

Original Research Article

# PRIMARY GESTATIONAL HYPERTENSION /PREECLAMPSIA IN MULTIGRAVIDA AT A TERTIARY HOSPITAL

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## ABSTRACT

### BACKGROUND

Gestational hypertension and preeclampsia are major causes of an array of adverse maternal & foetal outcome. Even though previous history is the strongest risk factor among multigravida, the incidence of preeclampsia is on raise with life style changes. High prepregnancy BMI and increase in the BMI between pregnancies contribute significantly to an adverse outcome. Birth interval is more is usually associated with increase in maternal age and more chance for maternal weight gain. Prior preterm delivery is also known to increase the risk of preeclampsia/ gestational hypertension in women with & without preeclampsia in previous pregnancy. Increase in maternal age and exorbitant gestational weight gain are known to increase the risk of preeclampsia. This prospective observational study was conducted to determine the incidence of primary gestational hypertension/ preeclampsia in multigravida & to delineate its risk factors.

### MATERIALS AND METHODS

This study was carried out between February 2009 and January 2011 in a tertiary care hospital among multigravid pregnant women booked at the antenatal clinic. Multigravida with 2 or more singleton pregnancies with records of previous pregnancies furnishing lack of evidence of GHT/ preeclampsia and those with complications like HT, DM, renal disease, autoimmune disease with their onset in the interpregnancy period were included in the study. Data was analysed for the risk variables among the total group and the results were expressed as percentages.

Qualitative analysis was done using the chi square test .Value of less than 0.05 was taken as significant.

## RESULTS

After all exclusions, the final cohort consisted of 723 women with 2 or more consecutive singleton pregnancies. Incidence of primary gestational hypertension/preeclampsia among parous women in the study population was 4.8% .Incidence of gestational hypertension was 3%, while preeclampsia was 1.7%. Majority of patients among GHT were in the 31-35 yrs age group (36.4%) while preeclampsia was more frequent in > 35yrs (38.5%). Elderly gravida was observed to be a notable risk factor. The percentage of overweight & obese women was more among cases compared with the remaining multigravida. Change in BMI of more than 1 unit compared to previous pregnancy was seen to be an important risk factor. Exorbitant gestational weight gain, chronic hypertension & diabetes mellitus were also significant risk factors for primary onset of GHT/preeclampsia in multigravida.

## CONCLUSION

This study infers that there is a significant association between- high prepregnancy BMI (overweight/ obesity), change in prepregnancy BMI between pregnancies (of more than 1 unit), advanced maternal age (>35yrs), excessive gestational weight gain in pregnancy, chronic hypertension and diabetes mellitus prior to present pregnancy with their onset in the interpregnancy period, with gestational HT/ preeclampsia in the index pregnancy among parous women with previous normal pregnancies.

## KEY WORDS

Gestational hypertension, preeclampsia, multigravida, pregnancy.

## INTRODUCTION

Gestational hypertension/ preeclampsia are major causes of an array of adverse maternal & fetal outcome. They cause preterm birth, fetal growth restriction, perinatal mortality & maternal morbidity & mortality. Gestational hypertension is defined as BP more than or equal to 140/90 mm of Hg for first time in pregnancy, without proteinuria after 20 weeks of pregnancy. Preeclampsia is defined as BP more than or equal to 140/90 mm of Hg after 20 weeks of gestation with proteinuria > 300mg/24 hrs or 1+ dipstick.

Essentially gestational hypertension/ preeclampsia are disease manifestations common in primigravida. Their occurrence in parous women after previous normal pregnancies is the primary onset or primary gestational hypertension/ preeclampsia. Even though previous history is the strongest risk factor among multigravida, the incidence of preeclampsia is on raise with life style changes. The factors for risk of preeclampsia/ gestational hypertension in multiparous women other than previous history of gestational hypertension/ preeclampsia in pregnancy are as follows:

### **Changes in prepregnancy BMI between pregnancies**

Overweight & obese women present with dyslipidemia, higher concentrations of leptin, interleukin-6 and C- reactive protein and impaired micro vascular endothelial function in contrast to women with normal BMI.<sup>[1]</sup> Overweight & obese women secrete inflammatory substances from adipose tissues which may lead to chronic inflammation & adversely affect vascular function. As a result, there is link between prepregnancy BMI in the earlier pregnancy & preeclampsia in the following pregnancy due to chronic inflammation.<sup>[2]</sup>

### **High prepregnancy BMI (overweight & obesity)**

Overweight & obesity cause hyperinsulinemia & hyperlipidemia. Insulin at increased levels may regulate intracellular cation pumps that affect vascular tone & blood pressure, stimulate the sympathetic nervous system or cause hypertrophy of vascular smooth muscles. Vasoconstrictive peptides at high levels may contribute to the endothelial cell injury, feature of both preeclampsia & insulin resistance syndrome.<sup>[3]</sup> Prostacyclin secretion is reduced & peroxidase production is increased in hyperlipidemia contributing to vasoconstriction & platelet aggregation which increase risk of preeclampsia.<sup>[4]</sup>

