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To Find the Association Between Clinical and Demographic Risk Factors and Development of Pre-Eclampsia

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Abstract

Background: Hypertensive disorders of pregnancy are an important cause of maternal and perinatal morbidity and mortality in developing countries like India. It is one of the leading causes of maternal and perinatal mortality and morbidity worldwide.

Aims: The current study will study a wide range of maternal demographic, socio- economic, obstetric, nutritional, and anthropometric parameters risk factors for pre- eclampsia in a tertiary hospital and assess their level of association so as to find the best predictors of pre-eclampsia.

Methods and materials: This retrospective study done in Department of Obstetrics & Gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, New Delhi, for period of one years. In the present study, we analyzed forty-three clinico-demographic risk factors of preeclampsia and a significant association was found with twenty-nine of these. The present study found seven independent predictors of preeclampsia - mental stress (PSS), maternal hypothyroidism, family history of preeclampsia, previous history of hypertension disorder in previous pregnancy, gestational diabetes mellitus, non-veg food habit and autoimmune disorder. A risk factor-based prediction model and scoring system developed using the independent predictors has high sensitivity and specificity for preeclampsia risk prediction in a heavy antenatal OPD in resource constraint government hospitals.

Results- Risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years. Multigravida, longer duration of cohabitation (years) has lower risk of pre-eclampsia. Period of gestation (weeks) in cases, season of conception and the month of preeclampsia in pregnant women and sex of baby has no significant association with preeclampsia. Women with longer inter pregnancy interval (years), who conceived with ART, high BMI, high mean arterial pressure, more gestational weight gain (kg), history of hypertensive disorder, GDM, multi fetal pregnancy and raised lipid profile had high risk of pre-eclampsia. Women with change of paternity was higher in group A as compared to group B (19.64% vs 7.14% respectively) (p value =0.006). Women with high haemoglobin (g/dL) had significantly low risk of pre-eclampsia. (p value <.0001). PCOS, CKD, family history of CVS, non-veg diet, maternal hypothyroid, autoimmune disease, chronic hypertension and mental disorders was significantly higher in group A as compared to group B. Distribution of smoking habit (p value=0.469), history of urinary tract infection (p value=0.298), blood group (p value-0.136) and Rh factor (p value=0.498) no significant association of these factors were established in our study. Perceived stress scale in group A was 30(28-34.25) which was significantly higher as compared to group B (16(15-17)) (p value <.0001).

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Conclusion- The present study found seven independent predictors of preeclampsia - mental stress (PSS), maternal hypothyroidism, family history of preeclampsia, previous history of hypertension disorder in previous pregnancy, gestational diabetes mellitus, non-veg food habit and autoimmune disorder. A risk factor-based prediction model and scoring system developed using the independent predictors has high sensitivity and specificity for preeclampsia risk prediction in a heavy antenatal OPD in resource constraint government hospitals.

Keywords: Pre-eclampsia, Gestational diabetes mallitus, Hypothyroidism, Hypertension

Abbreviations

AEs: adverse events; BMI: body mass index; NRS: Numerical Pain Rating Scale; NSAIDs: Non-Steroidal Anti-Inflammatory Drugs; OTC: over the counter; PEA: palmitoylethanolamide; PP: per protocol; PMS: premenstrual syndrome; Q-LES-Q-SF: Quality-of-Life Enjoyment and Satisfaction Questionnaire - Short Form; QoL: Quality of Life; SD: standard deviation; TRPV1: transient receptor potential cation channel subfamily V member 1; VAS: Visual Analogue Scale.

Introduction

Hypertensive disorders of pregnancy are an important cause of maternal and perinatal morbidity and mortality in developing countries like India. It is one of the leading causes of maternal and perinatal mortality and morbidity worldwide. Incidence of pre-eclampsia was found to be 10.3% (*NER* 2013)[1]. The incidence of eclampsia is 1.9%. These numbers of PE are higher as compared to the developed countries of North America and Europe, where it is estimated to be about 5–7 cases per 10,000 deliveries[2]. Hypertensive disorders of pregnancy are the second only to hemorrhage as a cause of maternal mortality and are responsible for 14% of maternal deaths3. The National Institute for Health and Clinical Excellence[6] (NICE) has proposed, in a document published in 2010, a classification of the risk factors for pre-eclampsia as "moderate risk" and "high risk," so that it would make them tools capable of defining the group for which the immediate application of prophylactic measures would be indicated. Though the cause for pre-eclampsia is unknown, there does appear to be certain risk factors associated with the condition such as family or personal history of pre-eclampsia, the presence of antiphospholipid antibodies, pre-existing diabetes, multiple pregnancies, nulliparity, hypertension or raised blood pressure at antenatal visits, increased body mass index (BMI) before or during pregnancy and advanced maternal age (greater than 40 years of age). Similarly, there is evidence that the risk of pre-eclampsia increases with an interval of 10 years or more between pregnancies, UTI infection, autoimmune disease, renal disease, chronic hypertension, maternal protein and calorie intake, maternal blood group, sex of newborn and season of conception. The relative importance of risk factors leading to the occurrence of pre-eclampsia depends on the level of socioeconomic development reached by a given society. The current study will study a wide range of maternal demographic, socio- economic, obstetric, nutritional, and anthropometric parameters risk factors for pre- eclampsia in a tertiary hospital and assess their level of association so as to find the best predictors of pre-eclampsia. Early prediction and timely therapeutic intervention are currently the best strategy to reduce the high morbidity and mortality associated with pre- eclampsia.

