eight to fourteen hours. three days before the test, the subject can take unrestricted diet, which contains at least 150g carbohydrate per day, no limitation of physical activity. Always seated during the test and should not smoke throughout the test.

The test done with oral glucose (100 gm anhydrous glucose powder) taken once. Then blood is drawn at hourly interval:

BLOOD GLUCOSE	Carpenter&Coustan	NDDG
FBS	>95 mg/dl	> 105mg/dl
Post 1 hour	>180mg/dl	>190mg/dl
Post 2 hour	>155 mg/dl	>165mg/dl
Post 3 hour	>140 mg/dl	>145mg/dl

NDDG (national diabetes data group)

Diagnostic criteria from NDDG have been used most often,Compared with the NDDG criteria, the carpenter and coustan criteria lead to an over diagnosis of GDM in pregnant women (54%), with an increased cost and no improvement in perinatal outcomes.

The American Diabetes Association cut off values to diagnose GDM (With 100 g of glucose):

- Fasting blood glucose level ≥95 mg/dl (5.33 mmol/L)
- 1 hr blood glucose level ≥ 180 mg/dl (10 mmol/L)
- 2 hr blood glucose level ≥ 155 mg/dl (8.6 mmol/L)
- 3 hr blood glucose level ≥ 140 mg/dl (7.8 mmol/L)

Another test using 75 g glucose load and measures the blood glucose levels in fasting and post 1 and 2 hours, use as the same reference values in ADA. This test will identifies only a few women, and is weak concordance (agreement rate) with the 3 hour 100g test.

O'Sullivan and Mahan conducted a retrospective cohort study; they used 100 grams of glucose for oral glucose tolerance test. This was designed to diagnose the risk of developing type two diabetes mellitus in the future.

In 1964, O'Sullivan and Mahan first demonstrated that the blood glucose values can be used to diagnose GDM. Four whole blood samples were drawn. The positive result requires two values reaching or exceeding the cut off value.

Based on further studies alterations in O'Sullivan's criteria were made. Like whole blood changed to plasma sample, changes in cut off for GDM.

URINARY GLUCOSE TESTING;

During pregnancy there is physiological glycosuria this is due to increased GFR. This is responsible for 50 % of women having glycosuria in their urine on dipstick tests at some time in their pregnancy.

When glycosuria is used as a marker of GDM it has the sensitivity of 10 % and the positive predictive value of 20 % in first and second trimester.

Glycosuria of 2+ or above on 1 occasion or 1+ or above on 2 occasion or more detected by urine strip during routine antenatal visit may indicate undiagnosed GDM. If this is observed may consider further testing to exclude GDM (NICE 2015)

MANAGEMENT

Treatment aim is to decrease the risk of both the mother and fetus. Adequate control of blood glucose is necessary to prevent fetal and maternal morbidity and thereby improves quality of life of mother and fetus. Crowther Et al (ACHOIS study 2005).

Follow up of GDM women is necessary, since most of them land up in type 2 DM. two to four months after delivery to do repeat OGTT. These women are more prone for type two diabetes. Hence Regular follow up is needed. Low dose hormonal contraceptive pills can be advised

Insulin therapy is initiated if lifestyle modification and oral hypoglycemic drugs Fails.

Ultrasound detect macrosomia in pregnancy

GDM Women who was on insulin, with previous stillbirth, or with PIH are managed as overt diabetes.

Daily self monitoring of blood glucose is essential for women with GDM.

By proper monitoring of blood glucose we can prevent increase in perinatal mortality.

4th international workshop, Conference on GDM, recommends maintaining the following capillary. Blood glucose values: preprandial glucose less than 95 mg/dl, 1hr PPBS<140 mg/dl, and 2hr PPBS < 120 mg/dl.

ACOG Guidelines are the same except that the 1-hour postprandial glucose value is considered acceptable at either 130 or 140 mg/dl.

FBS< 90 mg/dl, PPBS< 120 mg/dl another strict guideline suggested by jovanovic Et al.

Agarwal Et al, 2007 conducted a prospective study recruited 668 patients. This includes 334 women with GDM and 334 women without GDM, they calculated a mean blood glucose level; women with GDM who had a mean blood glucose level of 87 had increased rate of IUGR and 104 mg/dl had increased rate of LGA infants comparable to the control group. Based on their study we conclude that hyperglycemia must be controlled, not to over treat, because it's harmful to the fetus. It increases the risk of IUGR.

Maintenance of postprandial blood glucose is important as it is more associated with macrosomia than fasting blood glucose

Occurding to Diabetes in Early Pregnancy Study conducted by Boyd Et al, the best predictor of percentile birth weight is postprandial glucose levels measured in third trimester of pregnancy. Dose of insulin therapy is titrated according to PPBS, rather than preprandial glucose levels. so the incidence of neonatal hypoglycemia, macrosomia, and cesarean delivery for cephalopelvic disproportion found to be decreased.

Medical Nutrition Therapy

MNT aims to improve nutritional status of the mother and fetus, it also helps us to maintain adequate weight gain in the antenatal women, it also maintains normoglycemia and to prevent ketoacidosis.

First trimester of pregnancy does not need increased energy requirement normally. Whereas in second and third trimester an additional 300kilocalories /day is required.

For women of normal weight with gestational diabetes calorie intake of 30 kcal/kg/day is recommended.

For obese women (BMI>30 kg/m2), a 33 % calorie restriction of their estimated energy needs is recommended (~25 kcal/kg/day).this much diet restriction does not cause any ketonuria. We need more calorie restriction in

morbidly obese women. Very cautious about ketosis when you advise more calorie restriction.

GDM mother who develops ketonemia during pregnancy is found to have long term complications in the children such as poor psychomotor skills and low intelligence.

It is ideal to measure pre-breakfast levels of ketone in patients, who practice to take low calorie diet or carbohydrate restricted diet.

Carbohydrates should be splitted throughout the day. GDM Women is advice to take three small- to medium-sized meals and three snacks per day. Such that to limit the carbohydrate intake to 40% of total daily calorie requirement which shows to decrease postprandial glucose.

Insulin resistance is high in the morning. So restricting the carbohydrate at breakfast to 33% is needed to meet the desired postprandial glucose.

Restricting carbohydrate to less than 42%,will decreases the large for gestational age infant in GDM mother, this lead on to decrease in cesarean deliveries for CPD and macrosomia and also patient need decreased insulin therapy.

Always advice low glycemic index diet, it will lower the PPBS, especially in late gestation.

EXERCISE

The role of exercise in women with GDM has been proven to improve glycemic control LIZETT ET AI, Concluded from their study Previously women were discouraged from physical activity, because it leads to preterm delivery before 37 weeks. Excercise is known to increase circulating level of both norepinephrine and epinephrine. Norepinephrine increases both strength and duration of uterine contraction but epinephrine inhibits uterine activity. This Meta analytical study concludes exercise improves glycemic control not harm the baby.

(NICE 2015) also recommends 30 minutes of mild to moderate exercise daily

Mottola MF conducted a randomized trial, it was a small trial they take two groups of people, one group were GDM women managed with diet and exercise, another group was managed with diet alone for 6 weeks.

They found that diet-and- exercise group had a significant decrease in HBa1c levels in both fasting and post 1-hour glucose level during OGCT compared to the diet group.

American diabetes association recommends moderate exercise in women with GDM

INSULIN

Insulin therapy is gold standard in the management of GDM and pregestational diabetes. Most association recommends short acting regular insulin(onset of action 30 minutes lasting for 6-8 hours) and intermediate acting NPH insulin(ONSET OF ACTION 1-HOUR,lasting for 10-14hours).

Insulin therapy is initiated when MNT fails to maintain blood glucose level at desired ranges or when there is evidence of excessive fetal growth.

Kick Et al concluded from their study

GDM women treated with insulin showed a decreased incidence of macrosomia and related morbidities it includes operative delivery and birth trauma.

A large prospective study conducted in almost 2500 women with GDM compared the effect of intensive versus conventional management of GDM. Women were randomized to the intensive management group and conventional management group. Concluded from this study intensive management group showed decreased rate of macrosomia, cesarean section, shoulder dystocia, neonatal intensive care admission, respritory

complication. In this study GDM is diagnosed based on only one or more abnormal values rather than the current standards

No study to demonstrate optimal insulin regimen till date, the type and dose of insulin must be tailored to meet each patient's requirements. Human insulin is currently recommended by ADA. Recent research has added newer rapid acting insulin lispro and aspart whose action begins within 15 minutes.

Insulin lispro is considered to be pregnancy cat B by FDA, it s appears to be safe in pregnancy, if we start after first trimester. ADA recommends human insulin until further studies.

Insulin aspart is considered as pregnancy category C by the FDA. Insulin aspart was effective in decreasing postprandial glucose concentration. More studies will require for ensuring the safety of the drug.

Only case report is available regarding Use of insulin glaring in pregnancy. We need more number of clinical trials to evaluate use of glargine in pregnancy. It is pregnancy category C by FDA.

ORAL HYPOGLYCEMIC AGENTS (OHA):

Two OHA have been used in pregnancy Metformin (Biguanide group and gluburide). ADA also recommends, in the past, there was concern regarding the teratogenecity of these drugs due to their transplacental transfer. Metformin can be used in pregnant women with GDM. It's considered to be pregnancy category B by FDA

Jamie et al, they found out Metformin is an effective alternative to insulin in patient with GDM. There is no significant difference in birth weigh between the Metformin and insulin group.

Another study it's a retrospective cohort study found women treated with Metformin had an increased prevalence of preeclampsia and perinatal mortality, although larger studies are needed for evaluating the safety of the Metformin during pregnancy.

Pratap et al conducted prospective study involving women with PCOS or women with type-two DM who used Metformin in pregnancy; they found no unpleasant pregnancy outcome.

First generation sulfonylurea's chlorpropamie and tolbutamide could cross the placenta, stimulate the fetal pancreas, cause fetal hyperinsulinemia.

Transfer of second generation sulfonylurea's glyburide can cross the human placenta insignificantly in experimental model.

ADA(2016),ACOG not recommended this drug ,we need larger studies to support this drug

Uric acid and gestational diabetes mellitus

Because of risk factor GDM prevalence is increasing, Hedderson and Ferrara

Another study conducted by Kim Et al, those women with gestational diabetes are more prone for developing preeclampsia, because of this reason they prone for induction of labour and its lead to increased cesarean rate, GDM is risk factor for development of type 2 DM in feature.

Hollander Et al 2007, preeclampsia is a complication of GDM but association between the two is not understood well. But several studies support underlying common Pathophysiology. It includes insulin resistance, chronic inflammation and endothelial dysfunction. Some common risk factor also found between the two conditions, such as increased BMI and advanced age.

Poly cystic ovary syndrome was the main reason for development of gestational diabetes mellitus according to toulis et al, 2009.

Essential hypertension was the main reason for development of gestational diabetes mellitus according to tamas et al, 2001.

Monozygotic twins 70% and dizygotic twins 20-30% were reasons for development of gestational diabetes mellitus according to kaprio et al, 1992; lebtovirta et al,

Enzyme xanthine oxidase/dehydrogenase is needed for uric acid synthesis,Uric acid is produced from purine metabolism(catabolism) (Roberts et al)

- Dehghan et al 2008 concluded from their study

In non pregnant women, uric acid is linked with insulin resistance and is an independent risk factor for development of type 2 diabetes within 10 years

- **Simmikharb 2007concluded from his study** decreased detoxification or free radical scavenging capacity in GDM and Compensatory elevation of uric acid confers protection in pregnancies complicated by diabetes

Aparna et al 2014, concluded from their study raised serum uric acid levels in early pregnancy as a risk factor for subsequent development of GDM in an Indian population. Diagnostic criterion 3.4 mg/dL appears to have good sensitivity and specificity in identifying those patients who are most likely to develop GDM later in pregnancy. This, if replicated and confirmed, can have important therapeutic implications in helping identify and manage GDM early, and thus prevent adverse maternal and fetal complications.

Two proposed hypothesis by which uric acid can cause insulin resistance.