### **Longer birth interval**

Increased interval between births is associated with increase in maternal age and increase in maternal weight gain, a change of partner or onset of chronic diseases like diabetes mellitus, hypertension, renal disease, autoimmune diseases.<sup>[3]</sup>

### **Change of parity**

Beneficial outcome of multiparity is obscured with change of parity. Maternal immune adaptation to paternal genes may be abnormal at the maternal fetal intersurface which may contribute.<sup>[2]</sup>

### **Prior preterm delivery**

Prior preterm delivery increased the risk of preeclampsia/ gestational hypertension in women with & without preeclampsia in previous pregnancy. Preeclampsia & preterm delivery share familiar risk factors such as overweight, low socioeconomic status, presence of underlying maternal medical conditions.<sup>[5,6]</sup>

### **Advanced maternal age**

With maternal age > 35years the rates of chronic diseases- hypertension, diabetes mellitus and medical complications in pregnancy- GDM & PET are known to increase. Even with a modest increase in maternal age, there is significant increase in pregnancy complications for antenatal mothers at advanced age.<sup>[7]</sup>

### **Small for gestational age newborn in previous pregnancy**

Women have increased risk of developing preeclampsia in the current pregnancy, if they have delivered growth restricted fetus in her previous pregnancy. 10% of the total cases of preeclampsia in second pregnancy & 30% of recurrent cases were attributed to growth restriction below tenth percentile in first pregnancy.<sup>[8]</sup> Failure of fetal trophoblast to invade the arteries in early pregnancy have been associated with preeclampsia & FGR.

### **Excessive gestational weight gain**

Within each BMI category, the risk of preeclampsia increased with the rate of weight gain, new onset of chronic renal disease, autoimmune disease, chronic hypertension & diabetes in pregnancy in the interpregnancy interval, multifetal gestation, GTN in the present pregnancy.<sup>3</sup>

There are few studies for gestational hypertension/ preeclampsia that are population based. It is crucial to have practical estimate for risk factors in parous women for patient counseling. The objective of this prospective observational study is to determine incidence of primary gestational hypertension/ preeclampsia in multigravida & to delineate its risk factors.

## **MATERIALS & METHODS**

This study was carried out at Southern Railway Headquarters hospital, a tertiary care hospital, Perambur, Chennai from February 2009 to January 2011. Multigravida booked at the antenatal clinic at the outpatient department of the hospital & who planned to deliver at the hospital were enrolled for the study.

### **Inclusion Criteria were as follows**

Multigravida with 2 or more singleton pregnancies with records of previous pregnancies furnishing lack of evidence of GHT/ preeclampsia.

Multigravida with complications like HT, DM, renal disease, autoimmune disease with their onset in the interpregnancy period.

Multigravida planned to stay & deliver at Railway hospital.

### **Exclusion Criteria were as follows:**

Multigravida with recurrent GHT/ preeclampsia

Multigravida with chronic hypertension, DM, renal disease, autoimmune disease with their onset prior to first pregnancy

Multigravida with multiple pregnancy. Multigravida with molar pregnancy.

Multigravida with pregnancies ending less than 28 wks.

### **Study Design**

It is a prospective observational study with intention to provide patient counseling to modify the risk factors. The risk factors considered for the study were:

- Change in prepregnancy BMI between pregnancies.
- Overweight & obesity prior to the index pregnancy.
- Excessive Gestational weight gain in the current pregnancy
- Longer birth interval
- Advanced maternal age
- Change of partner
- Previous preterm birth
- Medical problems like chronic HT, DM, autoimmune diseases, renal disease with their onset in the interpregnancy period.

The total number of multigravida on regular antenatal checkup attending the OPD included the study population -1101

After all exclusions, the final cohort consisted of 723 women with 2 or more consecutive singleton pregnancies. Within this cohort, 35 multiparous women were given the diagnosis of primary GHT/preeclampsia.

After fulfilling the exclusion criteria, the final cohort was evaluated for the risk variables & the strength of association determined.

At enrollment, detailed history of previous pregnancy - prepregnancy BMI, history of GHT, preeclampsia, diabetics mellitus, chronic hypertension, autoimmune diseases, renal disease, date of birth of the previous child, gestational age at birth & birth weight were noted. Patient's history was further confirmed with her previous pregnancy records. Reliability of previous records was ensured. Regarding present pregnancy, demographic data, parity, maternal age, whether GHT or preeclampsia, gestational age at onset of GHT/ preeclampsia, any change of paternity, gestational weight gain were recorded.