Aims and objectives

The aim of study was- ''To Study the Clinico-Demographic Predictors of Pre-Eclampsia in a Tertiary Hospital''

Materials and methods- This retrospective study done in Department of Obstetrics & Gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, New Delhi, for period of one years. Women admitted in postnatal ward of Dr BSA hospital diagnosed with and without preeclampsia satisfying the inclusion and exclusion criteria categorized in 2 groups **case (group A)** and **control (group B)**.

Inclusion criteria- Women delivering within the preceding two days.

-Delivery after 24 weeks of gestation.

Exclusion criteria- Study subjects on aspirin during pregnancy.

-Delivery before 24 weeks of gestation.

-Unconscious subject (unable to provide information)

Case and Control was defined with the following definitions

Case: Case was defined as a woman delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP[4] definition. Woman admitted to post- natal ward who delivered during the preceding 2 days, who in the antenatal period or before going to labor was diagnosed by a doctor as having pre-eclampsia.

Control: Control was a normotensive woman delivering within the preceding two days and satisfying the above inclusion and exclusion criteria. Control was selected by systematic random sampling wherein every tenth normotensive woman who delivered at our institute during the study period was enrolled. The controls were administered the same questionnaire.

Matching among cases and controls was not performed because most of the socio-demographic parameters are

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established risk factors for pre-eclampsia. The study was approved by the Institutional Ethics Committee and informed consent was taken. Potential risk factors selected based on literature review and biological plausibility for an association with both the exposure and outcome. After proper written information and explanation, a well explained consent in Hindi was taken for participation in study on the patient's information sheet in prescribed format. Data was gathered using a questionnaire. The questionnaire was administered to both cases and controls. The questionnaire included demographic and socioeconomic information. Direct questions were asked to record basic information like age, residence, education, occupation, income of family age at menarche, gravidity, parity, inter pregnancy interval, duration of cohabitation, conceived with ART or not, preconception use of condoms, sex of baby, season of conception, change of paternity, women born as small for gestational age, nutrition history, physical activity level during pregnancy.

ANC records and previous medical records were analyzed to detect blood group, RH Factor, Hb%, BMI, MAP, smoking habits, serum lipid profile, thyroid status, pregestational and gestational diabetes mellitus, chronic Hypertension, mental disease, chronic kidney disease, history of UTI, family history of pre-eclampsia, history of hypertension, history of PCOS, chronic vascular disease, weight gain during pregnancy, diagnosed autoimmune disease like SLE, or APLA Syndrome, Thrombophilia apart from other covariates. The presentation of the Categorical variables is done in the form of number and percentage (%). On the other hand, the quantitative data were presented as the means ± SD and as median with 25th and 75th percentiles (interquartile range). The data normality was checked by using Kolmogorov-Smirnov test. To develop a predictive score of pre-eclampsia, 1 point was assigned if accuracy is <75% and 2 points if accuracy is >75%. The data entry was done in the Microsoft EXCEL spread sheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, version 25.0. For statistical significance, p value of less than 0.05 was considered statistically significant.

Observations and results

A retrospective case control study was conducted in Department of Obstetrics & Gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, Sector-6, Rohini, New Delhi. The present study has been undertaken to find the association between clinical and demographic risk factors and development of preeclampsia. Clinico-demographic risk factors were assessed, and following observations were made:

- Risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years.
- Risk of pre-eclampsia was lower in wife educated till primary school, middle school, high school, graduate/post graduate and risk of pre- eclampsia was lower in husband educated till middle school, high school, graduate/post graduate.
- The present study found no significant association between the occupations of the husband (p value = 0.386) and wife (p value =0.213) and the risk of preeclampsia.
- Women with lower income had significantly higher risk of pre-eclampsia. However, no association was found between socioeconomic class and preeclampsia in the present study.
- Women with lower age at menarche had significantly higher risk of pre-eclampsia with odds ratio of 0.618(0.524 to 0.728).
- Multigravida have lower risk of pre-eclampsia.
- Period of gestation (weeks) in cases has no significant association with preeclampsia as it was 37 (36-37.75) and in controls was 38(34-38) (p value=0.949).
- Present study indicates that preconception use of condom also had no association to preeclampsia (p value=0.688).
- Women with longer inter pregnancy interval (years) had high risk of pre-eclampsia.
- Women with longer duration of cohabitation (years) had low risk of pre-eclampsia.
- There was no statistically significant relationship between the season of conception and the month of preeclampsia in pregnant women in our study as it is found to be comparable with group A and B (p value=0.575).
- Sex of baby had no association with preeclampsia based on our study where distribution of gender of baby was comparable with group A and B (Boy: - 40.18% vs 49.11% respectively, Girl:- 59.82% vs 50.89% respectively) (p value=0.179).
- We found that the risk of preeclampsia was very high among women who conceived with ART as the women who conceived with ART was significantly higher in group A as compared to group B (34.82% vs 16.07% respectively).
- Women with high BMI had significantly high risk of pre-eclampsia.
- Mean arterial pressure (mmHg) was found to be significant predictor of preeclampsia based on our study where in group A was 119mmHg (117-125.5) which was significantly higher as compared to group B 80(80-82) mmHg (p value <.0001).
- Women with serum lipid profile (Serum triglyceride and total cholesterol) raised was significantly higher in group A as compared to group B (Raised 61.61% vs 0% respectively).