First hypothesis, uric acid causes endothelial dysfunction and Decrease nitric oxide production by endothelial cells.Insulin mediated Glucose uptake into the cell (adipose tissue and skeletal muscle) depends on nitric oxide.Hence decrease in nitric oxide lead to decrease in glucose uptake and development of insulin resistance. (Cook et al, 2003)

Another mechanism by which uric acid causes insulin resistance may be That uric acid causes inflammation and oxidative stress in adipocytes Which contributes to metabolic syndrome in mice? (Sautin et al, 2007)Uric Acid:It is a diprotic acid, its pka1 and pka2 value was 5.4 and 10.3. It has

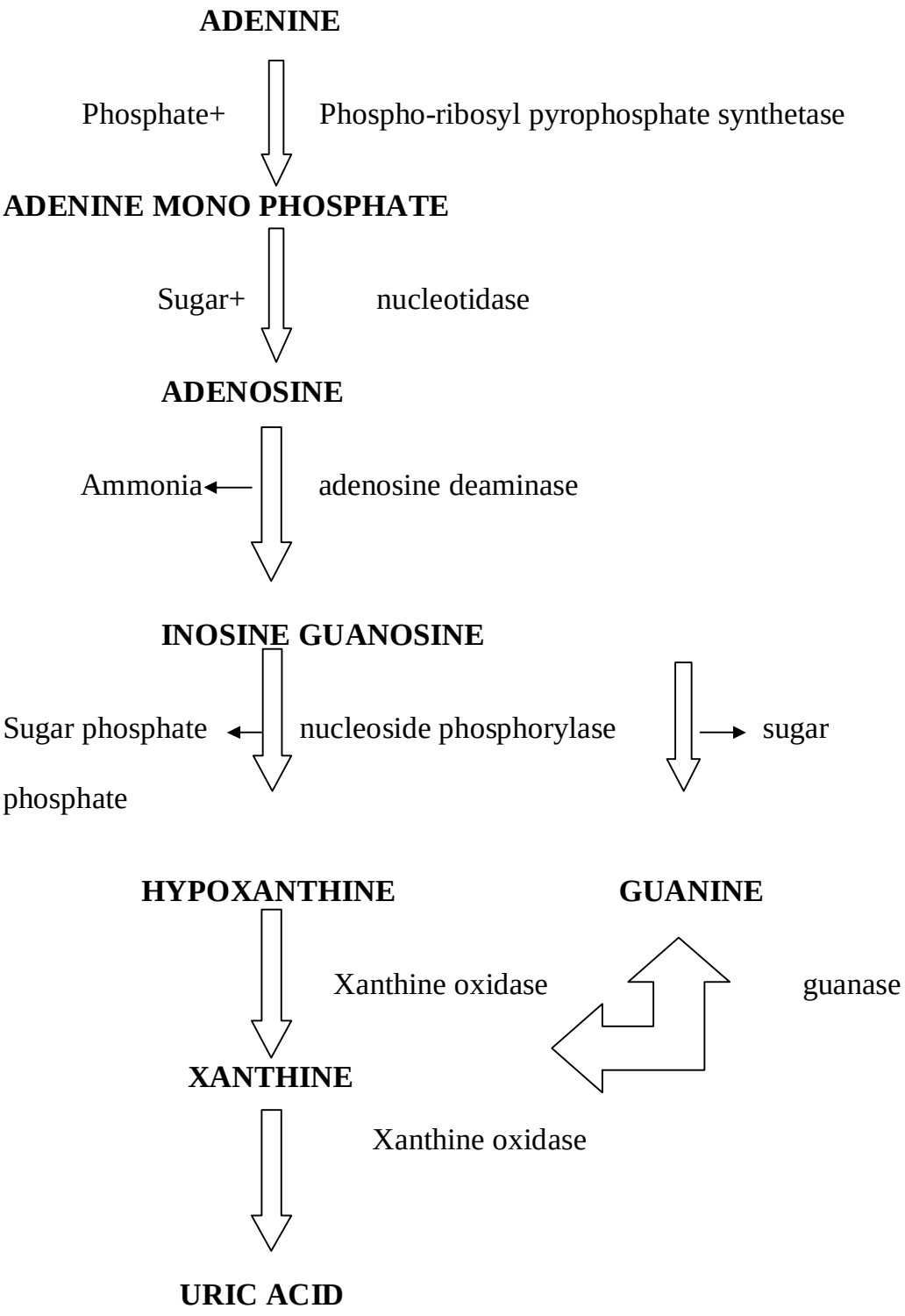
purine functional group, aromatic because of purine functional group, strong alkali at high pH.

URIC ACID

Biology:

Xanthine and hypoxanthine forms uric acid by enzyme called xanthine oxidase, Xanthine and hypoxanthine produced from purine, kidney excretes uric acid. It is mostly released in hypoxic condition. In mammal's uric acid oxidized to allantoin by enzyme uricase. Ascorbic acid and uric acid act as both reducing agent and antioxidants. Majority of antioxidant capacity of blood mainly mediated by uric acid, kidney excrete uric acid about 70% daily.

Uric acid formation;



High level of uric acid is called as hyperuricemia,impaired renal excretion also leads to hyperuricemia.It causes gout, Lesch-nychan syndrome, cardiovascular disease, uric acid stone formation and metabolic syndrome.

Nagakawa et al concluded from their study that fructose induced hyperuricemia associated with metabolic syndrome. Mainly due to increased consumption of fructose-containing beverages this may associated with obesity and diabetes.

Causes of low uric acid

Also known as hypouricemia, causes of hypouricemia are low intake of zinc, more commonly associated with oral contraceptive all contributes to low uric acid level

Xanthine oxides are a Fe-Mo enzyme, so deficiency of iron and molybdenum also leads to hypouricemia.

In chronic renal failure patient, a drug used for prevention of hyperphosphataemia is sevelamer, will reduce serum uric acid.Low uric acid leads to Multiple sclerosis and Oxidative stress.

Materials and Methods

MATERIALS AND METHODS

- Prospective study conducted in the Institute of Obstetrics and GynaecologyEgmore,chennai

- Aim of work will be explained to the pregnant women and informed consent obtained

Study population; 200 antenatal women, the study conducted for eight months from January 2016 to august 2016

INCLUSION CRITERIA

Antenatal women in their 1st trimester of pregnancy (<13 weeks of Gestation).

EXCLUSION CRITERIA

- Renal disease
- Liver disease
- Pre gestational diabetes
- Chronic hypertension
- Gout
- Smoking and alcohol intake

- Drugs known to increase Uric acid levels in blood. Eg aspirin, phenothiazines, diuretics.

METHODS

- Maternal plasma uric acid → measured before 13 weeks →venous sample.

  Blood sample will be Centrifuged → to separate the serum → stored at – 70 degree up to examination.

- It is measured using a Colorimetric assay (kit U7581-120; Pointe scientific INS, Canton, MI)→ with a detection limit of 10 mg/dl.

- Cut off taken in my study is 3.6 mg/dl (AJOG,Vol 201,Oct 2009)

SCREENING FOR GDM

- All patients will undergo → random oral GCT (75gms) between 22-24 weeks.

- If the value is > 200 mg/dl → patient is considered to have GDM

OR

- If plasma glucose level →> 140 mg/dl → patient at increased risk of developing GDM → will then undergo 3 hr oral GTT

- FBS level → oral intake of 100 gms glucose → measuring blood glucose level at 1,2 and 3 hrs.

Patients are considered to have GDM if 2 or more values of the 4 exceed described in carpenter &Coustan Criteria (**American diabetes association 2009**)

Analysis of Results

ANALYSIS OF RESULTS

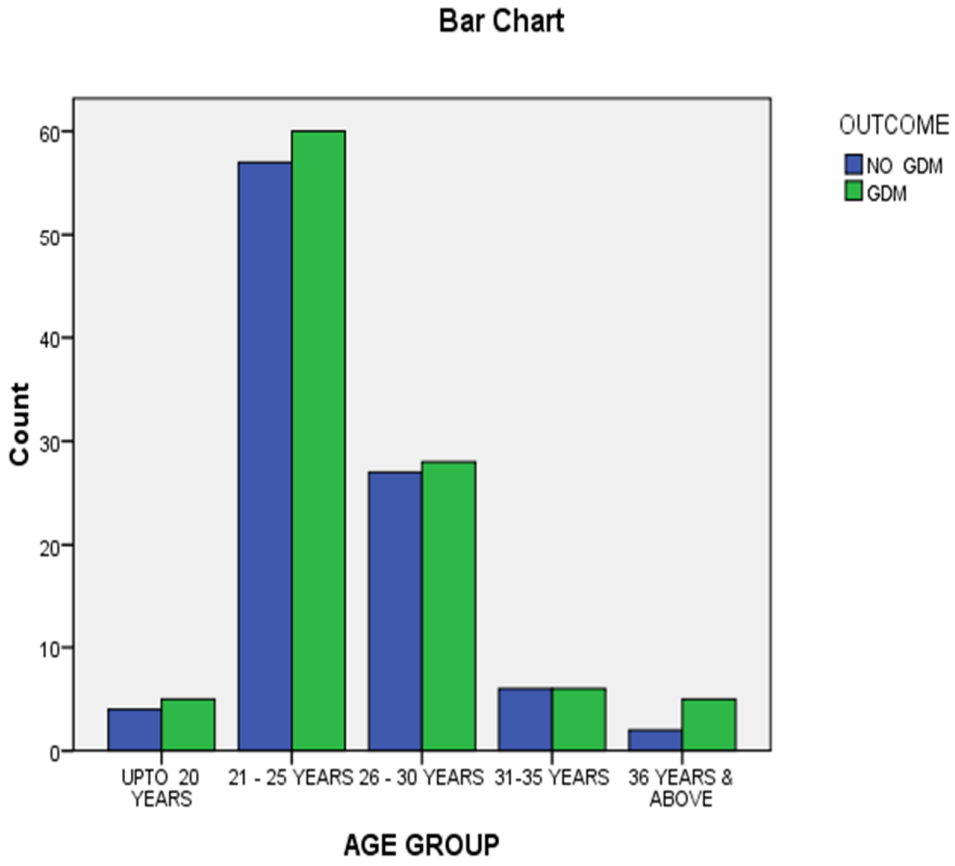
ASSOCIATION BETWEEN AGE GROUP AND GDM

Crosstab					
			OUTCOME		
			NO GDM	GDM	Total
AGE GROUP	UPTO 20 YEARS	Count	4	5	9
		% within OUTCOME	4.2%	4.8%	4.5%
	21 - 25 YEARS	Count	57	60	117
		% within OUTCOME	59.4%	57.7%	58.5%
	26 - 30 YEARS	Count	27	28	55
		% within OUTCOME	28.1%	26.9%	27.5%
	31-35 YEARS	Count	6	6	12
		% within OUTCOME	6.3%	5.8%	6.0%
	36 YEARS & ABOVE	Count	2	5	7
		% within OUTCOME	2.1%	4.8%	3.5%
	Total	Count	96	104	200
		% within OUTCOME	100.0%	100.0%	100.0%

Chi square=1.174 P=0.882 Not significant.

There is no statistical significance between GDM and Non GDM patients with respect to age.

Chi-Square Tests			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	1.174[a]	4	.882
Likelihood Ratio	1.215	4	.876
Linear-by-Linear Association	.214	1	.643
N of Valid Cases	200		
a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 3.36.			