### **Measurement of Outcomes**

Maternal prepregnancy weight was used to derive BMI, wt in kg/ ht mm<sup>2</sup> Change in prepregnancy BMI between pregnancies was calculated as the difference between the BMI at the beginning of first & second pregnancy categorized as the difference as less than -1, -1 to <1, 1 to <2, 2- <3, 3 & more units. Overweight & obesity were assessed according to BMI (WHO Classification) BMI <18.4 overweight, >30 - obese. Underweight, 18.5-24.9-normal weight, 25-29.9.

Gestational weight gain was ascertained by taking the difference between maternal weight at the time of delivery & prepregnancy weight from first prenatal visit. It was classified as inadequate, adequate or excessive based on IOM guidelines. The time interval between pregnancies calculated as the number of completed years between birth of first child, & first day of LMP of present pregnancy categorized as <1 yr, 1-5 yrs, 6-10 yrs, >10yrs. Advanced maternal age - those women who aged >35yrs on the date of delivery.<sup>[7]</sup> Age categorized as <20yrs, 20-25 yrs, 26-30 yrs, 31-35yrs & >35yrs. Previous preterm delivery was termed as delivery before 37 completed weeks

of gestation, categorized as gestational age at birth <37 weeks & >28 weeks. >37 weeks.

Change of partner enquired .Multigravida with documented history of diabetes mellitus, chronic hypertension, autoimmune diseases and chronic renal disease were noted.

**Statistical Analysis**

Data were analyzed for the risk variables among the total group. Data were expressed as number percentage. SPSS for windows (V1 7) was used for data analysis. Qualitative analysis of data was done using Pearson chi square test at 5% level of significance. P value of less than 0.05 was taken as significant & more than 0.05 as not significant.

**RESULTS**

Number of multigravida enrolled in the study were 723. The incidence of primary gestational hypertension/ preeclampsia among parous women in the study population was 4.8% (35), of which gestational hypertension was 3% (22) preeclampsia 1.7% (12) and preeclampsia superimposed on chronic hypertension 0.1% (1). Majority (97%) of the study population belonged to second gravida.

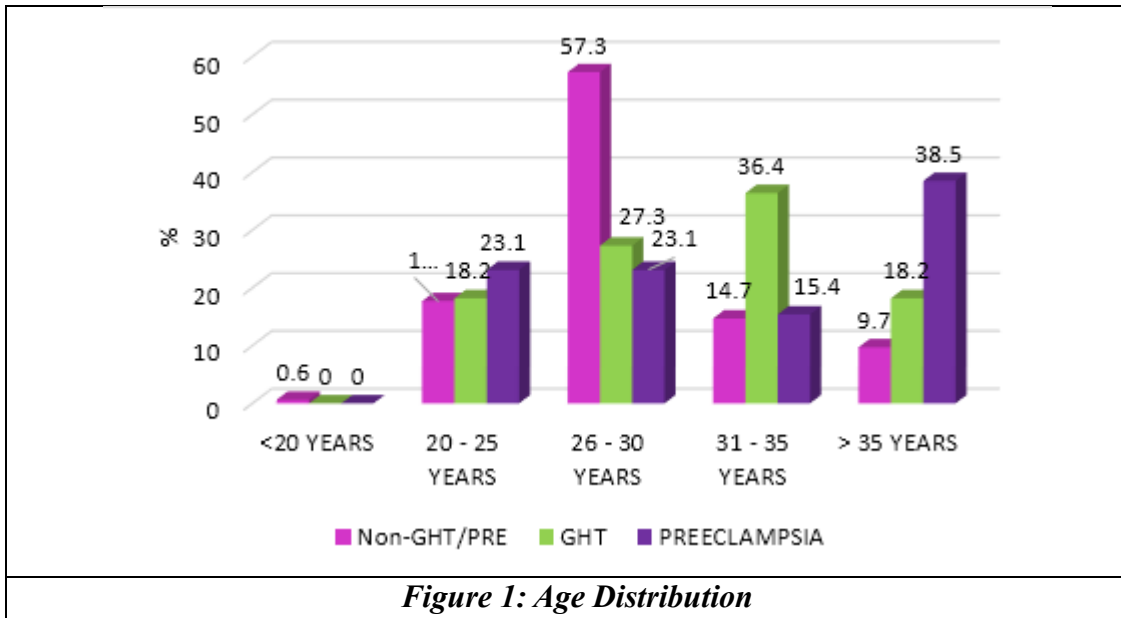
**Age Distribution**

Majority (55.7%) of study subjects belonged to 26-30 years age group. GHT was more common in the 31-35 years age group (36.4%), whereas preeclampsia was more common among > 35years age group (38.5%).The percentages of women with advanced maternal age were more among the cases than the rest of the study group. With P value of 0.002, advanced maternal age was observed to be a notable risk factor. The results are as depicted in Table 1 and figure 1

