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Original Article

Comparative Study on the Effect of Pre-pregnant Body Mass Index on the Occurrence of Preeclampsia in a Tertiary Health-care Setup

S Kokila, R Radha

Assistant Professor, Department of Obstetrics and Gynaecology, Madurai Medical College, Madurai, Tamil Nadu, India

Abstract

Introduction: Association between maternal body mass index (BMI) and preeclampsia had been established by many a foreign study. A high number of maternal deaths in low-income countries is due to preeclampsia; therefore, both prevention of preeclampsia is exteremely important to bring down maternal mortality. Hence, we decided to find out the association between pre-pregnancy BMI and preeclampsia in our study.

Aim: The aim of the study was to compare the BMI between normotensive and preeclamptic women and to correlate it to occurrence of preeclampsia.

Materials and Methods: This was a case–control study conducted in the Department of Obstetrics and Gynecology, Government Kilpauk Medical College and Hospital, Chennai, Tamil Nadu, India. A total of 60 age-matched pregnant women were enrolled for the study. Out of the 60 women, 30 normal healthy pregnant women formed the control group, while another 30 preeclamptic patients formed the case group. All the patients underwent detailed history taking and clinical examination. Pre-pregnancy weight was self-reported during the first prenatal care visit. Calculation of BMI was done using Quetelet index formula, BMI was calculated as weight (kg) divided by the square of height (m), that is, BMI = Weight (kg)/Height (m^2).

Results: Mean BMI for preeclamptic women is 24.7 while that of normotensive women is 21, t-test for equality for means was 7.371, $P = 0.000$. Hence, BMI is statistically significant between two groups.

Conclusion: Increased BMI was seen in preeclamptic women, while BMI was less is normotensive women on comparison. Maintenance of pre-pregnant BMI in the lower normal values would help a long way in preventing preeclampsia.

Key words: Normotensive pregnancy, Preeclampsia, Pre-pregnancy body mass index

INTRODUCTION

Preeclampsia is a serious complication affecting 2–8% of all pregnancies. Globally, more than 287,000 women die each year due to pregnancy related causes,[1] of which 10–15% are estimated to be due to preeclampsia. The etiology of preeclampsia remains unclear, but mechanisms related to the placenta, genes, immune response, insulin resistance, and maternal vascular disease are suggested to contribute.[2-5] Established risk factors for preeclampsia include nulliparity, advanced maternal age, overweight/obesity, chronic hypertension, diabetes, previous preeclampsia, family history of preeclampsia, long time since previous pregnancy, and multiple pregnancy.[6] Obesity has been associated with a 2–4-fold increased risk of preeclampsia in different populations and is a leading identified attributable risk for this disorder. The risk of preeclampsia has been shown to increase with an increasing body mass index (BMI), with the lowest prevalence among underweight women.[7-12]

Researchers believe that preeclampsia is a multifactorial disease and propose several risk factors for it, including a history of preeclampsia, low and high maternal age, diabetes, chronic hypertension, null parity, birth intervals, history of abortion, high BMI value, twin pregnancy, fetal sex, migraine, and maternal RH.[6,13-15]

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Corresponding Author: Dr. R Radha, Department of Obstetrics and Gynaecology, Madurai Medical College, Madurai, Tamil Nadu, India.

Some studies have referred to obesity as a risk factor for preeclampsia and showed that the relationship between maternal weight and preeclampsia is a progressive risk and varies from 4.3% in women with a BMI <19.8 Kg/m^2, up to 13.3% for women with a BMI ≥35 kg/m^2.[16]

High BMI is an important risk factor for both preeclampsia[17,18] and cardiovascular disease[19,20] Obesity prevalence is increasing at an alarming rate in both high- and low-income countries.[21]

Maternal obesity and insulin resistance are believed to be important risk factors for the development of placental endothelial dysfunction and preeclampsia.[22,23] Because an elevated BMI (BMI; weight [kg] per height squared [m^2]) is a major component of dysmetabolic syndrome, as well as an important risk factor for preeclampsia and other complications of pregnancy,[7] a more precise estimate of the association between maternal pre-pregnancy BMI and preeclampsia is needed.

Aims and Objectives

The aim of the study was to compare the BMI between normotensive and preeclamptic women and correlate it to occurrence of preeclampsia.

MATERIALS AND METHODS

This was a case–control study carried out in the Department of Obstetrics and Gynecology, Government Kilpauk Medical College and Hospital, Chennai, Tamil Nadu, India, after obtaining approval from the Institutional Ethics Committee. A total of 60 age-matched pregnant women were enrolled for the study. Out of the 60 women, 30 normal healthy pregnant women formed the control group, while another 30 preeclamptic patients formed the case group. All the patients underwent detailed history taking and clinical examination.