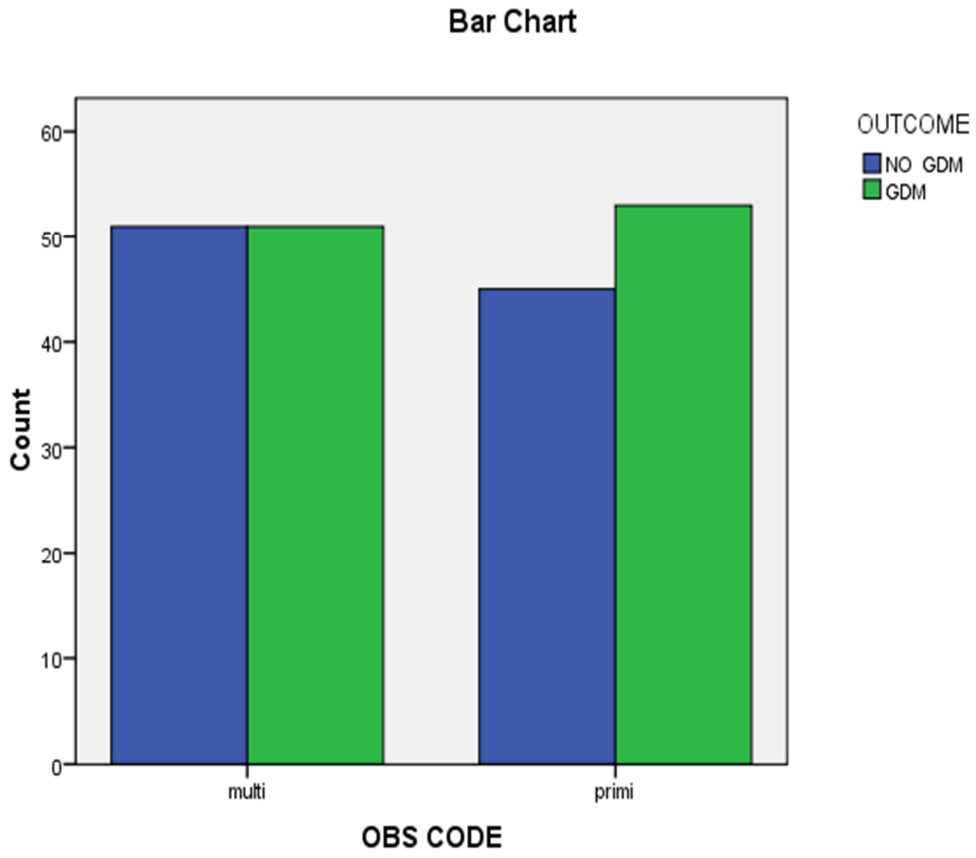


ASSOCIATION BETWEEN PARITY AND GESTATIONAL DIABETES MELLITUS

			OUTCOME		
		Crosstab	**NO GDM**	**GDM**	**Total**
OBS CODE	multi	Count	51	51	102
		% within OUTCOME	53.1%	49.0%	51.0%
	primi	Count	45	53	98
		% within OUTCOME	46.9%	51.0%	49.0%
	Total	Count	96	104	200
		% within OUTCOME	100.0%	100.0%	100.0%

Chi square=0.334 P=0.564 Not significant.

There is no statistical significance between GDM and Non GDM patients with respect to parity.



This bar diagram shows relation between the parity and GDM, there wsa no difference between the parity and GDM.

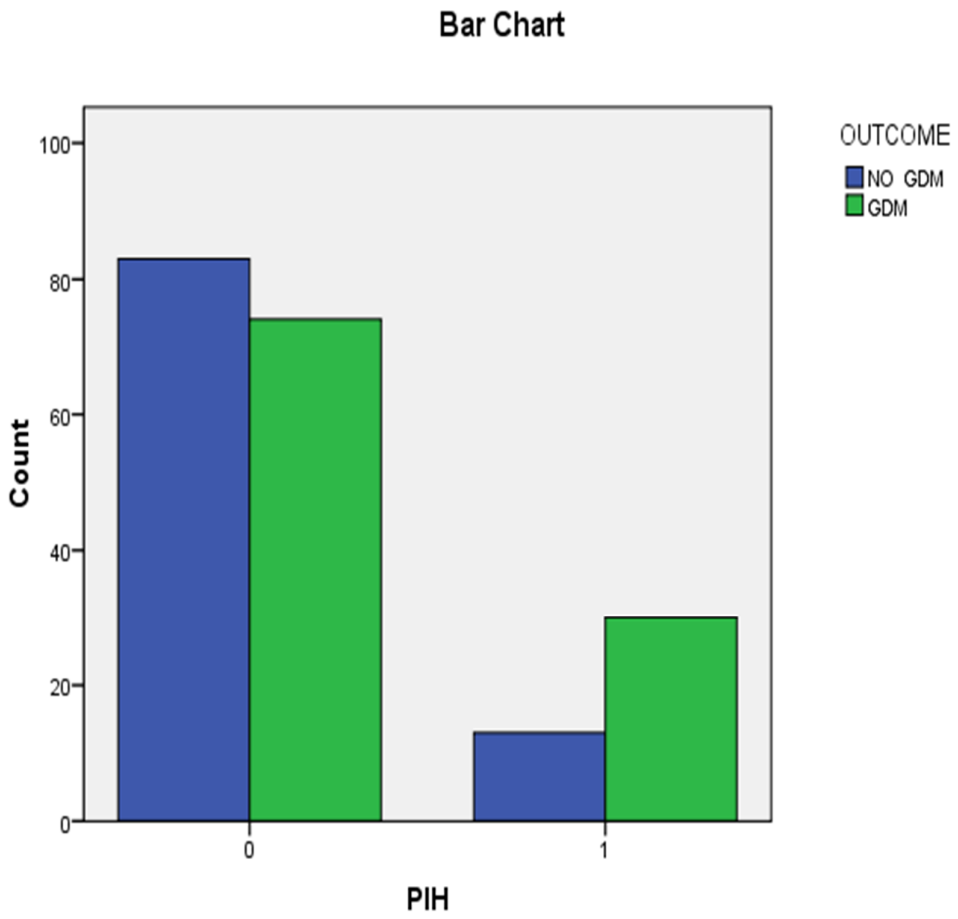
ASSOCIATION BETWEEN PIH AND GESTATIONAL DIABETES MELLITUS

Crosstab	OUTCOME		Total
	NO GDM	GDM	
Count	83	74	157
% within OUTCOME	86.5%	71.2%	78.5%
Count	13	30	43
% within OUTCOME	13.5%	28.8%	21.5%
Count	96	104	200
% within OUTCOME	100.0%	100.0%	100.0%

Chi square=6.928 P=0.008 significant.

There is a statistical significance between GDM and Non GDM patients with respect to PIH.

Chi-Square Tests					
	Value	**Df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	6.928[a]	1	.008		
Continuity Correction[b]	6.051	1	.014		
Likelihood Ratio	7.104	1	.008		
Fisher's Exact Test				.010	.007
Linear-by-Linear Association	6.893	1	.009		
N of Valid Cases	200				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.64.					
b. Computed only for a 2x2 table					



This bar chart shows association between GDM and PIH

More number of GDM women developed PIH,this shows some common association between GDM and pregnancy induced hypertension

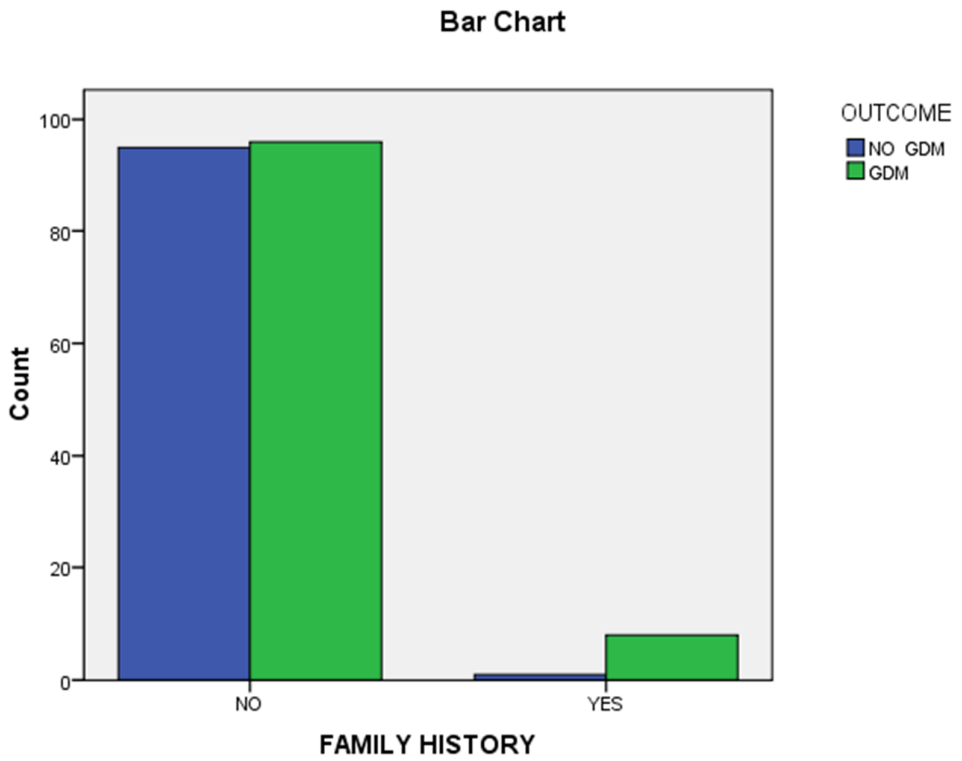
ASSOCIATION BETWEEN FAMILY HISTORY AND GESTATIONAL DIABETES MELLITUS

			OUTCOME		
			NO GDM	GDM	Total
FAMILY HISTORY	NO	Count	95	96	191
		% within FAMILY HISTORY	49.7%	50.3%	100.0%
		% within OUTCOME	99.0%	92.3%	95.5%
		% of Total	47.5%	48.0%	95.5%
	YES	Count	1	8	9
		% within FAMILY HISTORY	11.1%	88.9%	100.0%
		% within OUTCOME	1.0%	7.7%	4.5%
		% of Total	.5%	4.0%	4.5%
	Total	Count	96	104	200
		% within FAMILY HISTORY	48.0%	52.0%	100.0%
		% within OUTCOME	100.0%	100.0%	100.0%
		% of Total	48.0%	52.0%	100.0%

Chi square=5.138 P=0.023 significant.

There is statistical significance between GDM and Non GDM patients with respect to family history

Chi-Square Tests					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.138[a]	1	.023		
Continuity Correction[b]	3.707	1	.054		
Likelihood Ratio	5.883	1	.015		
Fisher's Exact Test				.036	.023
Linear-by-Linear Association	5.112	1	.024		
N of Valid Cases	200				
a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.32.					
b. Computed only for a 2x2 table					



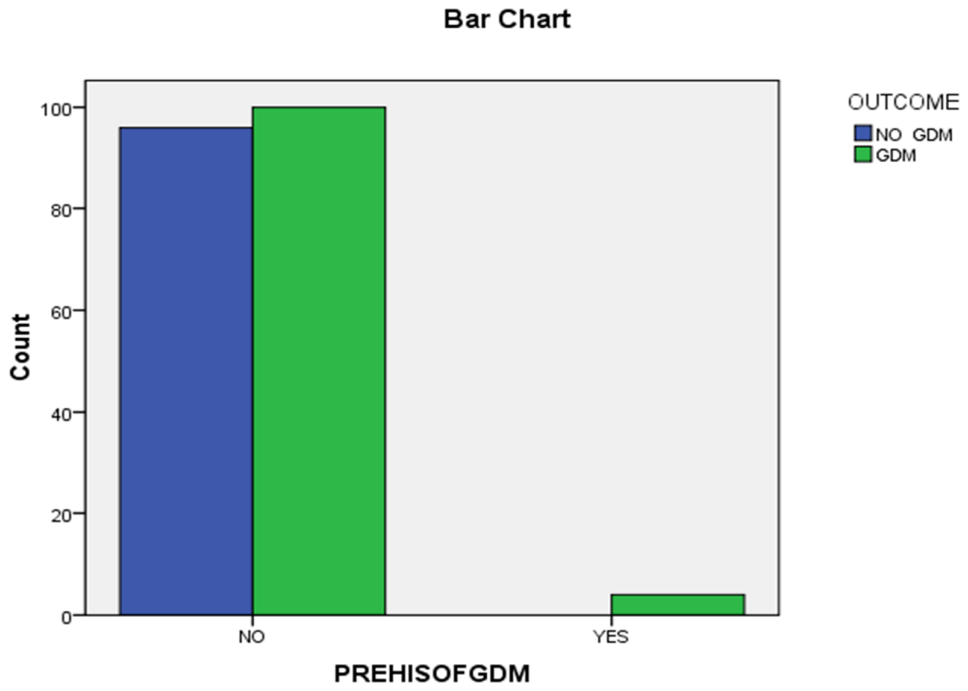
ASSOCIATION BETWEEN PREVIOUS HISTORY OF GDM AND GESTATIONAL DIABETES MELLITUS

			OUTCOME		
			NO GDM	**GDM**	**Total**
PRE HISTORY OF GDM	NO	Count	96	101	197
		% within OUTCOME	100.0%	97.1%	98.5%
	YES	Count	0	3	3
		% within OUTCOME	.0%	2.9%	1.5%
	Total	Count	96	104	200

Chi square=2.811 P=0.094 not significant.