	<b>Non-GHT/PRE</b>	<b>GHT</b>	<b>Preeclampsia</b>	<b>Total</b>
<20 Years	4 (0.6%)	0	0	4 (0.6%)
20 - 25 Years	122 (17.7%)	4 (18.2%)	3 (23.1%)	129(17.8%)
26 - 30 Years	394 (57.3%)	6 (27.3%)	3(23.1%)	403(55.7%)
31 - 35 Years	101 (14.7%)	8 (36.4%)	2(15.4%)	111(15.4%)
> 35 Years	67 (9.7%)	4 (18.2%)	5(38.5%)	76(10.5%)
Total	688 (100.0%)	22(100.0%)	13(100.0%)	723(100.0%)

**Table 1: Age Distribution**

Chi-square Test- 24.196 P value: 0.002



### Present Prepregnancy BMI

As shown in Table 2 and Figure 2, among the GHT group 40.9% were overweight & 27.3% were obese while in the preeclampsia group 30.8% were overweight & 53.8% were obese.

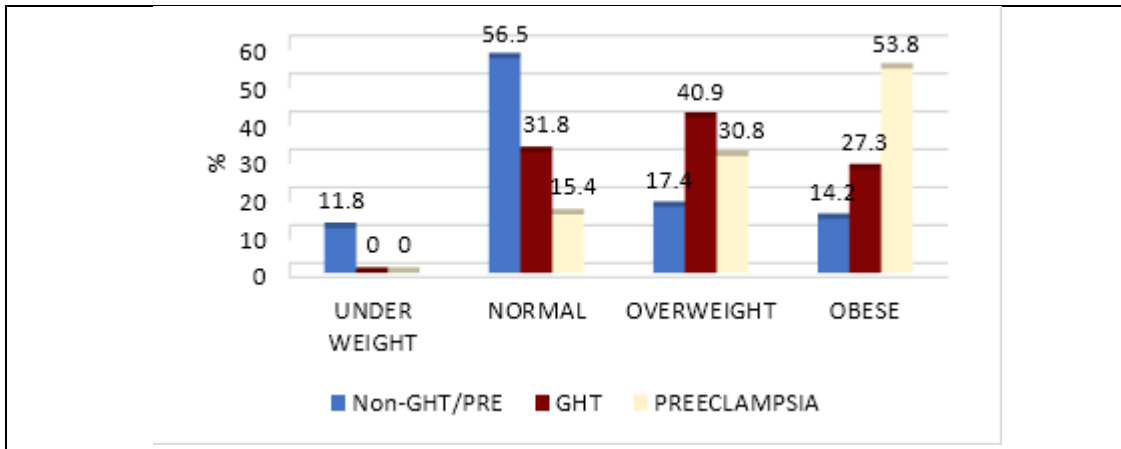
Among the non- GHT/preeclampsia group 56.5% were within normal BMI, 17.4% were overweight, 14.2% were obese.

Thus, the percentage of overweight & obese women were more among cases compared with the remaining multigravida with P value of 0.000, which has high statistical significance.

	Non-GHT/PRE	GHT	Preeclampsia	Total
Under Weight	81(11.8%)	0	0	81(11.2%)
Normal	389 (56.5%)	7 (31.8%)	2 (15.4%)	398(55%)
Overweight	120 (17.4%)	9 (40.9%)	4 (30.8%)	133(18.4%)
Obese	98(14.2%)	6 (27.3%)	7(53.8%)	111(15.4%)
Total	688(100.0%)	22(100.0%)	13(100.0%)	723(100.0%)

**Table 2: Present Prepregnancy Body Mass Index (BMI)**

Chi-square Test- 32.888 P value- 0.000



**Figure 2: Present Prepregnancy Body Mass Index (BMI)**

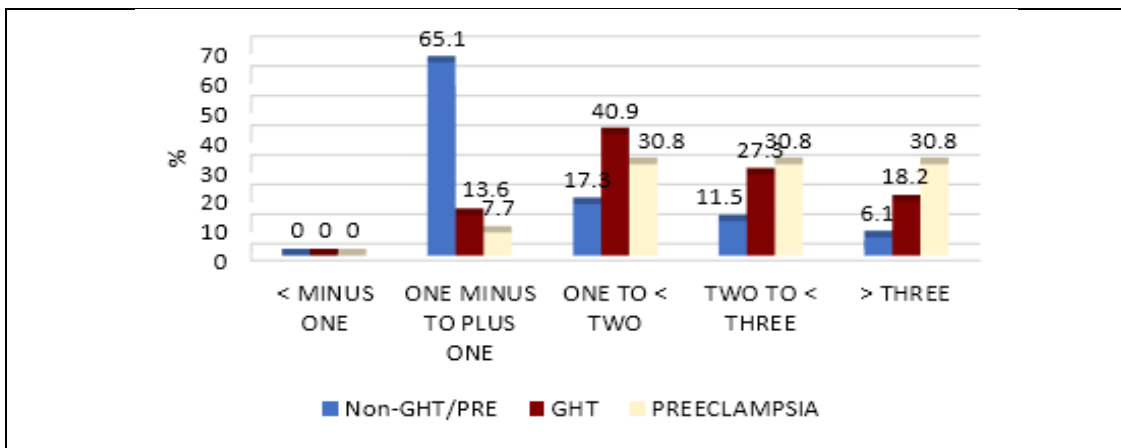
### Change in Prepregnancy BMI Between Previous & Present Pregnancy

