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Original Research Article

The association of pre-pregnancy body mass index and risk of pre-eclampsia

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ABSTRACT

Background: Preeclampsia is a pregnancy-related condition characterized by new-onset hypertension and proteinuria. Preeclampsia is responsible for 20% to 80% of mortality among pregnant in developing countries. Preeclampsia may cause prematurity and fetal growth restriction. It is the most serious complication affecting 2-8% of all pregnancies. The mortality and morbidity rates among the babies of pre-eclampsia mothers is five times higher than that among babies born to healthy mothers. Objective: To find the association between pre-pregnancy Body Mass Index (BMI) and gestational weight gain with incidence of pre-eclampsia.
Methods: Cross sectional Observational study was conducted among 140 cases. The study was conducted after obtaining approval from the ethics committee.
Results: In this study, in 27.9% of cases overweight, and in 12.1% of cases obesity were seen. In 60.7% of cases severe preeclampsia, and 39.3% of cases mild preeclampsia was reported. Preeclampsia had no significant association with age, marital life, parity, but had a significant association with liquor, birth weight, and NICU admission.
Conclusions: Pre pregnancy weight and Gestational weight gain were associated with high risk of preeclampsia.

Keywords: Preeclampsia, BMI, Pre pregnancy weight, and Gestational weight gain

INTRODUCTION

Preeclampsia (PE) is defined as the development of hypertension and proteinuria after 20 weeks of gestation.1 Preeclampsia is a grave complication of pregnancy that affects 2-8% of total pregnancies.[1] Nearly 2.9 million mothers die per year worldwide due to causes related to pregnancy, with preeclampsia accounting for 10-15% of these deaths.[2] Nulliparity, increased maternal age, overweight/obesity, chronic hypertension, diabetes, previous preeclampsia, family history of preeclampsia, and multiple pregnancies are all considered risk factors for pre-eclampsia.[3] Obesity is linked to 2-4 times more chance of preeclampsia in different communities and is the most common identified attributable risk factor for this disorder.[4-8]

Preeclampsia can cause growth restriction of fetus and prematurity.[9,10] The mortality rate is five times more for babies born to preeclamptic mothers than babies born to healthy mothers.[11] In intensive care unit admissions due to obstetric hemorrhage, preeclampsia is the second leading cause.[12] Cardiovascular diseases can develop in later life in the mothers who had preeclampsia earlier.[13,14] Recognizing the importance of preeclampsia, both prevention and management of preeclampsia during pregnancy is essential to reduce maternal mortality.[15]

Objectives

To determine the association between pre-pregnancy body mass index (BMI) and gestational weight gain with pre-eclampsia.

METHODS

It was a cross sectional observational study conducted at RL Jalappa Hospital, Tamaka, Kolar from June 2022 to December 2022. Total number of study cases were 140.

Sample size was calculated using formula:

$$\frac{z^2_{1-\frac{\alpha}{2}} p(1-p)}{d^2}$$

P = prevalence (from Duckitt et al.[3])

d = Absolute error 5%, z = 1.96.

Using the above formula, the required sample size was 128. It was rounded to 140.

Inclusion criteria

Women with singleton pregnancies. Age more than 18-35 years**.** Participants with confirmed diagnosis of pre-eclampsia.

Exclusion criteria

Women with history of chronic hypertension, cardiac disorders, renal disorders and cases without BMI data.

Procedure

Participants were enrolled in the RLJH OPD of the OBGY department. A pretested semi-structured questionnaire was used to collect the data. From pregnancy records relevant information such as age, parity, pre pregnancy weight, weight gain, BMI, blood pressure (BP) was recorded. Pre pregnancy weight was recorded on the first ante natal visit. For BMI, WHO classification was used.[16] Preeclampsia was defined as hypertension on two separate BP recordings (≥140/90 mmHg) at least 6 hours apart and proteinuria of ≥1+ or ≥300 mg of protein in a 24 hours urine sample after 20 weeks of gestation.[16] Preeclampsia was divided into mild preeclampsia and severe preeclampsia.[16] Mild PE was defined as blood pressure of ≥140/90 to <160/110 mmHg and proteinuria of ≥1+ to <2+.[16] Severe PE was defined as blood pressure of ≥160/110 mmHg and proteinuria of ≥2+.[16]

Ethical approval

After obtaining written informed consent, and study was conducted with the approval from institutional ethics committee with a number (DMC/KLR/IEC/596/2022-23).