There is no statistical significance between GDM and Non GDM patients with respect to previous h/o GDM

Chi-Square Tests					
	Value	**Df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	2.811[a]	1	.094		
Continuity Correction[b]	1.198	1	.274		
Likelihood Ratio	3.966	1	.046		
Fisher's Exact Test				.247	.139
Linear-by-Linear Association	2.797	1	.094		
N of Valid Cases	200				
a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.44.					
b. Computed only for a 2x2 table					



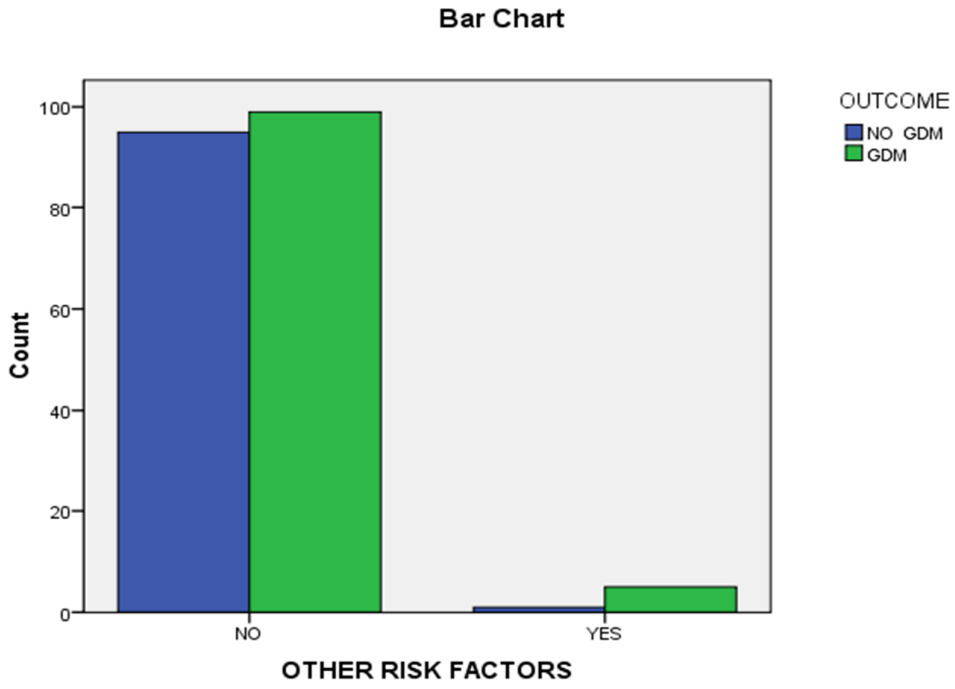
ASSOCIATION BETWEEN OTHER RISK FACTORS AND GESTATIONAL DIABETES MELLITUS

Crosstab					
			OUTCOME		
			NO GDM	**GDM**	**Total**
OTHER RISK FACTORS	NO	Count	95	99	194
		% within OUTCOME	99.0%	95.2%	97.0%
	YES	Count	1	5	6
		% within OUTCOME	1.0%	4.8%	3.0%
	Total	Count	96	104	200

Chi square=2.433 P=0.119 not significant.

There is no statistical significance between GDM and Non GDM patients with respect to other risk factor such as previous big baby, multiple pregnancy

Chi-Square Tests					
	Value	**Df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	2.433[a]	1	.119		
Continuity Correction[b]	1.311	1	.252		
Likelihood Ratio	2.673	1	.102		
Fisher's Exact Test				.214	.126
Linear-by-Linear Association	2.421	1	.120		
N of Valid Cases	200				
a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.88.					
b. Computed only for a 2x2 table					



RELATION BETWEEN BMI AND GDM

Group Statistics							
	OUTCOME	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**t**	**P**
BMI	GDM	104	23.097	1.8614	.1825	2.687	0.008
	NO GDM	96	22.434	1.6039	.1637		

There exists a statistical significance (p value 0.008) between GDM & Non GDM patients with respect to BMI mean level. The Mean BMI for GDM patients were 23.097, whereas Mean BMI for Non GDM patients were 22.434

Independent Samples Test					
		Levene's Test for Equality of Variances		**t-test for Equality of Means**	
		F	Sig.	T	Df
BMI	Equal variances assumed	.000	.984	2.687	198
	Equal variances not assumed			2.703	197.087

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
BMI	Equal variances assumed	.008	.6627	.2466
	Equal variances not assumed	.007	.6627	.2452

Independent Samples Test			
		t-test for Equality of Means	
		95% Confidence Interval of the Difference	
		Lower	Upper
BMI	Equal variances assumed	.1764	1.1491
	Equal variances not assumed	.1792	1.1463

RELATION BETWEEN GDM AND AGE

Group Statistics							
	OUTCOME	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**t**	**P**
AGE	GDM	104	25.46	4.036	.396	0.741	0.459
	NO GDM	96	25.05	3.754	.383		

There was a no statistical significance (p value 0.459) between GDM & Non GDM patients with respect to age level. The Mean age for GDM patients were 25.46, whereas Mean age for Non GDM patients were 25.05

Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	T	Df
AGE	Equal variances assumed	.154	.695	.741	198
	Equal variances not assumed			.743	197.987

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
AGE	Equal variances assumed	.459	.409	.552
	Equal variances not assumed	.458	.409	.551

Independent Samples Test			
		t-test for Equality of Means	
		95% Confidence Interval of the Difference	
		Lower	Upper
AGE	Equal variances assumed	-.680	1.499
	Equal variances not assumed	-.677	1.496

RELATION BETWEEN SERUM URIC ACID AND GESTATIONAL DIABETES MELLITUS

Group Statistics							
	OUTCOME	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**T**	**P**
serum uric acid	GDM	104	4.275	1.0753	.1054		
	NO GDM	96	3.250	.6142	.0627	8.187	0.0001

There exists a statistical significance (p value 0.0001) between GDM & Non GDM patients with respect to serum uric acid level. The biomarker of Mean serum uric acid for GDM patients were 4.275, whereas Mean age for Non GDM patients were 3.250

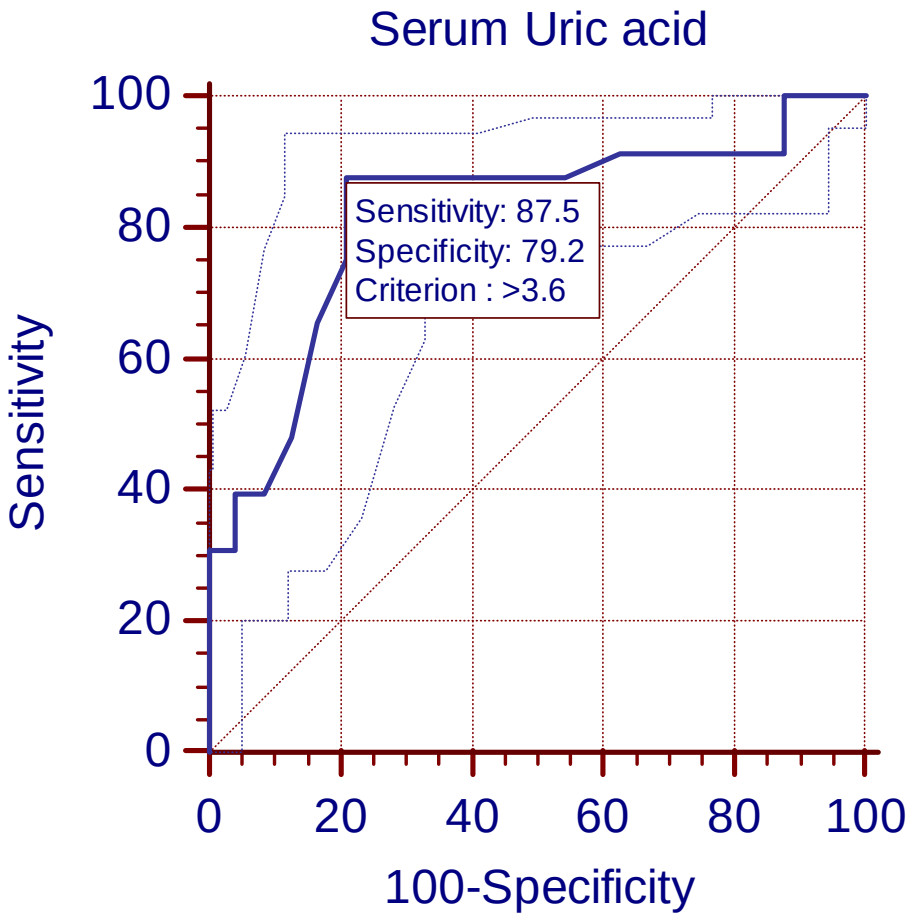
Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	T	Df
serum uric acid	Equal variances assumed	17.993	.000	8.187	198
	Equal variances not assumed			8.356	166.173

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
serum uric acid	Equal variances assumed	.0001	1.0250	.1252
	Equal variances not assumed	.000	1.0250	.1227

Independent Samples Test			
		t-test for Equality of Means	
		95% Confidence Interval of the Difference	
		Lower	Upper
serum uric acid	Equal variances assumed	.7781	1.2719
	Equal variances not assumed	.7828	1.2672

This shows stastisticaly significant association between serum uric acid and GDM.

The Receiver Operator Curve drawn showed serum uric acid as a predictor of GDM with Area under Curve of 0.81 with a sensitivity of 87.5%, specificity of 79.2% at an Optimum criterion of >3.6mg/dl



ROC curve

Variable	Serum Uric acid
Classification variable	GDM

Sample size		200
Positive group :	GDM = 1	104
Negative group :	GDM = 0	96

Disease prevalence (%)	Unknown

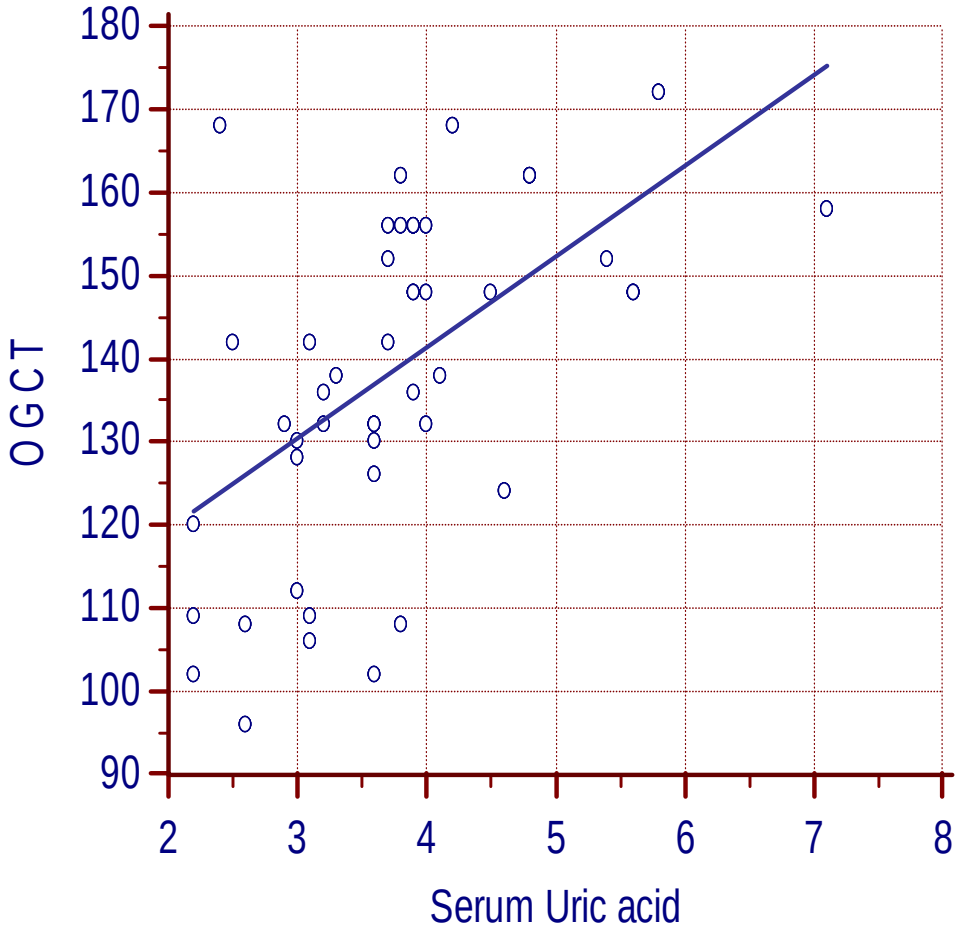
Area under the ROC curve (AUC)

Area under the ROC curve (AUC)	0.819912
Standard Error[a]	0.0310
95% Confidence interval[b]	0.759522 to 0.870554
z statistic	10.329
Significance level P (Area=0.5)	<0.0001

[a] Hanley & McNeil, 1982

[b] Binomial exact

Scatter Diagram



This diagram shows linear relationship between serum uric acid and gestational diabetes.