In this study, majority of GHT (86.3%) & Preeclampsia (92.35%) were observed to have a change in BMI of more than 1 unit, whereas in the non- GHT/preeclampsia group only 34.9 % had change in BMI of more than 1 unit. This difference was found to be statistically significant (p value – 0.000) & hence considered to be an important risk factor. (Table 3 and Figure 3)

	Non-GHT/PRE	GHT	Preeclampsia	Total
< -1	0	0	0	0
-1 To 1	448 (65.1%)	3 (13.6%)	1(7.7%)	452(62.5%)
1 To < 2	119 (17.3%)	9 (40.9%)	4 (30.8%)	132(18.3%)
2 To < 3	79(11.5%)	6 (27.3%)	4(30.8%)	89(12.3%)
> 3	42(6.1%)	4 (18.2%)	4(30.8%)	50(6.9%)
Total	688(100.0%)	22(100.0%)	13(100.0%)	723(100.0%)

**Table 3: Change in prepregnancy BMI between previous & present pregnancy**

Chi-square TEST – 46.418 Pvalue - .000



**Figure 3: Change in prepregnancy BMI between previous & present pregnancy**



**Change of Partner**

The percentage of women with change of partner was 3.5% within non-GHT/Preeclampsia group & 7.7% within preeclampsia group & none in GHT group. The difference was not statistically significant.

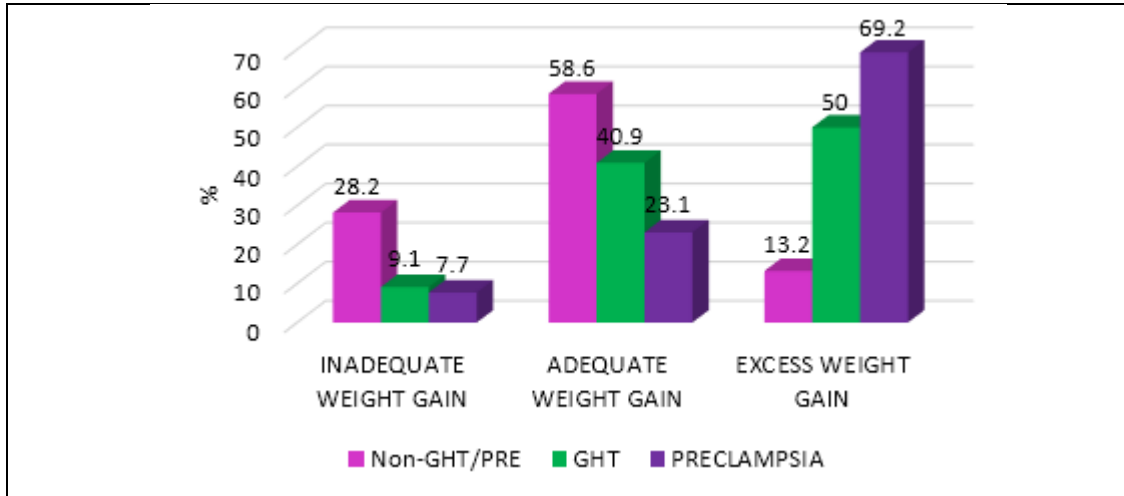
**Gestational Weight Gain**

As shown in Table 4 and Figure 4, in the present study, 50% of GHT patients & 69.2% of preeclampsia patients were observed to have excessive gestational weight gain according to BMI class, whereas in the non-GHT/ preeclampsia group only 13.2% had excessive gestational weight gain. This difference was found to be statistically significant (p value – 0.000) & hence considered to be an important risk factor.