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- Women with longer inter pregnancy interval (years) had high risk of pre-eclampsia.
- Women with change of paternity was higher in group A as compared to group B (19.64% vs 7.14% respectively) (p value =0.006).
- Hemoglobin(g/dL) in group B was 13 (12-14) which was significantly higher as compared to group A (9(7-10)) (p value <.0001). Women with high haemoglobin (g/dL) had significantly low risk of pre-eclampsia.
- Women with more gestational weight gain (kg) had significantly high risk of pre- eclampsia.
- Women with a history of hypertensive disorder in previous pregnancy was significantly higher in group A as compared to group B (70.54% vs 1.79% respectively) (p value<0.0001).
- GDM was independent significant high risk factor of pre-eclampsia with AOR 7.784(1.345-45.062).
- Women with multi fetal pregnancy were significantly higher in group A as compared to group B (40.18% vs 10.71% respectively) (p value <0.0001).
- PCOS was significantly higher in group A as compared to group B (50% vs 22.32% respectively) (p value <0.0001).
- Women with pre-gestational diabetes mellitus had significantly high risk of pre-eclampsia.
- In our study, proportion of women with maternal CKD was significantly higher in group A as compared to group B (38.39% vs 4.46% respectively) (p value <0.0001).
- Distribution of smoking habit (p value=0.469) and history of urinary tract infection (p value=0.298) and blood group (p value- 0.136) and Rh factor (p value=0.498) was comparable with group A and B. So no significant association of these factors were established in our study.
- Non vegetarian was significantly higher in group A as compared to group B (Non vegetarian 76.79% vs 28.57% respectively).
- Perceived stress scale in group A was 30(28-34.25) which was significantly higher as compared to group B (16(15-17)) (p value <.0001). Perceived stress scale had significant independent high risk of pre-eclampsia with AOR 1.281(1.123 to 1.46).
- Proportion of women with maternal hypothyroid was significantly higher in group A as compared to group B (56.25% vs 11.61% respectively).
- Proportion of women with autoimmune disease was significantly higher in group A as compared to group B (40.18% vs 6.25% respectively) (p value <0.0001).
- Proportion of women with mental disorder was significantly higher in group A as compared to group B (25% vs 7.14% respectively).
- Proportion of women with chronic hypertension was significantly higher in group A as compared to group B (48.21% vs 3.57% respectively).
- In present study, family history of pre-eclampsia immerses as independent significant risk factor AOR 5.233 (0.84 to 32.59) respectively. In our study, Women with family history of CVS had significantly high risk of pre-eclampsia with odds ratio of 11.245 (5.368 to 23.559).

Table 1: Association of demographic characteristics with group A and B.

Demographic characteristics	Group A(n=112)	Group B(n=112)	Total	P value	Odds ratio (95% CI)
Age(years)					
18-20	29 (25.89%)	1 (0.89%)	30 (13.39%)	<.0001†	1
21-30	33 (29.46%)	90 (80.36%)	123 (54.91%)		0.019(0.003 to 0.104)
31-40	50 (44.64%)	21 (18.75%)	71 (31.70%)		0.119(0.021 to 0.684)
Mean ± SD	29.34 ± 7.49	28.26 ± 2.61	28.8 ± 5.63	0.062‡	1.035(0.987 to 1.085)
Median (25th-75th percentile)	30(20-36)	28(27-30)	29(26-32)		
Range	18-40	18-35	18-40		
Education of wife					
Illiterate	25 (22.32%)	0 (0%)	25 (11.16%)	<.0001*	1
Primary school	17 (15.18%)	52 (46.43%)	69 (30.80%)		0.007(0.000 to 0.119)
Secondary school	65 (58.04%)	58 (51.79%)	123 (54.91%)		0.022(0.001 to 0.390)
Graduate/post graduate	5 (4.46%)	2 (1.79%)	7 (3.13%)		0.043(0.002 to 1.137)
Education of husband					
Illiterate	10 (8.93%)	0 (0%)	10 (4.46%)	<.0001†	1
Primary school	10 (8.93%)	0 (0%)	10 (4.46%)		1(0.015 to 68.057)
Secondary school	79 (70.54%)	101 (90.18%)	180 (80.36%)		0.037(0.002 to 0.743)
Graduate/post graduate	13 (11.61%)	11 (9.82%)	24 (10.71%)		0.056(0.003 to 1.221)