Regression

Dependent Y	OGCT
Independent X	Serum Uric acid

Sample size	200
Coefficient of determination R^2	0.3086
Residual standard deviation	16.7075

Regression Equation

y = 97.7561 + 10.9077 x					
Parameter	**Coefficient**	**Std. Error**	**95% CI**	**t**	**P**
Intercept	97.7561	4.5452	88.7929 to 106.7193	21.5076	<0.0001
Slope	10.9077	1.1602	8.6198 to 13.1956	9.4017	<0.0001

From this equation we can calculate OGCT value, y is OGCT, x is serum uric acid

Analysis of Variance

Source	DF	Sum of Squares	Mean Square
Regression	1	24674.0156	24674.0156
Residual	198	55269.9044	279.1409

F-ratio	88.3927
Significance level	P<0.0001

Binary Logistic Regression

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	0.31839	0.10752	0.0031
Serum_Uric_acid	1.77979	0.29829	<0.0001
FAMILY_HISTORY	2.55302	1.16402	0.0283
Constant	-13.8106		

BMI, familyhistory, serum uric acid all significant parameter individually with bivariat analysis were Included in binary logistic regression analysis. The dependant variable is GDM/noGDM. The following table Shows all the three parameters included in the final model. The log it equation showsLogit= -13.8106 + 0.31839(BMI) + 1.77979 (serum uric acid) +2.55302(Family History) Odds Ratios and 95% Confidence Intervals

The following table shows all the three parameters included in the final model

Variable	Odds ratio	95% CI
BMI	1.3749	1.1137 to 1.6974
Serum_Uric_acid	5.9286	3.3040 to 10.6379
FAMILY_HISTORY	12.8458	1.3120 to 125.7759

The odds ratio of BMI was 1.3749, serum uric acid was 5.928 and family history was 12.845. This shows one fold increase in BMI was associated with 1.3 times increased risk of developing GDM, elevated serum uric acid was associated with nearly six times the risk of developing GDM

Hosmer & Lemeshow test

Chi-square	12.3650
DF	8
Significance level	P = 0.1356

Classification table (cut-off value p=0.5)

Actual group	Predicted group		Percent correct
	0	1	
Y = 0	76	20	79.17 %
Y = 1	22	82	78.85 %
Percent of cases correctly classified			79.00 %

ROC curve analysis

Area under the ROC curve (AUC)	0.847
Standard Error	0.0276
95% Confidence interval	0.790 to 0.894

ROC curve of log it shows AUC of 0.84 (combination of BMI, FAMILY HISTORY, serum uric acid) which is greater than the AUC of serum uric acid alone.serum uric acid AUC is 0.81 mg/dl, This clearly indicates serum uric acid is a very good predictor with sensitivity of 87.5%, specificity of 79.5%, criterion > 3.6mg/dl

Discussion

DISCUSSION

In this study conducted in Institute of Obstetrics and Gynaecology, Egmore, Chennai, total of 200 patients have been analyzed and their relationship with uric acid and gestational diabetes mellitus and risk factors have been studied. Similar studies also done by AJOG, October 2009 did the study of total of 1570 patients.

- Assuit Et al analyzed 812 patients
- Helmymotawe et al analyzed 1200 patients
- Moden et al analyzed 1016 patients
- Aparna et al analyzed 225 patients

The Receiver Operator Curve drawn showed serum uric acid as a predictor of GDM with Area under Curve of 0.819[95% CI: (0.759-0.870)] with a sensitivity of 87.5%, specificity of 79.2% at an Optimum criterion >3.6 mg/dl

First trimester uric acid concentrations > 3.6 mg/dl were associated with a trend towards increased risk of developing gestational diabetes

(adjusted ODDS RATIO =5. 95%CI: 0.759-.870) compared to women with concentrations below this level.

ROC curve of log it shows AUC of 0.84 (combination of BMI, FAMILY HISTORY, serum uric acid) which is greater than the AUC of serum uric acid alone.serum uric acid AUC is 0.81 mg/dl, This clearly indicates serum uric acid is a very good predictor with sensitivity of 87.5%, specificity of 79.5%, criterion > 3.6mg/dl

PARITY-

Primigravida were 49% (98 patients)

Multigravida were 51% (102 patients)

URICACID-

Cut off taken in my study was 3.6mg/dl (AJOG, VOL 201 issue 4, Oct 2009)

Out of total 200 patients:

Uric acid < =3.6 mg/dl in 99 patients

Uric acid >3.6 mg/dl in 111 patients

As suit et al had 133 patients with raised uric acid concentration

Helmy et al had 312 patients with raised uric acid concentration

SPOT TEST

Spot test was done at 22-24 weeks (AJOG 2009)

<140mg/dl was noticed in 96 patients (48%)

>140-200 mg/dl noted in 104 patients (52%)

> 200mg/dl – nil

URIC ACID CONCENTRATION AND DEVELOPMENT OF GDM

Uric acid	No GDM	GDM
Normal	76	13
Abnormal	20	91

Therefore it was noticed that out of the 99 patients with normal uric acid 13 patients developed GDM(13.1%) and out of the 111 patients with raised uric acid 91(81.5%) patient developed GDM

RISK FACTORS

Risk factors were present in 28patients (14%)

No risk factors in 172patients (86%)

Patients with normal and abnormal uric acid were studied in relation to their risk factors and were found that

	Patients	Risk factor	No risk
Normal uric acid	99	14	85
Abnormal UA	111	14	97

RELATION OF NORMAL URIC ACID CONCENTRATION WITH RISK FACTOR AND DEVELOPMENT OF GDM

Totaly 99 patients had normal uric acid

NORMAL URIC ACID	RISK FACTOR	NO RISK FACTOR
99	14	85
GDM In this group	8	5

Therefore patient with normal uric acid and with risk factors developing GDM were 8 patients (8.08%)

RELATION OF ABNORMAL URIC ACID CONCENTRATION WITH RISK FACTOR AND DEVELOPMENT OF GDM

ABNORMAL URIC ACID	RISK FACTOR	NO RISK FACTOR
111	14	97
GDM in this group	14	77

Therefore patients with abnormal uric acid and with risk factors developing GDM were (12.61%)

DEVELOPMENT OF RISK FACTOR AND GDM

	RISK FACTOR	NO RISK FACTOR
TOTAL(200)	28	172
TOTAL GDM(104)	22	82

Therefore, 22(21.15%) patients developed GDM of the 28 patients with risk factors

RISK FACTOR STRATIFICATION IN THE TOTAL POPULATION STUDIED

		GDM
NO RISK FACTOR	172	82
Both parents DM	3	1
>35years	7	5
Father DM	5	5
MOTHER DM	4	3
Pre preg GDM	3	3
Others	6	5
Total	200	104

Correlation between serum uric acid and pregnancy induced hypertension and GDM

		PIH
Normal uric acid	99	11
Abnormal uric acid	111	32

43 patient developed PIH out of 200

Therefore it was noticed that out of the 99 patients with normal uric acid 11 patients developed PIH(11.1%) and out of the 111 patients with raised uric acid 32 patient developed PIH(28.8%)

RELATION OF URIC ACID CONCENTRATION WITH PIH AND DEVELOPMENT OF GDM

	GDM	NO GDM
Normal UA+PIH(11)	1	10
Abnormal UA+PIH(32)	29	3

OUT OF 11 PIH Patient with normal uric acid 1 patient developed GDM and out of 32 PIH patients with abnormal uric acid 29 patient developed GDM. This shows elevation of uric acid associated with metabolic syndrome.

The main reason for development of GDM as per my study was:

History of diabetes mellitus in family member, increased BMI,In this study normal uric acid group developing GDM was 13.1% AND abnormal uric acid group developing GDM 81.5% was statistically significant p value 0.0001, and also from this study normal uric acid group with risk factor

developing GDM was 8.08% and abnormal uric acid group with risk factor developing GDM was 12.61%, concluded from this observation serum uric acid act as a individual risk factor for the development of GDM

According to Hollander Et al, 2007- advanced maternal age and increased BMI was the main reason for development of GDM

History of GDM in previous pregnancy association with GDM. studied by Toroloni Et al, 2009.

No risk factors in 50% of GDM concluded from cook Et al.

Early diagnosis of GDM or with patients who are at risk of developing GDM should be properly screened to prevent the maternal and fetal complication due to Gestational diabetes

In this study mean age of population was 25.4 without any statistical difference among women .so the incidence of GDM was low in this age group

In this study 200 pregnant women analyzed. Among these 49% are primi and 51% are multi.

There was no statistical difference between parity. This was correlated with study done by Dunlop Et al.

But this was not correlated with study of nagalakshmi et al which shows increased incidence of GDM in primi.

In this study there was significant correlation between BMI and GDM. The p value was statistically significant-0.008. This was proved from various studies. Recent studies of laughon Et al showed that there is strong correlation between these two parameters.

Family history has significant correlation with GDM. This was proved from various studies. This was proved from Ratankar Et al study also.

In this study out of 200 cases 111 cases has increased level of serum uric acid more than 3.6mg/dl in the first trimester. Among them 91 patients developed GDM. There was statistical significance between serum uric acid and GDM

The p valve was very significant -0.0001

This was proved from various studies including langen et al ,Reece 2010, AJOG 2009 showed significant similarities also. In this study odds ratio was 5.95. This shows one fold increase in serum uric acid associated with 5.9 fold increased risk of GDM

According to Boyle et al analysis there is low level of serum uric acid level in first and second trimester and increased in third trimester normally occurs in a healthy women

But the cases that had increase in serum uric acid in first trimester is abnormal this leads to increased insulin resistance and metabolic syndrome and this leads to development of GDM and PIH

ROC curve of log it shows AUC of 0.84 (such as BMI, FAMILY HISTORY, serum uric acid) which is greater than the AUC of serum uric acid alone. This clearly indicates serum uric acid is a very good predictor with sensitivity of 87.5%, specificity of 79.5%, criterion> 3.6mg/dl with AUC 0.819

So in the screening itself if we take serum uric acid we can predict the GDM along with family history and BMI. So earlier detection will prevent both maternal and fetal complications

Limitations

1) Study population was small,
2) Influence of diet on serum uric acid was not studied,
3) Other important variable association with uric acid also not studied (race, ethintyet)
4) Fetal outcome also not studied

Summary

SUMMARY

Diabetes is one of the common medical disorder in India, and it's not so uncommon to encounter in the pregnant women. It is associated with high perinatal mortality and morbidity if it was not well controlled. Early diagnosis and preconception advice, optimum glycemic control, good monitoring of fetal well being are all essential to improve the perinatal outcome.

Since Indian women are more prone for developing type two DM, so universal screening is offered to Indian mothers to prevent maternal and fetal complications.

Early diagnosis by means of screening and history

To attain optimum glycemic control by means of diet, exercise and insulin, oral hypoglycemic agents, and also by daily self monitoring of blood glucose is essential,

During antenatal period fetal well being is assured by ultrasound and biophysical profile

During intrapartum period maintain blood glucose level below 140 mg/dl is essential to avoid neonatal hypoglycemia.

Progress of labor should be closely monitored with vigilant watch for shoulder dystocia

GDM mother is more prone for type 2 diabetes in the future. 75 gm GTT should be done six to twelve week after delivery then once in three years.

According to this study done in institute of obstetrics and gynecology first trimester uric acid is connected with a significant risk of developing GDM and it was observed that risk factors also involved in the development of GDM. This is supported by various studies like

- AJOG, 2009
- Reece, 2010
- Assuit Et al analyzed 812 patients
- Helmymotawe et al analyzed 1200 patients
- Moden et al analyzed 1016 patients
- Aparna et al analyzed 225 patients

Uric acid was increased with protein intake, alcohol consumption, decreased excretion or increased endogenous production

Study done by Lind Et al.1984 it has been proved that uric acid was positively correlated with fasting serum glucose and insulin resistance as well as features of metabolic syndrome, including waist circumference, Low HDL, hypertriglyceridemia, hypertension and fasting glucose >110mg/dl (Cappuccino Et al, 1993) concluded from his study GDM women is more prone for type two diabetes mellitus in feature.