	Non-GHT/PRE	GHT	Preclampsia	Total
Inadequate Weight Gain	194 (28.2%)	2(9.1%)	1 (7.7%)	197(27.2%)
Adequate Weight Gain	403(58.6%)	9 (40.9%)	3 (23.1%)	415(57.4%)
Excess Weight Gain	91(13.2%)	11(50%)	9(69.2%)	111(15.4%)
Total	688(100.0%)	22(100.0%)	13(100.0%)	723(100.0%)

**Table 4. Gestational weight gain**

Chi-square Test- 52.398 P value- 0.000



**Figure 4. Gestational weight gain**

**Previous Preterm Delivery**

Previous Preterm Delivery was more frequent among GHT/ preeclampsia (24.5%) than in non-GHT/ preeclampsia group (16.3%), but the difference was not found to be statistically significant (p – 0.663)

**Birth Interval between Previous & Present Pregnancy**

In this study, most of the multigravida has birth interval between 1-9 yrs. With the birth interval of > 10 yrs 4.5% of GHT & 5.1% of non-GHT/Preeclampsia were

present. P value not statistically significant & longer birth intervals not constitute a risk factor.

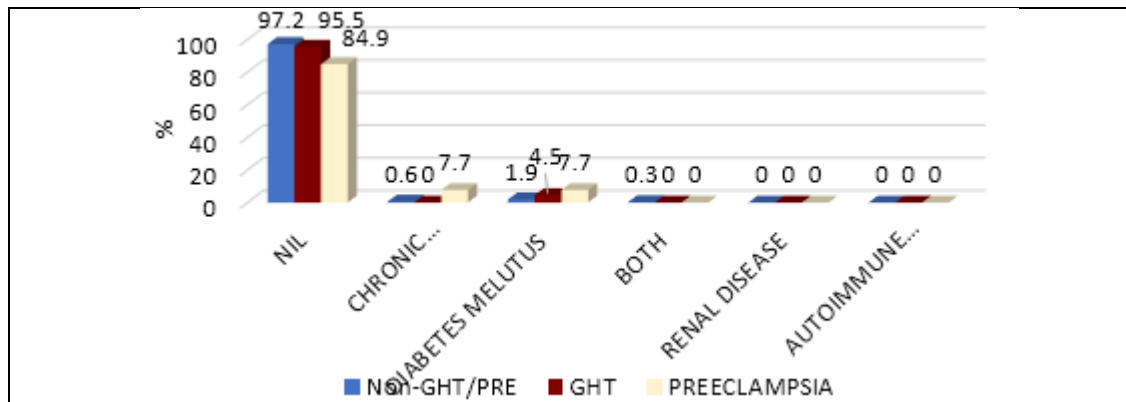
**Medical Complications with their Onset in the Interpregnancy Period**

In this study 4.5% of GHT patients had DM, 7.7% of preeclampsia patients had DM & chronic hypertension respectively, whereas in non GHT/preeclampsia only 0.6% had chronic hypertension, 1.9% had DM & 0.3% had both. This difference was statistically significant (P value- 0.05) and thus chronic hypertension & diabetes mellitus were observed to be an important risk factor for primary onset of GHT/preeclampsia in multigravida (Table 5 and Figure 5)

	Non-GHT/PRE	GHT	Preeclampsia	Total
Nil	669 (97.2%)	21 (95.5%)	11(84.9%)	701(97%)
Chronic Hypertension	4(0.6%)	0	1(7.7%)	5(5.7%)
Diabetes Melutus	13(1.9%)	1 (4.5%)	1(7.7%)	15(2.1%)
Both	2(0.3%)	0	0	2(0.3%)
Renal Disease	0	0	0	0
Autoimmune Disease	0	0	0	0
Total	688(100.0%)	22(100.0%)	13(100.0%)	723(100.0%)

**Table 5: Medical complications with their onset in the interpregnancy period**

Chisquare Test- 12.541 P value- 0.05



**Figure 5: Medical complications with their onset in the interpregnancy period**

**DISCUSSION**

The intention of this study was to observe the incidence of gestational hypertension/preeclampsia in multigravida with previous normal pregnancies & to evaluate the association between the risk factors, other than recurrence with GHT/preeclampsia among multigravida. Antenatal mothers with GHT/ preeclampsia in their previous pregnancy are most susceptible to develop preeclampsia in their

successive pregnancy,<sup>[2]</sup> but significant percentage of women develop preeclampsia without previous history. The incidence in the present study was comparable to that of other studies in literature, as shown in Table 6.

Study	Incidence Rate in Multigravida Preeclampsia	GHT	Incidence Rate of Hypertensive Disorders in Multi Gravida
Lill IS Trogstad & et al 2001	1.3%		
Mostell & et al 2002	2.5 %		
Rolv Skjaervan & et al 2002	1.3%		
Daris Getahum & et al 2007	2%		
Dorothea Mosttello & et al 2008	1.8%		
Renee Turzanski & et al 2009	3%	2%	5%
This study	1.8%	3%	4.8%

**Table 6. Incidence of Preeclampsia/GHT**

## Risk Factors Analysis

### 1) Advanced Maternal Age

There is a widespread recent tendency of shifting childbearing towards more advanced maternal age. According to Yariv Yogev & et al<sup>[7]</sup> & Cleary-Goldman J & et al<sup>[9]</sup> pregnancies at advanced maternal age were associated with increased rates of chronic maternal diseases and medical complications of pregnancy (GDM & PET) & foetal risk. The risk for pregnancy complication significantly increased even with modest increase in maternal age. Kale A & et al<sup>[10]</sup> concluded that women aged 45 years & above was not always related with adverse maternal & fetal outcome. In Mostello & et al<sup>[11]</sup> study, advanced maternal age showed no increased risk.<sup>[3]</sup>

In this study, among multigravida group with GHT/ preeclampsia, the percentage of women in the >35 yrs age group was 18.2% & 38.5% respectively, where as in the non-GHT/ Preeclampsia group was only 9.7%.