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31-40 years was significantly higher in group A as compared to group B (31-40 years:- 44.64% vs 18.75% respectively). Proportion of women of age group: - 21-30 years was significantly lower in group A as compared to group B (21- 30:- 29.46% vs 80.36% respectively), (p value <0.0001). After taking 18-20 years as reference, risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years with odds ratio of 0.019(0.003 to 0.104) and 0.119(0.021 to 0.684) respectively. Education of wife:- illiterate, secondary school, graduate/post graduate was significantly higher in group A as compared to group B (Illiterate:- 22.32% vs 0% respectively, Secondary school:- 58.04% vs 51.79% respectively, Graduate/post graduate:- 4.46% vs 1.79% respectively). After taking illiterate as reference, risk of pre-eclampsia was lower in wife educated till primary school, secondary school, graduate/post graduate with odds ratio of 0.007(0 to 0.119), 0.022(0.001 to 0.390) and 0.043(0.002 to 1.137) respectively. Education of husband:- illiterate, primary school, graduate/post graduate was significantly higher in group A as compared to group B. (Illiterate:- 8.93% vs 0% respectively, Primary school:- 8.93% vs 0% respectively, Graduate/post graduate:- 11.61% vs 9.82% respectively). Proportion of women with education of husband:- secondary school was significantly lower in group A as compared to group B (Secondary school:- 70.54% vs 90.18% respectively), (p value <0.0001). After taking illiterate as reference, risk of pre-eclampsia was lower in husband educated till secondary school, graduate/post graduate with odds ratio of 0.037(0.002 to 0.743) and 0.056 (0.003 to 1.221) respectively.

Distribution of occupation of wife was comparable with group A and B (Home maker: - 94.64% vs 98.21% respectively, Job: - 2.68% vs 1.79% respectively, Labour:- 2.68% vs 0% respectively) (p value=0.213). Distribution of occupation of husband was comparable with group A and B (Driver: - 1.79% vs 0% respectively, Labour:- 45.54% vs 50% respectively, Private job:- 52.68% vs 50% respectively) (p value=0.386). Median (25th-75th percentile) of income(/month) in group B was 17000(15000-19000) which was significantly higher as compared to group A (10000(5000-14000)) (p value <.0001). So, women with lower income had significantly higher risk of pre-eclampsia with odds ratio of 0.99(0.998 to 0.999). Distribution of area of residence was comparable with group A and B (Rural: - 50% vs 52.68% respectively, Urban: - 50% vs 47.32% respectively) (p value=0.688). Distribution of socioeconomic class was comparable with group A and B (Lower middle: - 45.54% vs 45.54% respectively, Upper lower: - 37.50% vs 45.54% respectively, Lower: - 16.96% vs 8.93% respectively) (p value=0.16).

Median (25th-75th percentile) of age at menarche(years) in group B was 13(12-14) which was significantly higher as compared to group A (11(10-13)) (p value <.0001). So women with lower age at menarche had significantly higher risk of pre-eclampsia with odds ratio of 0.618(0.524 to 0.728). Proportion of women with primi gravida was significantly higher in group A as compared to group B. (Primi:- 57.14% vs 41.07% respectively). Proportion of women with multi gravida was significantly lower in group A as compared to group B (Multi:- 42.86% vs 58.93% respectively),(p value=0.016). So multigravida has lower risk of pre-eclampsia with odds ratio of 0.523(0.308 to 0.889). Proportion of women with parity:- P0 was significantly higher in group A as compared to group B (P0:- 65.18% vs 41.07% respectively), (p value <0.0001). After taking P0 as reference, risk of pre-eclampsia was significantly lower in P2 with odds ratio of 0.263(0.146 to 0.471). Median (25th-75th percentile) of period of gestation (weeks) in group A was 37 (36-37.75) and in group B was 38(34-38) with no significant association between them (p value=0.949). Median (25th-75th percentile) of inter pregnancy interval (years) in group A was 10(7-11) which was significantly higher as compared to group B (2(1-2.75)) (p value <.0001). Women with longer inter pregnancy interval (years) had high risk of pre-eclampsia with odds ratio of 2.424(1.699 to 3.458).

Proportion of women with change of paternity was significantly higher in group A as compared to group B (19.64% vs 7.14% respectively), (p value =0.006). Proportion of women with change of paternity had high risk of pre-eclampsia with odds ratio of 3.178(1.3488 to 7.4871). Distribution of preconception use of condom was comparable with group A and B (No:- 47.32% vs 50% respectively, Yes:- 52.68% vs 50% respectively) (p value=0.688). Median (25th-75th percentile) of duration of cohabitation (years) in group B was 6 (4-8) which was significantly higher as compared to group A (0.75(0.5-7.25)) (p value <.0001). Women with longer duration of cohabitation (years) had low risk of pre-eclampsia with odds ratio of 0.888(0.835 to 0.944). Distribution of season of conception was comparable with group A and B (July:- 17.86% vs 18.75% respectively, August:- 17.86% vs 23.21% respectively, September: - 19.64% vs 16.07% respectively, October:- 25.89% vs 25% respectively, November:- 11.61% vs 6.25% respectively, December:- 7.14% vs 10.71% respectively) (p value=0.575). Distribution of gender of baby was comparable with group A and B (Boy:- 40.18% vs 49.11% respectively, Girl:- 59.82% vs 50.89% respectively) (p value=0.179).

Proportion of women born as SGA was significantly higher in group A as compared to group B (58.93% vs 12.50% respectively), (p value <0.0001). Proportion of women born as SGA had significantly high risk of pre-eclampsia with an odds ratio of 9.715(4.97 to 18.989). Proportion of women who conceived with ART was significantly higher in group A as compared to group B (34.82% vs 16.07% respectively), (p value=0.001). Proportion of women who conceived

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Table 2: Association of Obstetric History with Group A and B.