Statistical analysis

Data was entered into Microsoft excel data sheet and was analysed using SPSS version 25. Categorical data was represented in the form of frequencies and proportions. Chi-square test or Fischer's exact test, and independent t test was used as test of significance. P value <0.05 was considered as significant.

RESULTS

In this study, 27.9% of cases overweight, and 12.1% of cases obese were seen (Table 1). Most cases had severe preeclampsia (60.7%), and 39.3% of cases had mild preeclampsia (Figure 1).

Table 1: Pre pregnant BMI.

BMI	Frequency	Percentage
Under	8	5.7
Normal	76	54.3
Overweight	39	27.9
Obese	17	12.1
Total	140	100.0

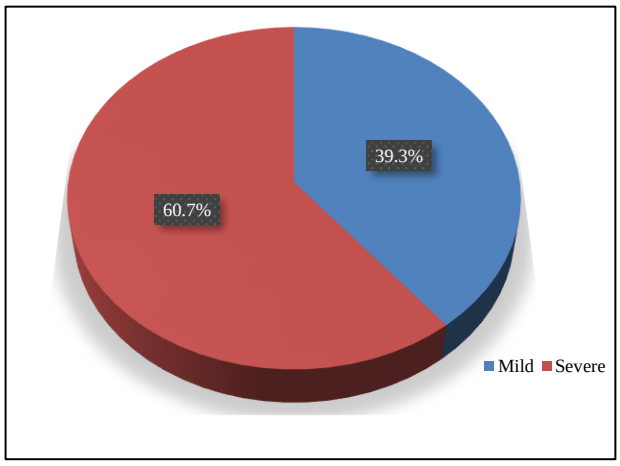

Figure 1: Severity of preeclampsia.

Table 2: Association between age group and preeclampsia.

Age distribution	Mild PE		Severe PE	
	N	%	N	%
<20 years	14	48.3%	15	51.7%
21-25 years	16	32.7%	33	67.3%
26-30 years	16	44.4%	20	55.6%
>30 years	9	34.6%	17	65.4%

Severe preeclampsia was seen in 51.7% of cases of <20 years, followed by 21-25 years (67.3%), 26-30 years (55.6%), >30 years (65.4%) (Table 2). Preeclampsia had no statistically significant association with parity, consanguineous marriage, and booking status (Table 3). Preeclampsia had a statistically significant association with liquor, but not with mode of onset, and mode of delivery (Table 4).

Severe preeclampsia was seen in 50% cases of underweight, followed by normal BMI (59.2%),

overweight (53.8%), and obese (88.2%) group (Table 5). Severe preeclampsia was seen in 56.2% of inadequate weight gain cases, followed by adequate weight gain (66.1%), excess weight gain (62.5%) (Figure 2).

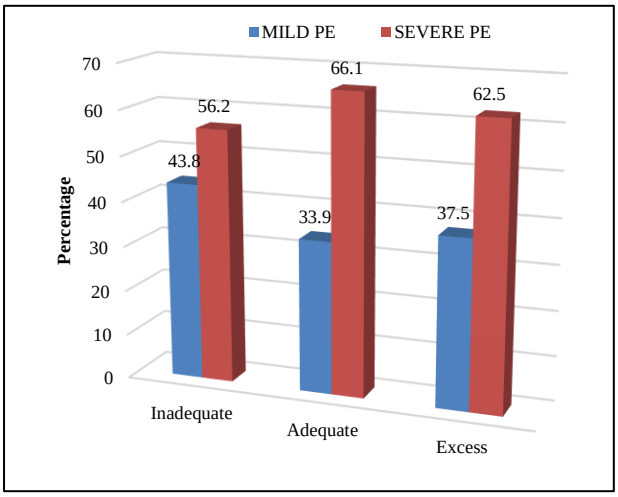

Figure 2: Weight gain and preeclampsia.

Table 3: Parity, booked/unbooked, consanguineous marriage and Preeclampsia.

	Mild PE		Severe PE		P value
	N	%	N	%	
Parity					
Primi	24	35.8	43	64.2	0.489
Multi	31	42.5	42	57.5	
Booked pregnancy					
Yes	21	50.0	21	50.0	0.094
No	34	34.7	64	65.3	
Consanguineous marriage					
Yes	16	57.1	12	42.9	0.050
No	39	34.8	73	65.2	

Table 4: Mode of delivery, onset, liquor and preeclampsia.