BMI: Pre-pregnancy weight was self-reported during the first prenatal care visit. Calculation of BMI was done using Quetelet index formula, BMI was calculated as weight (kg) divided by the square of height (m), that is, BMI = Weight (kg)/Height (m^2). Measurement of height: Using stadiometer height was measured in all individuals in meters. Measurement of weight: Using standard spring type weighing scale, weight was measured in all subjects in kilograms.

Inclusion Criteria

Cases

Cases include

The following criteria were included in the study:

1. Pregnant women with BP ≥140/90 mmHg (previously normotensive women) on at least two occasions 6 h apart
2. Gestational age 28–40 weeks (sure of gestational age by last menstrual period or ultrasonography in the 1st or early 2nd trimester).

Controls

Controls include healthy pregnant normotensive women of gestational age of 28–40 weeks.

Exclusion Criteria

Subjects with the following diseases or disorders were excluded from the study: Chronic hypertension, gestational diabetes mellitus type 1 and 2 diabetes mellitus, connective tissue disorders, multiple pregnancy, liver diseases, severe anemia, smoking, obesity, and pregnancy with antiphospholipid syndrome.

OBSERVATION AND RESULTS

As shown in Table 1, among preeclamptic women, in the age group up to 25 years, there were 6 women and, above 26 years, there were 24 women. Among normotensive women, up to 25 years, there were 8 women and, above 26 years, there were 22 women. This is depicted in Figure 1. As shown in Table 2, Pearson Chi-square value 0.373, P = 0.542. Hence, maternal age is not statistically significant. Normotensive and preeclampsia subjects are, therefore, matched by maternal age.

As shown in Table 3, mean BMI for preeclamptic women is 24.7 and that of normotensive women is 21, this is depicted in Figure 2, t-test for equality for means 7.371, P = 0.000. Hence, BMI is statistically significant between two groups.

Table 1: Age matching of cases and controls

			PREECLAMPSIA		
			NO	YES	Total
AGE GROUP	UP TO 25 YEARS	Count	8	6	14
		% within PREECLAMPSIA	26.7%	20.0%	23.3%
		% of Total	13.3%	10.0%	23.3%
	26 YEARS & ABOVE	Count	22	24	46
		% within PREECLAMPSIA	73.3%	80.0%	76.7%
		% of Total	36.7%	40.0%	76.7%
	Total	Count	30	30	60
		% within PREECLAMPSIA	100.0%	100.0%	100.0%
		% of Total	50.0%	50.0%	100.0%

Table 2: Chi-square test – age matching

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.373[a]	1	.542		
Continuity Correction[b]	.093	1	.760		
Likelihood Ratio	.374	1	.541		
Fisher's Exact Test				.761	.381
Linear-by-Linear Association	.366	1	.545		
No of Valid Cases	60				

Table 3: Mean body mass index of cases and controls

	PRE ECL AMP SIA	N	Mean	Std. Deviation	Std. Error Mean	P
PRE PREG BMI	YES	30	24.713	2.4710	.4511	
	NO	30	21.020	1.1941	.2180	0.000

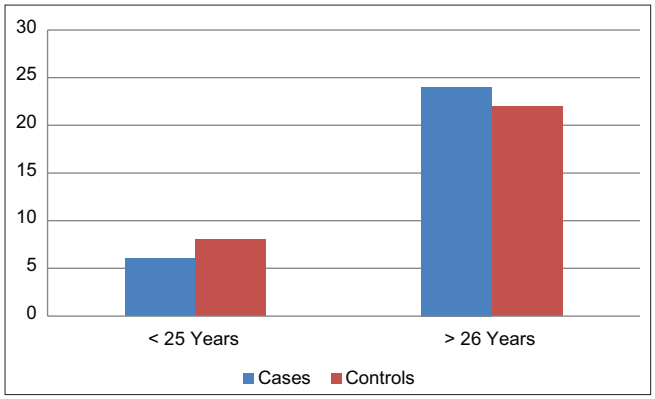

Figure 1: Age matching of cases and controls

As shown in Table 4 and in Figure 3, the area under the receiver operating characteristic curve is 0.918889, $P < 0.0001$. Hence, BMI is a statistically significant variable to predict preeclampsia.