The Receiver Operator Curve drawn showed serum uric acid as a predictor of GDM with Area under Curve of 0.819[95% CI: (0.759-0.870)] with a sensitivity of 87.5%, specificity of 79.2% at an Optimum criterion >3.6mg/dl.

First trimester uric acid concentrations >3.6 mg/dl were associated with a tendency towards increased risk of developing gestational diabetes (adjusted ODDS RATIO =5. 95%CI: 0.759-.870) compared to women with concentrations below this level.

ROC curve of log it shows AUC of 0.84 (combination of BMI,FAMILY HISTORY, serum uric acid) which is greater than the AUC of serum uric acid alone .This clearly indicates serum uric acid is a very good predictor of GDM and the risk increases when there are other associated risk factors.

Conclusion

CONCLUSION

Based on the results and the methodology employed, we conclude that there is risk of development of GDM with elevated levels of serum uric acid in the first trimester. This relationship is independent of age, parity, BMI and family history of diabetes mellitus though there is association of these variables (advanced maternal age, high parity, increased BMI and positive family history) with GDM. Uric acid levels at <13 weeks of gestation is more significantly associated with risk of development of GDM

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Annexures

PROFORMA

Serial No;

Hospital No

Name

Age

Address

Phone No

Booked&Unbooked

Socio Economic Status

Obstetric Score

Gestational Age

Present Obs H/O

Menstrual H/O

Marital H/O

Obstetric H/O

Past H/O	:	H/O GDM In First Pregnancy, Renal , Liver Disease, Chronic Hypertension,Gout, Drug Intake
Family H/O	:	H/O DM In First Degree Relative
Personal H/O	:	Diet, Smoking, Alcohol, Weight gain during pregnancy

EXAMINATION

Height

Weight

BMI

Temperature

Pulse Rate

Blood Pressure

Pallor

Pedal Oedema

SYSTEMIC EXAMINATION

Cardiovascular System

Respiratory System

Central Nervous System

Abdomen

INVESTIGATION

Haemoglobin

Packed Cell Volume

Serum Uric Acid

Blood Group

HIV

HBSAG

VDRL

OGCT

GTT

USG

ABBREVIATIONS

ACOG	- American college of obstetrics and gynaecology
ADA	- American Diabetes Association
BMI	- Body mass index
DIPSI	- Diabetes in pregnancy study group india
DM	- Diabetes Mellitus
FBS	- Fasting Blood Sugar
GDM	- Gestational Diabetes Mellitus
GTT	- Glucose Tolerance Test
HBA1c	- Glycosylated Haemoglobin
IADPSG	- International Association of Diabetes and Pregnancy Study Group
OGCT	- Oral Glucose Challenge Test
PIH	- Pregnancy Induced Hypertension
PPBS	- Post Prandial Blood Sugar
UA	- Uric Acid

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CERTIFICATE OF APPROVAL

To
Dr.P.Prasanna
PG in M.S.(O & G)
Madras Medical College/IOG
Chennai 600 003

Dear Dr.P.Prasanna ,

The Institutional Ethics Committee has considered your request and approved your study titled **" CORRELATION BETWEEN FIRST TRIMESTER URICACIC CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES MELLITUS " - NO.21012016.**

The following members of Ethics Committee were present in the meeting hold on **12.01.2016** conducted at Madras Medical College, Chennai 3

1.Dr.C.Rajendran, MD.,	:Chairperson
2.Dr.R.Vimala,MD.,Dean,MMC,Ch-3	:Deputy Chairperson
3.Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3	: Member Secretary
4.Prof.B.Vasanthi,MD.,Inst.of Pharmacology,MMC,Ch-3	: Member
5.Prof.P.Raghumani,MS, Dept.of Surgery,RGGGH,Ch-3	: Member
6.Prof.M.Saraswathi,MD.,Director, Inst.of Path,MMC,Ch-3	: Member
7.Tmt.J.Rajalakshmi, JAO,MMC, Ch-3	: Lay Person
8.Thiru S.Govindasamy, BA.,BL,High Court,Chennai	: Lawyer
9.Tmt.Arnold Saulina, MA.,MSW.,	:Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

MADRAS MEDICAL COLLEGE
21 JAN 2016
CHENNAI-600 003

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

Information to Participants

Title:STUDY THE CORRELATION BETWEEN FIRST TRIMESTER URICACID CONCENTRATION AND ITS ASSOCIATION WITH GESTATIONAL DIABETES MELLITUS.

Principal Investigator: Dr.P.PRASANNA

Name of Participant:

Site: Institute of obstetrics and gynaecology, Egmore, Chennai.

You are invited to take part in this study. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns.

What is the purpose of research?

The objective is to determine the correlation between first trimester uric acid concentration and its association with gestational diabetes mellitus

The study design

All participating pregnant women will undergo uricacid measurement before 13wks of GA

Study Procedures

The study involves evaluation of uricacid before 13wks of GA.if its more than3.6mg/dl will undergo OGCT(75gm) at 22to24wks of GA.if its>200mg considered GDM.value >140mg increased risk of diabetes.they will undergo GTT(100gm). If the two value exceed carpenter and coustan criteria consider GDM.

Possible benefits to other people

The results of the research may provide benefits to the society in terms of advancement of medical knowledge and/or therapeutic benefit to future patients.

Confidentiality of the information obtained from you

You have the right to confidentiality regarding the privacy of your medical information (personal details, results of physical examinations, investigations, and your medical history). By signing this document, you will be allowing the research team investigators, other study personnel, sponsors, Institutional Ethics Committee and any person or agency required by law like the Drug Controller General of India to view your data, if required.
The information from this study, if published in scientific journals or presented at scientific meetings, will not reveal your identity.

How will your decision to not participate in the study affect you?

Your decision not to participate in this research study will not affect your medical care or your relationship with the investigator or the institution. You will be taken care of and you will not loose any benefits to which you are entitled.

Can you decide to stop participating in the study once you start?

The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during the course of the study without giving any reasons. However, it is advisable that you talk to the research team prior to stopping the treatment/discontinuing of procedures etc.

Signature of Investigator

Date

Signature of Participant

Date

INFORMED CONSENT FORM

Title: study the correlation between first trimester uricacid and its association with gestational diabetes mellitus

Name of the Investigator: Dr.P.PRASANNA

Name of the Participant:

Name of the Institution: Institute of obstetrics and gynaecology, MMC, Chennai

I _____ have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in this study.

1. I have read and understood this consent form and the information provided to me.
2. I have had the consent document explained to me.
3. I have been explained about the nature of the study.
4. I have been explained about my rights and responsibilities by the investigator.
5. I have informed the investigator of all the treatments I am taking or have taken in the past months/years including any native (alternative) treatments.
6. I have been advised about the risks associated with my participation in the study.*
7. I agree to cooperate with the investigator and I will inform him /her immediately if I suffer unusual symptoms. *
8. I have not participated in any research study within the past.*
9. I am aware of the fact that I can opt out of the study at any time without having to give any reasoned this will not affect my future treatment in this hospital.*
10. I am also aware that the investigators may terminate my participation in the study at any time, for any reason, without my consent. *
11. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC if required.
12. Iunderstand that my identity will be kept confidential if my data are publicly presented.
13. I have had my questions answered to my satisfaction.
14. I consent voluntarily to participate in the research/study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form, I attest that the information given in this document has been clearly explained to me and understood by me. I will be given a copy of this consent document.

For adult participants

1. Name and signature / thumb impression of the participant (or legal representative if participantincompetent)

Name _____ Signature_____ Date_____

2. Name and Signature of impartial witness (required for illiterate patients):

Name _____ Signature_____ Date_____

Address and contact number of the impartial witness:

3. Name and Signature of the investigator or his representative obtaining consent:
Name _____ Signature_____ Date_____

ஆய்வு தகவல் தாள்

ஆய்வு தலைப்பு :

இரத்தத்தில் உப்புச்சத்து அதிகமாக இருப்பதினால் கர்ப்பிணி பெண்களுக்கு நீரிழிவு நோயை கண்டறிதல்.

ஆய்வாளர் : பங்கேற்பாளர் :

எழும்பூர் தாய் சேய் நல மகப்பேறு அரசு மருத்துவமனையில் நடைபெற உள்ளது. நீங்களும் இந்த ஆய்வில் பங்கேற்க நாங்கள் விரும்புகிறோம். இதிலுள்ள தகவலின் அடிப்படையில் இந்த ஆய்வில் பங்கேற்பதா அல்லது வேண்டாமா என்று நீங்கள் முடிவு செய்து கொள்ளலாம். உங்களது சந்தேகங்களை எங்களிடம் கேட்டு நிவர்த்தி செய்து கொள்ளலாம்.

இந்த ஆய்விற்கு இன்ஸ்ட்டியூசனல் எத்திக்கல் கமிட்டி சம்மதம் பெற்றிருக்கிறோம்.

ஆய்வின் நோக்கம்:

நமது இரத்தத்தில் உப்புச்சத்து நிறைய வகைகள் உள்ளன அவற்றில் யூரிக் அமிலம் அதிகமாக இருப்பதினால் இரத்தத்தில் சர்க்கரை அளவு அதிகமாகும். அதனால் பிரசவ காலத்தில் நீரிழிவு நோய் ஏற்பட வாய்ப்புள்ளதா என்பதை கண்டறிவதே இந்த ஆராய்ச்சியின் நோக்கம்.

மருத்துவ சிகிச்சையின் தகவல்கள் குறித்த விவரங்கள்:

நீங்களும் இந்த ஆராய்ச்சியில் பங்கேற்க நாங்கள் விரும்புகிறோம். இந்த ஆராய்ச்சியில் உங்களுடைய இரத்தத்தை இரு முறை சேகரித்து (முதல் முறை : 13 வாரத்திற்கு முன்பு, 2வது முறை : 22 - 24 வாரத்தில்) எடுத்து சில சிறப்புப் பரிசோதனைக்கு உட்படுத்தி அதன் தகவல்களை ஆராய்வோம். அதனால் தங்களது நோயின் ஆய்வறிக்கையோ அல்லது சிகிச்சையோ பாதிப்புக்குள்ளாகாது என்பதையும் தெரிவித்துக் கொள்கிறோம்.

முடிவுகளை அல்லது கருத்துகளை வெளியிடும் போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிட மாட்டோம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியில் இருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த சிறப்புப் பரிசோதனைகளின் முடிவுகளை ஆராய்ச்சியின் போது அல்லது ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆய்விற்கு தங்களிடமிருந்து சில விவரங்களை ஆராய்ச்சியாளர் நேர்காணல் மூலம் கேட்டறிந்து கொள்வார்.

ஆய்வாளர் கையொப்பம் பங்கேற்பாளர்/பாதுகாவலர் கையொப்பம்

தேதி :

பங்கேற்பாளரின் ஒப்புதல் படிவம்

இரத்தத்தில் உப்புசத்து அதிகமாக இருப்பதினால் கர்பினி பெண்களுக்கு நீரிழிவு நோயை கண்டறிதல்

ஆராய்ச்சியாளர் Dr.ப.பிரசன்னா

பங்கேற்பாளர் பெயர்

நான் _____ ஆராய்ச்சியாளர் குறிப்புகளை படித்தேன் (அல்லது படிப்பித்ததை கேட்டேன்) நான் எனது சந்தேகங்களை கேட்டு அறிந்து கொண்டேன். நான் 18 வயது கடந்தவள், நான் முழுமனதுடன் இந்த ஆராய்ச்சியில் பங்கு பெற சம்மதிக்கிறேன்.

1. நான் மருத்துவரின் குறிப்பை படித்தோ/படிப்பித்தோ அறிந்து கொண்டேன்.
2. நான் அந்த குறிப்பின் நகல் ஒன்றை பெற்றுக் கொண்டேன்
3. ஆராயச்சியின் விவரத்தை நான் அறிவேன்.
4. என்னுடைய உரிமைகளையும் பொறுப்புகளையும் அறிந்து கொண்டேன்.
5. நான் இதுவரை பெற்ற அனைத்து சிகிச்சையின் விவரங்களை மருத்துவரிடம் கூறியுள்ளேன்.
6. இந்த ஆராய்ச்சியால் என் சிகிச்சையில் எவ்வித பாதிப்பு நேராது என்பதை அறிவேன்.
7. நான் ஆராய்ச்சியிலிருந்து எந்நேரமும் விலக முழு உரிமை உண்டு என்பதை அறிவேன்.
8. என் மூலம் நடந்த ஆராயச்சி முடிவுகளை அரசாங்கத்திற்கும், எத்திகல் கமிட்டி இன்சிடியூசனுக்கும் (IEC) தெரியப்படுத்த ஆராயச்சியாளருக்கு முழு உரிமை அளிக்கிறேன்.
9. எனது தனித்துவ அடையாளம் ரகசியத்துடனும், நம்பிக்கையுடனும் வைத்துக் கொள்ளப்படும் என்பதை அறிந்து கொண்டேன்.
10. நான் முழுமனுசுடன் இந்த ஆராயச்சியில் பங்கு பெற சம்மதிக்கிறேன்.
11. ஆராய்ச்சியின் போது எனக்கு ஏதாவது சந்தேகம் ஏற்பட்டால், நான் ஆராய்ச்சியாளரை அணுகலாம் எனபதை அறிவேன்.