Consistent with the above studies, advanced maternal age was also observed to be a significant risk factor in this study.

### 2) Overweight & Obesity before Present Pregnancy

The occurrence of overweight & obesity has increased in our population in the last few decades creating an important public health issue.<sup>[12]</sup> Multiparous women are obese when compared to nulliparous women, as evidence suggest an increase of about 1 kg/ pregnancy.<sup>[13]</sup>

Renee et al<sup>[14]</sup> analyzed that obese woman had a 2-fold increased risk for hypertensive disorders. (95% CI 1.1-3.8). Mostella et al,<sup>[11]</sup> Sibai et al,<sup>[15]</sup> Meenakshi. T, Sahu<sup>[4]</sup> evaluated that high BMI & increase in BMI has been associated with an

increased risk of preeclampsia/ GHT. AK Mhah & et al<sup>[16]</sup> examined the association between the obesity subtypes & found the rate of preeclampsia increased with increasing BMI with super obese women having higher incidence (13.4%). Gaillard R & et al<sup>[17]</sup> study concluded that maternal obesity & morbid obesity are strongly associated blood pressure in each trimester & increased risks of gestational hypertensive disorders. Athukorala & et al<sup>[18]</sup> suggest that obese women are at increased risk of gestational diabetes, pregnancy induced hypertension & preeclampsia. Belogolovkin V & et al<sup>[19]</sup> found that women with low BMI in the first trimester were significantly less likely to develop gestational hypertension or preeclampsia than women with a normal BMI.

As shown in Table 7, the findings of the present study are in agreement with the previous investigators & support the fact that obese & overweight women are more likely to develop GHT/ Preeclampsia than women with normal BMI. The information on prepregnancy BMI was procured at first prenatal visit before the occurrence/ detection of outcome, hence its unlikely that it would be a source of bias though it's a self reported data.

Study	Renee & et al	Mostello & et al	Present Study
BMI	% of women with hypertensive disorders		
Obesity	27.9%	39.5%	37.1%
Over weight	14.4%	25.4%	37.1%
Normal weight	46%	31.5%	27.5%
Under weight	11.7%		
<b>Table 7: Present Pregnancy BMI</b>			

### 3) Change in Prepregnancy BMI between Pregnancies

Obesity related inflammatory mechanism, genetic susceptibility, immunological maladaptation & endothelial cell dysfunction in pregnancy are hypothesized as the primary etiology for preeclampsia.<sup>[2]</sup> Darios & Getahum et al<sup>[2]</sup> in their study inferred, dose dependent increase in preeclampsia risk between pregnancies when BMI increased from present category to next higher category. Mostello D & et al<sup>[11]</sup> concluded that interpregnancy weight reduction reduced the risk of preeclampsia in next pregnancy & should be encouraged.

Eduardo Villamor & et al<sup>[1]</sup> demonstrated that a modest increase in weight between pregnancy or shift from healthy to overweight category would be sufficient to increase the women's risk of serious adverse maternal & neonatal outcome during next pregnancy. Their result show that with change in BMI of more than 1 unit was associated with increased risk of GHT/ preeclampsia.<sup>[3]</sup>

In our study, 86.3% of GHT & 92.35% of preeclampsia had BMI change of more than 1 unit whereas 65.1% of non-GHT/ Preeclampsia had BMI change of -1 to 1, in concurrence with previous studies.

#### 4) Change of Partner

A change in paternity has impact on subsequent pregnancies for GHT/ preeclampsia is explained by the hypothesis that immune maladaptation is involved in the etiology.<sup>[5]</sup> Mostello & et al<sup>[3]</sup> & Daris Getahum<sup>[2]</sup> studies revealed a small protective effect of same paternity for subsequent pregnancy or a longer period of sexual cohabitation with the same father before a pregnancy may confer a protective effect on preeclampsia. Studies by Lill Is Trogstad<sup>[20]</sup> & Tubbergen & et al<sup>[21]</sup> show that for women with no previous preeclampsia. Change in paternity increased the risk of preeclampsia in second pregnancy. De-kun Li & et al<sup>[5]</sup> hypothesised that when a parous women changes partner, the protective effect offered by the previous pregnancies no longer exists; thus, her risk of preeclampsia in a pregnancy fathered by a new partner is higher than that of a women who remain with the same partner. Tolv Skjaervein & et al (2002)<sup>[22]</sup> conclude that after adjustment for interbirth interval, a change of partner was no longer associated with increased risk of preeclampsia.