Obstetric history	Group A(n=112)	Group B(n=112)	Total	P value	Odds ratio(95% CI)
Age at menarche(years)					
Mean ± SD	11.62 ± 2.24	13.28 ± 1.25	12.45 ± 1.99		0.618(0.524 to 0.728)
Median(25th-75th percentile)	11(10-13)	13(12-14)	13(11-14)	<.0001‡	
Range	Aug-16	Nov-15	Aug-16		
Gravida					
Primi	64 (57.14%)	46 (41.07%)	110 (49.11%)		1
Multi	48 (42.86%)	66 (58.93%)	114 (50.89%)	0.016†	0.523(0.308 to 0.889)
Parity					
P0	73 (65.18%)	46 (41.07%)	119 (53.13%)		1
P1	9 (8.04%)	4 (3.57%)	13 (5.80%)	<.0001*	1.405(0.407 to 4.849)
P2	27 (24.11%)	62 (55.36%)	89 (39.73%)		0.263(0.146 to 0.471)
>=P3	3 (2.68%)	0 (0%)	3 (1.34%)		5.297(0.127 to 220.663)
Period of gestation(weeks)					
Mean ± SD	36.52 ± 1.72	36.17 ± 2.04	36.35 ± 1.89		
Median(25th-75th percentile)	37(36-37.75)	38(34-38)	37(34-38)	0.949‡	1.102(0.958 to 1.267)
Range	32-39.57	33-38	32-39.57		
Inter pregnancy interval(years)					
Mean ± SD	8.82 ± 3.37	2.12 ± 1.09	4.84 ± 4.02		
Median(25th-75th percentile)	10(7-11)	2(1-2.75)	3(2-9)	<.0001‡	2.424(1.699 to 3.458)
Range	Jan-15	01-May	Jan-15		
Change of paternity					
No	90 -80.36%	104 -92.86%	194 -86.61%	0.006†	1
Yes	22 -19.64%	8 -7.14%	30 -13.39%		3.178(1.349 to 7.487)
Preconception use of condom					
No	53 (47.32%)	56 (50%)	109 (48.66%)		1
Yes	59 (52.68%)	56 (50%)	115 (51.34%)	0.688†	1.113(0.659 to 1.88)
Duration of cohabitation(years)					
Mean ± SD	3.96 ± 5.26	6.38 ± 3.55	5.17 ± 4.64		
Median(25th-75th percentile)	0.75(0.5-7.25)	6(4-8)	4(0.75-8)	<.0001‡	0.888(0.835 to 0.944)
Range	0.25-20	Jan-15	0.25-20		
Season of conception					
July	20 (17.86%)	21 (18.75%)	41 (18.30%)	0.575†	1
August	20 (17.86%)	26 (23.21%)	46 (20.54%)		0.806(0.346 to 1.877)
September	22 (19.64%)	18 (16.07%)	40 (17.86%)		1.288(0.538 to 3.086)
October	29 (25.89%)	28 (25%)	57 (25.45%)		1.089(0.488 to 2.431)
November	13 (11.61%)	7 (6.25%)	20 (8.93%)		1.937(0.643 to 5.837)
December	8 (7.14%)	12 (10.71%)	20 (8.93%)		0.699(0.236 to 2.068)
Gender of baby					
Boy	45 (40.18%)	55 (49.11%)	100 (44.64%)		1
Girl	67 (59.82%)	57 (50.89%)	124 (55.36%)	0.179†	1.435(0.846 to 2.436)

†Chi square test, * Fisher's exact test, ‡ Mann Whitney test

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Table 3: Association of maternal baseline characteristics with group A and group B.

Maternal baseline characteristics	Group A (n=112)	Group B (n=112)	Total	P value	Odds ratio (95% CI)
Women born as SGA	66 (58.93%)	14 (12.50%)	80 (35.71%)	<0.0001†	9.715 (4.97 to 18.989)
Conceive with ART or not	39 (34.82%)	18 (16.07%)	57 (25.45%)	0.001†	2.749 (1.456 to 5.19)
Physical activity					
Light	42 (37.50%)	52 (46.43%)	94 (41.96%)	#	#
Moderate	50 (44.64%)	48 (42.86%)	98 (43.75%)	0.212†	1.294 (0.733 to 2.282)
Heavy	20 (17.86%)	12 (10.71%)	32 (14.29%)	#	2.062 (0.906 to 4.697)
Body mass index (kg/m²)					
<18.5 (Underweight)	4 (3.57%)	3 (2.68%)	7 (3.13%)	#	4.056 (0.796 to 20.672)
18.5–22.99 (Normal BMI)	12 (10.71%)	38 (33.93%)	50 (22.32%)	<0.0001*	#
23–24.99 (Overweight)	14 (12.50%)	36 (32.14%)	50 (22.32%)	#	1.205 (0.494 to 2.939)
≥25 (Obese)	82 (73.21%)	35 (31.25%)	117 (52.23%)	#	7.23 (3.394 to 15.4)
Mean ± SD	27.37 ± 4.58	23.45 ± 4.21	25.41 ± 4.21	#	1.336 (1.22 to 1.463)
Median (25th–75th percentile)	28 (24.75–30)	23 (22–25)	25 (22.25–28.25)	<0.0001†	#
Range	14.2–40.5	18–31	14.2–40.5	#	#
Multi fetal pregnancy	45 (40.18%)	12 (10.71%)	57 (25.45%)	<0.0001†	5.416 (2.681 to 10.942)
Gestational weight gain (kg)					
Mean ± SD	14.99 ± 3.25	11.24 ± 0.91	13.12 ± 3.03	#	2.67 (2.021 to 3.527)
Median (25th–75th percentile)	15 (13–17)	11 (10–12)	12 (11–15)	<0.0001‡	#
Range	5–30	9–14	5–30	#	#
Smoking habit	37 (33.04%)	32 (28.57%)	69 (30.80%)	0.469†	1.233 (0.698 to 2.177)
Food habit					
Non-veg	86 (76.79%)	32 (28.57%)	118 (52.68%)	<0.0001†	#
Veg	26 (23.21%)	80 (71.43%)	106 (47.32%)	#	8.082 (4.441 to 14.708)