பங்கேற்பாளரின் கையொப்பம்

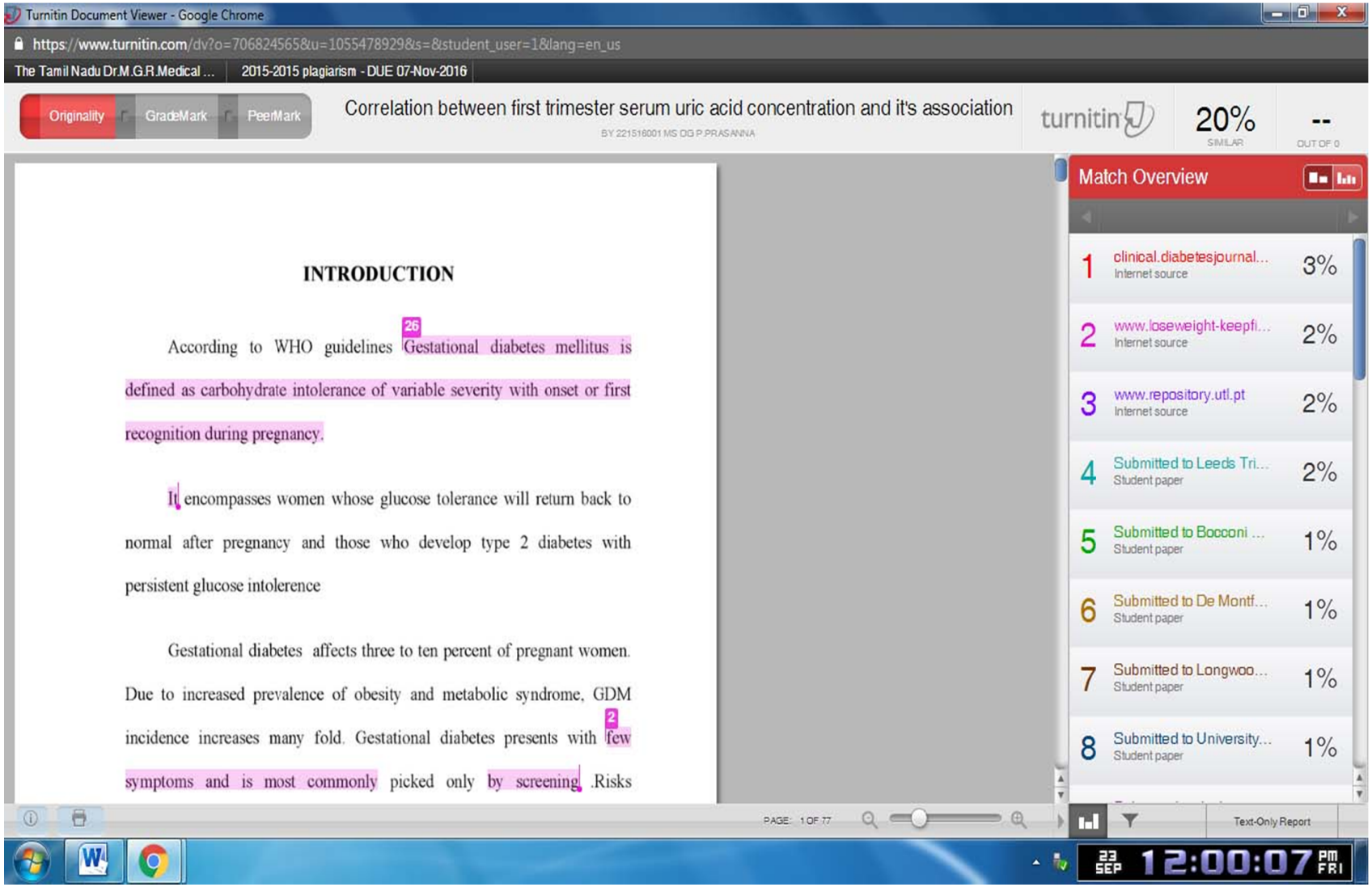
பெயர்:

தேதி:

ஆராய்சியாளரின் கையொப்பம்

பெயர்:

தேதி: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INTRODUCTION
According to WHO guidelines Gestational diabetes mellitus is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.
It encompasses women whose glucose tolerance will return back to normal after pregnancy and those who develop type 2 diabetes with persistent glucose intolerence
Gestational diabetes affects three to ten percent of pregnant women. Due to increased prevalence of obesity and metabolic syndrome, GDM incidence increases many fold. Gestational diabetes presents with few symptoms and is most commonly picked only by screening .Risks
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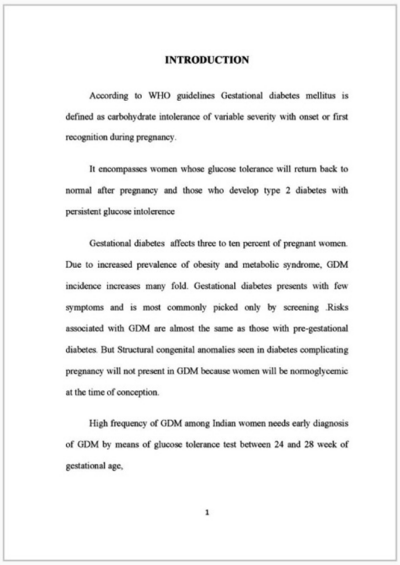

INTRODUCTION

According to WHO guidelines Gestational diabetes mellitus is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.

It encompasses women whose glucose tolerance will return back to normal after pregnancy and those who develop type 2 diabetes with persistent glucose intolerence

Gestational diabetes affects three to ten percent of pregnant women. Due to increased prevalence of obesity and metabolic syndrome, GDM incidence increases many fold. Gestational diabetes presents with few symptoms and is most commonly picked only by screening .Risks associated with GDM are almost the same as those with pre-gestational diabetes. But Structural congenital anomalies seen in diabetes complicating pregnancy will not present in GDM because women will be normoglycemic at the time of conception.

High frequency of GDM among Indian women needs early diagnosis of GDM by means of glucose tolerance test between 24 and 28 week of gestational age,

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MASTER CHART

Sl No	Name	Age	Obs Code	Risk Factors	BMI	Sr.Uric acid	OGCT	GTT	FBS	PPBS	PIH	treatment
1	saranya	22	multi	-	19	2.6	96	-	-	-	0	-
2	judith	22	primi	-	23.1	2.2	102	-	-	-	0	-
3	jegadeswari	20	primi	-	19.8	3.6	102	-	-	-	0	-
4	bhavani	27	primi	-	24	3.1	106	-	-	-	0	-
5	sudha	28	primi	-	23.8	2.6	108	-	-	-	0	-
6	kanmani	34	multi	both parents DM	22	3.8	108	-	-	-	1	-
7	vimala	22	primi	-	24	2.2	109	-	-	-	0	-
8	glory	22	primi	-	21.9	3.1	109	-	-	-	1	-
9	janavi	22	primi	-	23	3	112	-	-	-	0	-
10	sivakami	21	primi	-	25	2.2	120	-	-	-	0	-
11	kanaga	28	multi	-	24	4.6	124	-	-	-	1	-
12	naglini	20	primi	both parents DM	21.6	3.6	126	-	-	-	0	-
13	divya	32	multi	-	22	3	128	-	-	-	0	-
14	udhaya	31	primi	-	21.8	3.6	130	-	-	-	0	-
15	rekha	34	multi	-	23.4	3	130	-	-	-	0	-
16	deepika	21	primi	-	21.4	3.6	132	-	-	-	0	-
17	suriya	22	multi	-	22	3.2	132	-	-	-	0	-
18	buela	21	primi	-	23.5	2.9	132	-	-	-	0	-
19	kalaivani	40	multi	-	25	4	132	-	-	-	0	-
20	geetha	30	primi	-	24.5	3.6	132	-	-	-	1	-
21	raghavi	23	multi	-	22	3.2	136	-	-	-	0	-
22	mahalakshmi	23	multi	-	19	3.9	136	-	-	-	1	-
23	sasikala	22	multi	-	19.5	4.1	138	-	-	-	0	-
24	vanmathi	31	multi	-	24	3.3	138	-	-	-	0	-
25	saranya	21	primi	-	23.4	3.7	142	92/168/150/130			0	meal plan
26	meenakshi	21	multi	-	21.4	3.1	142	98/190/168/157			0	insulin
27	chitra	28	multi	both parents DM	22	2.5	142	78/140/120/110			0	meal plan
28	umadevi	24	multi	pre big baby	21.5	4.5	148	90/180/165/140			1	meal plan
29	latha	29	multi	TWIN	24	4	148		90	120	1	meal plan
30	ranjith	23	primi	-	23.6	3.9	148	92/170/150/140			1	meal plan
31	Aarifa	30	multi	-	23.3	3.9	148	70/142/120/110	92	140	0	meal plan
32	prabavathy	26	multi	-	24.5	5.6	148	96/182/155/140	92	138	1	meal plan
33	nalini	22	multi	-	19	5.6	148	99/185/148/142			1	meal plan
34	valli	22	multi	-	19.5	3.7	152		98	176	0	insulin
35	Ramya	23	primi	-	23	5.4	152	89/192/159/146			0	meal plan
36	pramila	23	multi	-	21	3.9	156		98	114	0	meal plan
37	Thamarai	24	multi	-	21.4	3.8	156	90/182/155/140			0	meal plan
38	geetha	28	multi	pre GDM	22	3.7	156	94/186/160/110	98	190	0	insulin
39	sasikala	30	multi	-	19.8	4	156		96	146	0	meal plan
40	Reeta	35	multi	-	23	3.9	156		102	156	0	insulin
41	Ashwini	24	primi	-	24	7.1	158	98/182/156/140			1	meal plan
42	pavithra	26	multi	-	21.5	4.8	162		146	210	1	insulin
43	Roselin	26	primi	pcos	21	4.8	162	98/192/168/140	140	220	1	insulin
44	Dhanalakshmi	34	primi	-	23	3.8	162	94/186/172/142	90	112	1	meal plan