In contrast to the findings of the above-mentioned studies, the current study showed no impact of the change in paternity. This may be due to the fact that, it is a population-based study with small sample size & the incidence of change in paternity is less among Indian couples.

#### 5) Gestational Weight Gain (GWG)

Ranee Turzanski & et al<sup>[14]</sup> showed 4 fold increased risk of hypertensive disorders in those with excessive weight gain in contrast to women with adequate weight gain. AK Mbah & et al<sup>[16]</sup> observed that in the category of obese women, incidence of preeclampsia was 28% with low weight gain to more than fourfold increase in woman with high weight gain. Deborah W Kiel et al<sup>[23]</sup> observed that limited or no weight gain in obese woman has favorable pregnancy outcomes. In line with previous study findings, the present study also showed an association between gestational weight gain & the incremental increase in the incidence of preeclampsia. In this study 50% of GHT patients & 69.2% of preeclampsia had excessive weight gain concurring with earlier studies.

#### 6) Previous Preterm Birth

Preeclampsia & preterm delivery have been shown to share elements of a common pathophysiology & a significant overlap is therefore feasible among groups at risk for either preeclampsia or preterm delivery.<sup>[6]</sup> Mostella & et al (2008)<sup>[11]</sup> imply that earlier gestational age at first delivery & increasing BMI progressively increase the risk of subsequent preeclampsia in women both with & without prior preeclampsia, although the magnitude of absolute risk was markedly higher in those with prior preeclampsia. Bhattacharya S & et al<sup>[24]</sup> also showed that only previous deliveries beyond 37 weeks, irrespective of outcome were protective against preeclampsia in the second pregnancy.

Contrary to the observations of previous studies, this study showed no significant association between gestational age at first delivery & GHT/ preeclampsia risk in the subsequent pregnancy probably due to small sample size.

### 7) Longer Birth Interval

Lill Is Trogstad & et al<sup>[20]</sup> study for women with no previous preeclampsia the risk of preeclampsia in the second pregnancy increases with increase in time interval (for interval longer than 15yrs the adjusted OR was 2.11, 95% CI- 1.75-2.53). According to Rolv Skjaerven & et al<sup>[21]</sup> the risk in the second & third pregnancy was directly related to the time that had elapsed since the preceding delivery, when the interbirth interval was 10yrs or more, the risk approximated that of any nulliparous women.

Not concurring with the previous studies, this study showed that longer birth interval is not a significant risk factor.

### 8) Medical Complications with Onset in the Interpregnancy Period

Women with gestational as well as preexisting diabetes are at increased risk of gestational hypertension & preeclampsia. Mostello & et al<sup>[3]</sup> showed that history of chronic HT, DM & renal disease was associated with increased risk of preeclampsia.

	Mostello & et al	This study
Medical complications	Cases, n-2332 No. %	Cases, n- 35 No. %
Chronic HT	81 3.5%	1 2.8%
DM	133 5.7%	2 5.7%
Renal disease	21 0.9%	

**Table 8: complications with onset in the inter pregnancy period**

As shown in Table 8, Concurring with the previous studies, this study also showed that chronic HT, diabetes mellitus and renal disease with their onset in the inter pregnancy period is associated with increased risk of GHT/ preeclampsia.

This study has its limitations. This study was limited to singleton births because multiple births may have different etiological pathway for preeclampsia. The effect of all the risk variables on the association noted merits some discussion. Weight gain in pregnancy could have an impact on outcome independent of prepregnancy BMI. Medical complications could have a dual effect as they were associated with both the exposure (high BMI) & outcome of interest (preeclampsia), can be regarded as confounders. The time interval between pregnancies could express the impact of increase in maternal age, a well-known risk factor of preeclampsia. The preterm delivery may obscure the effect of SGA birth as a risk factor.

Many covariates act synergistically to amplify the risk of preeclampsia. In this study each covariate has been examined independently & each risk factor not adjusted for the confounding effect of other risk factors, for which further randomized controlled trials are needed.

## CONCLUSION

This study infers that there is a significant association between- high prepregnancy BMI (overweight/ obesity), change in prepregnancy BMI between pregnancies (of more than 1 unit), advanced maternal age (>35yrs), excessive gestational weight gain in pregnancy according to BMI, chronic hypertension, diabetes mellitus prior to present pregnancy with their onset in the interpregnancy period, with gestational HT/ preeclampsia in the index pregnancy among parous women with previous normal pregnancies. Timely identification of these risk factors may help in mitigating the occurrence of gestational HT/ preeclampsia.

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