‡ Mann Whitney test, * Fisher's exact test, † Chi square test

with ART had significantly high risk of pre-eclampsia with odds ratio of 2.749(1.456 to 5.19). Distribution of physical activity was comparable with group A and B (Light:- 37.50% vs 46.43% respectively, Moderate:- 44.64% vs 42.86% respectively, Heavy:- 17.86% vs 10.71% respectively) (p value=0.212). Proportion of women with body mass index (kg/m²):- <18.5 kg/m² {Underweight}, >=25 kg/m² {Obese} was significantly higher in group A as compared to group B (<18.5 kg/m² {Underweight}:- 3.57% vs 2.68% respectively, >=25 kg/m² {Obese}:- 73.21% vs 31.25% respectively). Proportion of women with body mass index (kg/m²):- 18.5 to 22.99 kg/m² {Normal BMI} was significantly lower in group A as compared to group B (18.5 to 22.99 kg/m² {Normal BMI}:- 10.71% vs 33.93% respectively), (p value <0.0001). After taking normal BMI as reference, risk of pre-eclampsia was higher in <18.5 kg/m² {Underweight},23 to 24.99 kg/m² {Overweight}and >=25 kg/m² {Obese} with odds ratio of 4.056(0.796 to 20.672), 1.205(0.494 to 2.939), 7.23(3.394 to 15.4) respectively.

Median (25th-75th percentile) of body mass index(kg/m²) in group A was 28(24.75-30) which was significantly higher as compared to group B (23(22-25)), (p value <.0001). So women with high BMI had significantly high risk of pre-eclampsia with odds ratio of 1.336(1.22 to 1.463). Proportion of women with multi fetal pregnancy was significantly higher in group A as compared to group B (40.18% vs 10.71% respectively) (p value <0.0001). Women with multi fetal pregnancy had significantly high risk of pre-eclampsia with odds ratio of 5.416(2.681 to 10.942). Median (25th-75th percentile) of gestational weight gain (kg) in group A was 15 (13-17) which was significantly higher as compared to group B (11(10.75-12)), (p value <.0001). Women with more gestational weight gain (kg) had significantly high risk of pre-eclampsia with odds ratio of 2.67(2.021 to 3.527).

Distribution of smoking habit was comparable with group A and B (No:- 66.96% vs 71.43% respectively, Yes:- 33.04% vs 28.57% respectively) (p value=0.469). Proportion of women with food habit:- non vegetarian was significantly higher in group A as compared to group B (Non vegetarian:- 76.79% vs 28.57% respectively). Proportion of women with

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food habit:- vegetarian was significantly lower in group A as compared to group B (Vegetarian:- 23.21% vs 71.43% respectively), (p value <0.0001). Taking non vegetarian as gold standard, vegetarian had significantly high risk of pre-eclampsia with odds ratio of 8.082(4.441 to 14.708). It is shown in table 3, figure 3.1, 3.2 and 3.3.

Table 4: Association of clinical characteristics with group A and group B.