45	sarojini	22	multi	father DM	27.4	2.4	168		146	222	0	insulin
46	Nandhini	30	primi	-	23	4.2	168	90/180/170/140	114	170	0	insulin
47	visalatchi	25	multi	-	22	5.8	172	90/200/180/154	144	202	1	insulin
48	pavithra	28	multi	-	22.1	2.6	96	94/168/16/152	102	142	0	-
49	jeyalakshmi	26	multi	-	19	2.2	102	-	-	-		-
50	nivethidha	24	primi	-	24.5	3.6	102	-	-	-	0	-
51	geetha	24	multi	-	19.9	3.1	106	-	-	-	0	-
52	saraswathi	22	multi	-	21	2.6	108	-	-	-	0	-
53	devi	28	primi	-	24.3	3.8	108	-	-	-	0	-
54	sumathi	22	multi	-	23	2.2	109	-	-	-	0	-
55	ponni	27	primi	-	21	3.1	109	-	-	-	1	-
56	dhanam	28	primi	-	21.4	3	112	-	-	-	0	-
57	shanthi	23	multi	-	22	2.2	120	-	-	-	0	-
58	madhavi	22	multi	pre big baby	24.4	4.6	124	-	-	-	1	-
59	chandra	28	primi	-	23	3.6	126	-	-	-	0	-
60	priya	23	primi	-	24.2	3	128	-	-	-	0	-
61	Bakiyalakshmi	28	multi	-	23	3.6	130	-	-	-	0	-
62	Rama	27	multi	-	21	3	130	-	-	-	0	-
63	Rekha	22	multi	-	23.5	3.6	132	-	-	-	0	-
64	prasanna	27	multi	-	19.4	3.2	132	-	-	-	0	-
65	prema	24	primi	-	23	2.9	132	-	-	-	0	-
66	ponniammal	22	multi	-	22.6	4	132	-	-	-	0	-
67	vendam	24	multi	-	21.6	3.6	132	-	-	-	0	-
68	pavithra	29	primi	-	22	3.2	136	-	-	-	0	-
69	pathuvai	25	primi	-	21	3.9	136	-	-	-	0	-
70	mahalakshmi	23	primi	-	19.5	4.1	138	-	-	-	0	-
71	Usha	20	multi	-	23	3.3	138	-	-	-	0	-
72	Durga	19	primi	father DM	21.7	3.7	142	88/162/150/130	92	140	0	insulin
73	Devi	24	multi	-	22	3.1	142	78/188/58/146	90	108	1	metformin
74	chitra	26	primi	-	29.9	2.5	142	89/170/160/132	88	112	0	insulin
75	sudha	21	primi	-	23	4.5	148	95/196/74/110	90	110	0	meal plan
76	saraswathi	24	primi	-	22	4	148	78/184/160/48	112	148	0	metformin
77	veena	28	multi	mother DM	19.7	3.9	148	91/184/150/147	93	125	0	meal plan
78	saranya	32	multi	-	23	3.9	148	89/170/160/154	89	114	1	insulin
79	sandhiya	32	multi	father DM	22	5.6	148	99/170/162/155	122	176	1	insulin
80	poovizhi	26	multi	-	21.8	5.6	148	100/190/170/110	94	126	1	meal plan
81	pavithra	27	primi	-	23.4	3.7	152	-	100	132	0	metformin
82	kanchana	35	primi	-	22.5	5.4	152	115/272/210/150	160	202	0	insulin
83	pathuvai	26	primi	-	19	3.9	156	-	98	143	0	meal plan
84	vani	22	multi	-	19.6	3.8	156	-	146	210	0	insulin
85	devi	26	multi	pre GDM	23	3.7	156	120/180/168/110			0	meal plan
86	Dhanalakshmi	25	primi	-	24.6	4	156	98/164/160/158	98	122	0	meal plan
87	shantha	26	primi	-	23	3.9	156	102/160/154/84	90	120	0	meal plan
88	Devi	24	multi	-	22.1	7.1	158	-	112	146	0	meal plan
89	ranjani	29	primi	-	24	4.8	162	-	87	102	0	meal plan
90	Roshini	25	primi	-	21.8	4.8	162	-	134	167	0	insulin
91	lalitha	23	primi	-	22	3.8	162	88/162/130/150	88	122	0	meal plan

92	Madhu	20	multi	pre GDM	23.9	2.4	168	99/193/150/132	-	-	0	insulin
93	Subha	22	multi	-	22.6	4.2	168	-	104	142	0	insulin
94	Shanthi	24	primi	mother DM	23.3	5.8	172	90/180/160/142	90	122	0	meal plan
95	kanchana	21	primi	-	21.4	2.6	96	-	-	-	1	-
96	kavitha	27	multi	-	22	2.2	102	-	-	-	0	-
97	Fathima	22	multi	-	22.1	3.6	102	-	-	-	0	-
98	Sankari	25	primi	-	23	3.1	106	-	-	-	0	-
99	Usha	26	multi	-	22	2.6	108	-	-	-	0	-
100	Rani	24	multi	mother DM	23.1	3.8	108	-	-	-	0	-
101	Madhumidha	24	primi	-	24	2.2	109	-	-	-	0	-
102	Nancy	38	primi	-	24.5	3.1	109	-	-	-	0	-
103	Supraba	25	primi	-	21	3	112	-	-	-	0	-
104	surya	28	primi	-	30.1	2.2	120	-	-	-	0	-
105	Kavitha rani	22	multi	-	22	4.6	124	-	-	-	0	-
106	Anitha	25	multi	-	22.5	3.6	126	-	-	-	0	-
107	Mariyammal	29	multi	-	23	3	128	-	-	-	0	-
108	Vinarasi	22	multi	-	23.4	3.6	130	-	-	-	0	-
109	Swathi	25	multi	-	21	3	130	-	-	-	0	-
110	Vasanthi	20	primi	-	21.4	3.6	132	-	-	-	1	-
111	Udhaya	25	multi	-	21.3	3.2	132	-	-	-	0	-
112	Vaishnavi	27	multi	-	23	2.9	132	-	-	-	0	-
113	Kanmani	22	multi	-	23.4	4	132	-	-	-	0	-
114	umadevi	27	multi	-	22	3.6	132	-	-	-	0	-
115	Brindha	24	primi	-	22.4	3.2	136	-	-	-	0	-
116	Fathima	22	multi	-	21.4	3.9	136	-	-	-	0	-
117	Anushya	24	multi	-	24	4.1	138	-	-	-	0	-
118	Kalaivani	22	primi	-	23	3.3	138	-	-	-	0	-
119	Kavitha	24	multi	-	22.3	3.7	142		98	145	0	metformin
120	Shanthi	36	primi	-	21	3.1	142	100/190/140/120	98	108	1	metformin
121	Deepa	28	primi	-	21.3	2.5	142	94/168/16/152			1	meal plan
122	Rupadevi	37	primi	-	28.9	4.5	148		102	152	1	insulin
123	Usha	22	primi	-	24	4	148	90/182/150/130			1	meal plan
124	Latha	24	multi	-	24.3	3.9	148	78/188/158/146			0	meal plan
125	Anitha	36	primi	-	21.3	3.9	148		98	108	0	metformin
126	Monisha	28	primi	-	22	5.6	148	90/178/160/154			0	mealplan
127	Suganya	37	primi	-	19	5.6	148		102	152	0	insulin
128	Suguna	25	primi	father DM	19.4	3.7	152	94/182/162/145	76	110	0	mealplan
129	Lavanya	21	multi	-	18.7	5.4	152	94/156/160/110			0	meal plan
130	Jasmine	25	multi	-	23	3.9	156		156	224	0	insulin
131	Udayarani	24	primi	-	22	3.8	156	99/188/164/160			0	meal plan
132	Aarthi	24	primi	-	21	3.7	156	94/180/160/154	76	98	0	insulin
133	Akila	22	multi	-	21.7	4	156	88/162/158/142			0	metformin
134	Saroja	21	multi	-	24	3.9	156		146	178	0	insulin
135	Poornima	24	multi	-	23	7.1	158	88/170157/150			0	mrtformin
136	Surya	24	primi	-	19.4	4.8	162	92/180/162/145			0	mealplan
137	Anandhi	36	primi	-	25.6	4.8	162	98/166/154/140			0	mealplan
138	Sundari	20	primi	-	24	3.8	162		88	100	0	mealplan

139	Arunthadhi	31	multi	-	25	2.4	168	88/160/158/148	80	100	1	mealplan
140	Uma	20	primi	-	21.5	4.2	168		99	200	0	insulin
141	Kavya	19	primi	-	22	5.8	172		80	114	0	mealplan
142	Vimala	24	multi	-	23	2.6	96	-	-	-	0	-
143	Lavanya	26	multi	-	24	2.2	102	-	-	-	0	-
144	Nancy	28	primi	-	23.4	3.6	102	-	-	-	0	-
145	Nandhini	24	primi	-	22.4	3.1	106	-	-	-	0	-
146	poomika	24	multi	-	19	2.6	108	-	-	-	0	-
147	poonjolai	32	primi	-	19.5	3.8	108	-	-	-	0	-
148	Malliga	24	multi	-	21	2.2	109	-	-	-	0	-
149	thilagam	22	primi	-	22.4	3.1	109	-	-	-	0	-
150	manimegalai	22	primi	-	23	3	112	-	-	-	1	-
151	vinitha	27	multi	-	19.8	2.2	120	-	-	-	0	-
152	prabha	22	primi	-	23	4.6	124	-	-	-	0	-
153	Suganya	22	primi	-	21	3.6	126	-	-	-	0	-
154	sumathi	27	primi	-	24.3	3	128	-	-	-	0	-
155	Bakiyalakshmi	25	multi	-	22	3.6	130	-	-	-	0	-
156	valli	21	primi	-	21.4	3	130	-	-	-	1	-
157	poomika	27	primi	-	23.5	3.6	132	-	-	-	0	-
158	revathy	25	primi	-	19	3.2	132	-	-	-	0	-
159	poomathi	25	multi	-	19.6	2.9	132	-	-	-	0	-
160	Nancy	24	primi	-	21	4	132	-	-	-	0	-
161	vimala	22	multi	-	21.3	3.6	132	-	-	-	1	-
162	vincila	28	multi	-	22	3.2	136	-	-	-	0	-
163	mary	24	multi	-	22.5	3.9	136	-	-	-	0	-
164	nancy stella	24	primi	-	24	4.1	138	-	-	-	0	-
165	Manjula	26	multi	-	23.4	3.3	138	-	-	-	1	-
166	vanaja	25	multi	-	21	3.7	142	100/190/158/120			1	meal plan
167	prema	23	multi	-	23	3.1	142	96/182/147/99			1	meal plan
168	sarala	23	primi	mother DM	22.5	2.5	142	90/180/170/155	100	108	0	mealplan
169	Lakshmi	25	primi	-	23.4	4.5	148	98/164/148/120	112	156	0	insulin
170	meenakshi	24	multi	-	21	4	148	98/166/154/140			0	meal plan
171	VANI	25	primi	-	19	3.9	148	88/160/158/148	92	122	1	insulin
172	Savithri	25	primi	-	19.5	3.9	148	97/179/164/159	87	116	0	meal plan
173	bhavani	29	multi	-	21.4	5.6	148	110/190/160/130			1	-
174	Bhakya	30	multi	-	22	5.6	148	-	99	162	1	insulin
175	Vidhya	27	primi	-	31.1	3.7	152		102	166	0	insulin
176	kumari	27	primi	-	23	5.4	152		110	153	0	metformin
177	Keerthika	22	primi	-	24	3.9	156	96/190/170/90			0	insulin
178	Vasantha	22	primi	father DM	21	3.8	156	100/160/154/116	80	106	1	mealplan
179	Manjula	26	primi	-	24	3.7	156		94	122	0	insulin
180	Minnala	27	multi	-	21	4	156	84/170/160/150	90	110	1	insulin
181	Poorvika	24	multi	-	21.8	3.9	156	100/190/150/140	88	118	0	insulin
182	Jasmine	24	multi	-	22	7.1	158	90/170/160/150	88	110	0	mealplan
183	janavi	24	multi	-	23.5	4.8	162	98/160/140/120			0	mealplan
184	karuthamma	22	primi	-	19.7	4.8	162	90/170/158/120			1	mealplan
185	poovizhi	24	primi	-	21	3.8	162	92/186/155/132			0	

186	Radhika	26	multi	-	24.6	2.4	168	96/176/162/143			0	metformin
187	Vimala	25	primi	-	23	4.2	168	88/190/160/120	84	98	0	mealplan
188	Vinodhini	23	primi	-	23.1	5.8	172	-	94	164	0	insulin
189	Thangam	21	primi	-	24	3.9	156	98/160/158/140	84	119	0	mealplan
190	Kani	26	multi	-	23	3.8	156	90/185/163/140	-	-	1	insulin
191	Dhanasri	24	primi	pre big baby	23.5	3.7	156	98/190/166/120	-	-	0	insulin
192	Vani	21	primi	-	19	4	156	90/182/155/100	-	-	0	meal plan
193	Vijaya	27	multi	-	21	3.9	156	98/160/158/120	-	-	0	mealplan
194	Hemalatha	24	primi	-	21.7	7.1	158	-	143	189	0	insulin
195	Kalaivani	23	multi	-	25	4.8	162	-	98	156	0	meal plan
196	pommi	24	multi	-	28	4.8	162	98/190/168/140	100	148	0	insulin
197	mala	23	primi	-	24.5	3.8	162		90	126	1	meal plan
198	Suguna	25	multi	-	21	2.4	168	84/182/154/132	102	146	0	meal plan
199	Vanathi	25	multi	pre big baby	21.7	4.2	168	86/190/160/124	84	118	1	insulin
200	meenakshi	23	multi	-	22	5.8	172	92/178/160/146	88	193	0	insulin

0 = No Pregnancy Induced Hypertension 1 = Presence of Pregnacy Induced Hypertension