	Mild PE		Severe PE		P value
	N	%	N	%	
Mode of delivery					
LSCS	30	39.5	46	60.5	1.00
Vaginal	25	39.1	39	60.9	
Induced					
No	39	41.5	55	58.5	0.468
Yes	16	34.8	30	65.2	
Liquor					
Blood stained	0	0	9	100.0	0.044
Clear	41	41.8	57	58.2	
Meconium stained	14	42.4	19	57.6	

Statistically significant association was found (p value <0.001) between onset of preeclampsia and severity of preeclampsia (Figure 3).

Preeclampsia had statistically significant association with birth weight, and NICU admission (Table 6), but statistically significant difference was not found with age and marital life (Table 7).

Table 5: Pre pregnant BMI and preeclampsia.

BMI	Mild PE		Severe PE	
	N	%	N	%
Under	4	50.0	4	50.0
Normal	31	40.8	45	59.2
Overweight	18	46.2	21	53.8
Obese	2	11.8	15	88.2

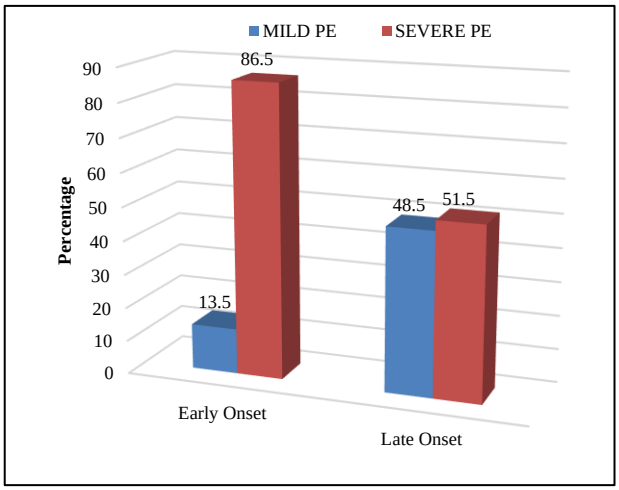

Figure 3: Onset of preeclampsia and severity of preeclampsia.

Table 6: Birth weight, NICU admission and preeclampsia.

	Mild PE		Severe PE		P value
	N	%	N	%	
Birth weight (kg)					
<1.5	2	9.1	20	90.9	<0.001
1.5-2.5	12	23.5	39	76.5	
>2.5	41	61.2	26	38.8	
NICU admission					
No	40	63.5	23	36.5	<0.001
Yes	14	25.0	42	75.0	
IUD	1	4.8	20	95.2	

Table 7: Comparison of mean age, married life according to preeclampsia.

	Mild PE		Severe PE		P value
	Mean	SD	Mean	SD	
Age (in years)	25	5.1	26	5.3	0.371
Marital life (years)	3	0.2	3	0.3	0.871

DISCUSSION

Age distribution

In this study, among <20 years age, 29% of cases were seen, among 21-25 years, 49% of cases were seen, among 26-30 years, 46% of cases, and in >30 years, 26% of cases were seen.

In the study by Shao et al, among <25 years, 37.8% of cases, in 25-29 years, 14.9% of cases, and in ≥30 years, 47.3% of cases were seen.[16] Different age distributions were mentioned by Roberts et al, and Duckitt et al.[3,11]

Parity

In the present study, multi para was seen in 67% of cases, while it was higher than Shao et al. study (34.1%).[16] Primi para was seen in 33% of cases of the present study, which was lesser than Shao et al study (65.9%).[16]

Pre pregnancy weight

Pre pregnancy underweight was seen in 8% of cases, while it was lesser than Shao et al study (13.3%).[16] Pre pregnancy normal weight was seen in 76% of cases, while it was higher than Shao et al study (63.7%).[16] Pre pregnancy overweight and obese was seen in 17% of cases, while it was lesser than Shao et al study (23.1%).[16]

Weight gain

In the present study, inadequate weight gain was seen in 73% of cases, which was higher than Shao et al study (9.5%).[16] Adequate weight gain was seen in 59% of cases, which was higher than Shao et al study (17.9%).[16] Excess weight gain was seen in 8% of cases, which was lesser than Shao et al study (72.6%).[16]