Clinical characteristics	Group A (n=112)	Group B (n=112)	Total	P value	Odds ratio (95% CI)
Mean arterial pressure (mmHg)					
Mean ± SD	120.67 ± 6.53	79.96 ± 2.8	100.31 ± #	#	1.355 (1.2 to 1.531)
Median (25th–75th percentile)	119 (117–125.5)	80 (80–82)	95.5 (80–119)	<0.0001‡	#
Range	107–143	70–84	70–143	#	#
Hemoglobin (g/dL)					
Mean ± SD	8.89 ± 2.02	12.7 ± 1.44	10.79 ± 2.59	#	0.292 (0.211 to 0.403)
Median (25th–75th percentile)	9 (7–10)	13 (12–14)	12 (9–13)	<0.0001‡	#
Range	5–14	7–14	5–14	#	#
Blood group					
A+	11 (9.82%)	5 (4.46%)	16 (7.14%)	#	1
AB+	10 (8.93%)	18 (16.07%)	28 (12.50%)	#	0.227 (0.06 to 0.85)
B+	26 (23.21%)	22 (19.64%)	48 (21.43%)	0.136*	0.519 (0.155 to 1.741)
O-	2 (1.79%)	0 (0%)	2 (0.89%)	#	0.402 (0.131 to 1.234)
O+	63 (56.25%)	67 (59.82%)	130 (58.04%)	#	4.073 (0.032 to 511.222)
Rh factor					
Rh negative	2 (1.79%)	0 (0%)	2 (0.89%)	#	1
Rh positive	110 (98.21%)	112 (100%)	222 (99.11%)	0.498*	0.033 (0.000 to 77.289)
Serum lipid profile					
WNL	43 (38.39%)	112 (100%)	155 (69.20%)	<0.0001*	#
Raised	69 (61.61%)	0 (0%)	69 (30.80%)	#	360.244 (21.331 to 6084)
History of hypertension disorder in previous pregnancy	79 (70.54%)	2 (1.79%)	81 (36.16%)	<0.0001*	104.913 (27.887 to 394.687)
History of PCOS	56 (50%)	25 (22.32%)	81 (36.16%)	<0.0001†	3.437 (1.928 to 6.125)
Family history of CVS	60 (53.57%)	10 (8.93%)	70 (31.25%)	<0.0001†	11.245 (5.368 to 23.559)
Family history of pre eclampsia	81 (72.32%)	5 (4.46%)	86 (38.39%)	<.0001†	50.761(19.507 to 132.09)
Maternal CKD	43 (38.39%)	5 (4.46%)	48 (21.43%)	<.0001†	12.228(4.748 to 31.492)
Maternal hypothyroid	63 (56.25%)	13 (11.61%)	76 (33.93%)	<.0001†	9.453(4.774 to 18.717)
GDM	62 (55.36%)	6 (5.36%)	68 (30.36%)	<.0001†	20.302(8.418 to 48.966)
Autoimmune disease	45 (40.18%)	7 (6.25%)	52 (23.21%)	<.0001†	9.474(4.096 to 21.911)
Chronic hypertension	54 (48.21%)	4 (3.57%)	58 (25.89%)	<.0001	22.505(8.107 to 62.475)
Mental disorder	28 (25%)	8 (7.14%)	36 (16.07%)	0.0003†	4.161(1.818 to 9.526)
Perceived stress scale					
Mean ± SD	30.75 ± 5	16.36 ± 2.73	23.55 ± 8.26		
Median(25th-75th percentile)	30(28-34.25)	16(15-17)	22.5(16-30)		1.731(1.503 to 1.993)
Range	15-40	Dec-28	Dec-40	<.0001‡	
Pregestational diabetes mellitus	46 (41.07%)	6 (5.36%)	52 (23.21%)	<.0001	11.452(4.732 to 27.717)
History of UTI	28 (25%)	35 (31.25%)	63 (28.13%)	0.298†	0.734(0.409 to 1.318)

‡ Mann Whitney test, * Fisher's exact test, † Chi square test

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Median (25th-75th percentile) of mean arterial pressure (mmHg) in group A was 119(117- 125.5) which was significantly higher as compared to group B (80(80-82)), (p value <.0001). Women with high mean arterial pressure (mmHg) had significantly high risk of pre- eclampsia with odds ratio of 1.355(1.2 to 1.531). Median (25th-75th percentile) of Haemoglobin (g/dL) in group B was 13(12-14) which was significantly higher as compared to group A (9(7-10)), (p value <.0001). Women with high haemoglobin (g/dL) had significantly low risk of pre-eclampsia with odds ratio of 0.292(0.211 to 0.403). Distribution of blood group was comparable with group A and B (A+:- 9.82% vs 4.46% respectively, AB+:- 8.93% vs 16.07% respectively, B+:- 23.21% vs 19.64% respectively, O-:- 1.79% vs 0% respectively, O+:- 56.25% vs 59.82% respectively) (p value=0.136). Distribution of Rh factor was comparable with group A and B (Rh negative:- 1.79% vs 0% respectively, Rh positive:- 98.21% vs 100% respectively) (p value=0.498).

Proportion of women with serum lipid profile (Serum triglyceride + total cholesterol):- raised was significantly higher in group A as compared to group B (Raised:- 61.61% vs 0% respectively). Proportion of women with serum lipid profile (Serum triglyceride + total cholesterol):- WNL was significantly lower in group A as compared to group B (WNL:- 38.39% vs 100% respectively), (p value <0.0001). Women with raised serum lipid profile (Serum triglyceride + total cholesterol) had significantly high risk of pre-eclampsia with odds ratio of 360.244(21.331 to 6084). Proportion of women with history of hypertension disorder in previous pregnancy was significantly higher in group A as compared to group B (70.54% vs 1.79% respectively),(p value <0.0001). Women with history of hypertension disorder had significantly high risk of pre-eclampsia with odds ratio of 104.913(27.887 to 394.687).

Proportion of women with history of PCOS was significantly higher in group A as compared to group B (50% vs 22.32% respectively),(p value <0.0001). Women with history of PCOS had significantly high risk of pre-eclampsia with odds ratio of 3.437(1.928 to 6.125). Proportion of women with family history of CVS, family history of pre eclampsia was significantly higher in group A as compared to group B (Family history of CVS:- 53.57% vs 8.93% respectively (p value<.0001), Family history of pre eclampsia:- 72.32% vs 4.46% respectively (p value <0.0001)). Women with family history of CVS, family history of pre eclampsia had significantly high risk of pre-eclampsia with odds ratio of 11.245(5.368 to 23.559) and 50.761(19.507 to 132.09) respectively. Proportion of women with maternal CKD was significantly higher in group A as compared to group B (38.39% vs 4.46% respectively), (p value <0.0001).