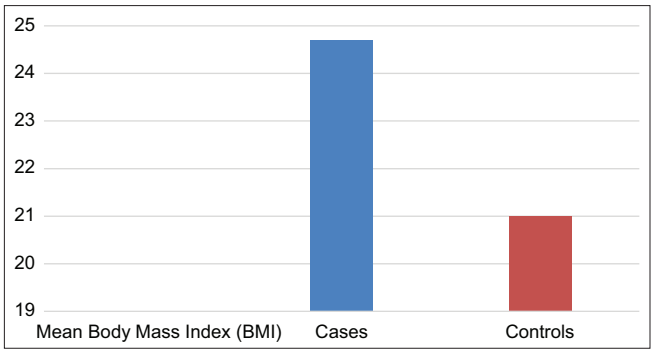

Figure 2: Mean body mass index of cases and controls

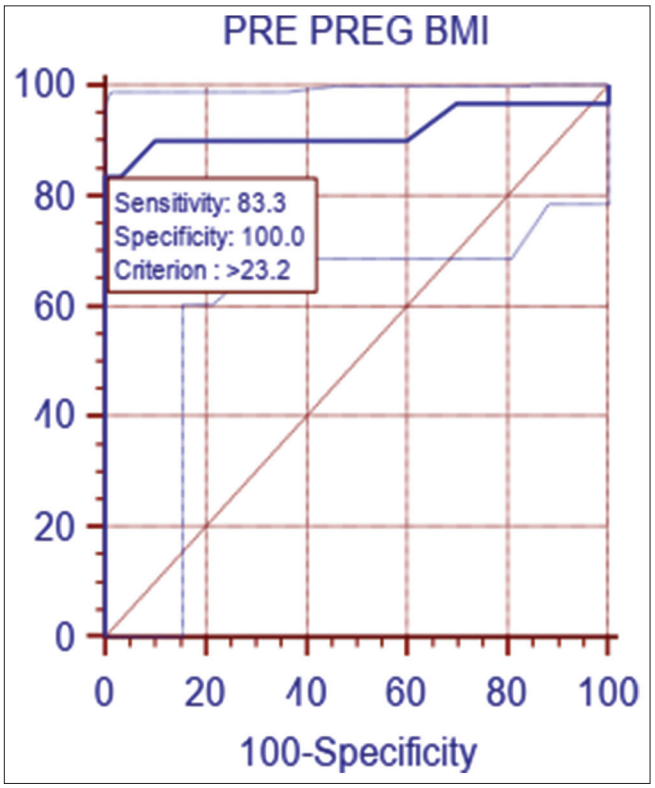

Figure 3: Receiver operating characteristic curve for mean body mass index in relation to preeclampsia

DISCUSSION

Obesity increases the risk of all "forms" of preeclampsia. Thus, the risk of severe and mild preeclampsia[18] and preeclampsia occurring in the early and late gestation[24] is greater in obese and overweight women. The relationship that obesity increases the risk of preeclampsia has been reported for several populations around the world indicating that this is not a phenomenon limited to western societies[25-27] It is also evident that this relationship is not limited to obese and overweight women, because increases in BMI in the normal range are also associated with an increased risk of preeclampsia.[10] The likelihood suggested by this, that fat mass is important, is supported by findings that weight loss reduces preeclampsia risk.[28,29]

Table 4: Area under the receiver operating characteristic curve

Variable		PRE_PREG_BMI PRE PREG BMI
Classification variable		PREECLAMPSIA
Sample size		60
Positive group :	PREECLAMPSIA = 1	30
Negative group :	PREECLAMPSIA = 0	30
Disease prevalence (%)	unknown	
Area under the ROC curve (AUC)		
Area under the ROC curve (AUC)	0.918889	
Standard Error[a]	0.0437	
95% Confidence interval[b]	0.819016 to 0.973660	
z statistic	9.588	
Significance level P (Area=0.5)	<0.0001	
Youden index		
Youden index J	0.8333	
Associated criterion	>23.2	

In our study, 60 patients were included after fulfilling the inclusion and exclusion criteria. Thirty patients had preeclampsia and 30 patients had normal pregnancy. The average gestational age of preeclamptic women was 36.03 weeks and normal pregnant was 35.70 weeks. There was no statistical difference in the gestational age in both the groups. In our study, we found out that BMI of normotensive pregnant individuals was 21 while that of preeclamptic women was 24.7. This difference is found to be statistically significant. Our findings were similar to a study done by Shao *et al.*[30] which also revealed that preeclampsia was more common in individuals with higher pre-pregnancy BMI.

A study done by AbdAllah *et al.*[31] also showed that the incidence of preeclamptic toxemia was higher in cases of raised levels of BMI which is similar to our findings that higher BMI had more risk of preeclampsia.

In a nationwide Swedish study by Sohlberg *et al.*,[32] similar to our findings, there was evidence to find an association between a high BMI and preeclampsia of all severities, but especially with the milder forms of preeclampsia. Nonetheless, the association between a high BMI and preeclampsia was established.

CONCLUSION

Our results were consistent with findings of many such previous studies. We conclude that higher pre-pregnant BMI, even though in the higher normal level, is a major risk factor for development of preeclampsia. Maintaining a lower normal pre-pregnant BMI would go a long way in preventing occurrence of preeclampsia. However, the sample size is small. Hence, our findings recommend an elaborate study with a large study population in the future.

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