Severity of pre pregnant BMI

In this study, 54.3% of cases had normal BMI, which was lesser than Shao et al (63.7%).[16] In this study, 40% of cases were obese and overweight, which was higher than study by Shao et al (23.1%).[16]

Distribution of severity of preeclampsia

In the present study, majority had severe preeclampsia (60.7%), which was similar to Shao et al (59.4%), and 39.3% of cases had mild preeclampsia, which was similar to Shao et al (40.6%).[16]

Age distribution and preeclampsia

Of the <20 years aged, 48.3% of cases had mild PE, and 51.7% of cases had severe PE. Among 21-25 years aged, 67.3% of cases had severe PE, and 32.7% of cases had mild PE. In 26-30 years aged, 55.6% of cases had severe PE, and 44.4% of cases had mild PE. Among >30 years aged, 65.4% of cases had severe PE, and 34.6% of cases had mild PE. Statistically significant association was not found between age distribution and preeclampsia (p value 0.471).

Pre pregnant BMI and preeclampsia

Of the underweight cases, 50% of cases had mild PE, which was in accordance with Shao et al study (52.2%).[16] Of the underweight cases, 50% of cases had severe PE, which was in accordance with Shao et al study (47.8%).[16]

In the present study, among normal BMI cases, 40.8% of cases had mild PE, which was similar to Shao et al study (38.9%), but higher than El-Makhzangy et al (4%).[16,17] Among normal BMI cases, 59.2% of cases had severe PE which was similar to Shao et al study (61.1%).[16]

In the present study, it was observed that with increased BMI, there is higher risk of pre-eclampsia, which was similar to the findings of Shao et al study, Wei et al, Tsai et al, Liu et al, and Chen et al.[16,18-21]

Pre pregnant weight and preeclampsia

In the present study, in overweight and obese cases, mild PE was noticed in 35.7% of cases which was similar to Shao et al study (38.8%).[16] In overweight and obese cases, severe PE was mentioned in 64.3% of cases which was similar to Shao et al study (61.3%).[16] No statistically significant association was found between pre pregnant BMI and severity of preeclampsia (p value 0.085).

Weight gain and preeclampsia

Among inadequate weight gain cases, 43.8% of cases had mild PE, which was higher than Shao et al study (33.3%).[16] Of the inadequate weight gain cases, 56.2% of cases had severe PE, which was lesser than Shao et al study (64.5%).[16] Among adequate weight gain cases, 33.9% of cases had mild PE, which was similar to Shao et al study (35.5%).[16] Of the adequate weight gain cases, 66.1% of cases had severe PE, which was similar to Shao et al study (64.5%).[16]

Among excess weight gain cases, 37.5% of cases had mild PE, which was similar to Shao et al study (42.9%).[16] Among excess weight gain cases, 62.5% of cases had severe PE, which was similar to Shao et al study (57.1%).[16] No statistically significant association found between Weight gain and preeclampsia.

In this study, it was observed that excessive weight gain was associated with pre-eclampsia, which was similar to studies by Shao et al, Baker et al, Swank et al, Truong et al, DeVader et al.[16,22-25]

Preeclampsia had no statistically significant association with age, marital life, parity, consanguineous marriage, booking status, mode of onset, and mode of delivery.

Preeclampsia had a statistically significant association with liquor, birth weight, and NICU admission. No statistically significant association was found between pre pregnant BMI and severity of preeclampsia. A statistically significant association was found between onset of preeclampsia and severity of preeclampsia.

Strength of study

Monitoring of pre-pregnancy weight and weight gain during pregnancy helps to identify the mothers at risk for early onset preeclampsia, and its management prevents IUGR and neonatal morbidity.

There were also limitations of study. This was a single institutional based study conducted at a tertiary health care center therefore the burden of the disease in a peripheral health care centers have not been taken into consideration.

CONCLUSION

From this study it was concluded that pre pregnancy weight and, gestational weight gain were associated with high risk of preeclampsia. Preeclampsia had statistically significant association with birth weight, and NICU admission. There is paucity of studies in this topic, hence more studies should be conducted for better prevention and management for preeclampsia in relation to BMI.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee number (DMC/KLR/IEC/596/2022-23)

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