Women with maternal CKD had significantly high risk of pre-eclampsia with odds ratio of 12.228(4.748 to 31.492). Proportion of women with maternal hypothyroid was significantly higher in group A as compared to group B (56.25% vs 11.61% respectively),odds ratio 4.161(1.818 to 9.526) (p value <0.0001). Women with maternal hypothyroid had significantly high risk of pre-eclampsia with odds ratio of 9.453(4.774 to 18.717). Proportion of women with GDM was significantly higher in group A as compared to group B (55.36% vs 5.36% respectively), (p value <0.0001). Women GDM had significantly high risk of pre-eclampsia with odds ratio of 20.302(8.418 to 48.966). Proportion of women with autoimmune disease was significantly higher in group A as compared to group B (40.18% vs 6.25% respectively),(p value <0.0001). Women with autoimmune disease had significantly high risk of pre-eclampsia with odds ratio of 9.474(4.096 to 21.911). Proportion of women with chronic hypertension was significantly higher in group A as compared to group B (48.21% vs 3.57% respectively), (p value <0.0001).

Women with chronic hypertension had significantly high risk of pre-eclampsia with odds ratio of 22.505(8.107 to 62.475). Proportion of women with mental disorder was significantly higher in group A as compared to group B (25% vs 7.14% respectively),(p value=0.0003). Women with mental disorder had significantly high risk of pre-eclampsia with odds ratio of 4.161(1.818 to 9.526). Median (25th-75th percentile) of perceived stress scale in group A was 30(28-34.25) which was significantly higher as compared to group B (16(15-17)). (p value <.0001). Women with high perceived stress scale had significantly high risk of pre-eclampsia with odds ratio of 1.731(1.503 to 1.993). Proportion of women with pre-gestational diabetes mellitus was significantly higher in group A as compared to group B (41.07% vs 5.36% respectively), (p value <0.0001). Women with pre-gestational diabetes mellitus had significantly high risk of pre-eclampsia with odds ratio of 11.452(4.732 to 27.717). Proportion of women with maternal hypothyroid was significantly higher in group A as compared to group B (56.25% vs 11.61% respectively),odds ratio 4.161(1.818 to 9.526) (p value <0.0001).

Women with maternal hypothyroid had significantly high risk of pre-eclampsia with odds ratio of 9.453(4.774 to 18.717). Proportion of women with GDM was significantly higher in group A as compared to group B (55.36% vs 5.36% respectively), (p value <0.0001). Women GDM had significantly high risk of pre-eclampsia with odds ratio of 20.302(8.418 to 48.966). Proportion of women with autoimmune disease was significantly higher in group A as compared to group B (40.18% vs 6.25% respectively),(p value <0.0001). Women with autoimmune disease had significantly high risk of pre-eclampsia with odds ratio of 9.474(4.096 to 21.911).

Proportion of women with chronic hypertension was significantly higher in group A as compared to group B

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(48.21% vs 3.57% respectively), (p value <0.0001). Women with chronic hypertension had significantly high risk of pre-eclampsia with odds ratio of 22.505(8.107 to 62.475). Proportion of women with mental disorder was significantly higher in group A as compared to group B (25% vs 7.14% respectively),(p value=0.0003). Women with mental disorder had significantly high risk of pre-eclampsia with odds ratio of 4.161(1.818 to 9.526). Median(25th-75th percentile) of perceived stress scale in group A was 30(28-34.25) which was significantly higher as compared to group B (16(15-17)). (p value <.0001). Women with high perceived stress scale had significantly high risk of pre-eclampsia with odds ratio of 1.731(1.503 to 1.993). Proportion of women with pre-gestational diabetes mellitus was significantly higher in group A as compared to group B (41.07% vs 5.36% respectively), (p value <0.0001).

Women with pre-gestational diabetes mellitus had significantly high risk of pre-eclampsia with odds ratio of 11.452(4.732 to 27.717). Distribution of history of UTI was comparable with group A and B (No:- 75% vs 68.75% respectively, Yes:- 25% vs 31.25% respectively) (p value=0.298).

On performing multivariate regression, perceived stress scale, history of hypertension disorder in previous pregnancy, GDM, family history of pre-eclampsia, maternal hypothyroid, autoimmune disease, food habit: non vegetarian were significant independent risk factors of pre-eclampsia after adjusting for confounding factors. With the increase in perceived stress scale, history of hypertension disorder in previous pregnancy, GDM, family history of pre eclampsia, maternal hypothyroid, autoimmune disease, risk of pre-eclampsia significantly increases with adjusted odds ratio of 1.281(1.123 to 1.46), 50.294(8.696 to 290.87), 7.784(1.345 to 45.062), 5.233(0.84 to 32.591), 3.831(0.842 to 17.439), 5.651(0.716 to 44.63) respectively. Women with food habit: non vegetarian had significantly high risk of pre-eclampsia with adjusted odds ratio of 7.178(30.095 to 1.712).

Discussion

The study was conducted in the Department of Obstetrics & Gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, Sector-6, Rohini, New Delhi. 112 women delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP[4] definition were included as cases {Group A} and 112 women delivered within the preceding two days and was not diagnosed with preeclampsia were included as controls {Group B}. Clinico-demographic risk factors were assessed and based on the results and statistical observations they are compared against the previously performed research in a similar field.

In the present study, after taking 18-20 years as reference, risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years with odds ratio of 0.019 (0.003 to 0.104) and 0.119(0.021 to 0.684) and 31-40 yr was significantly higher in group A as compared to Group B (44.64% vs 18.75%) which was similar to previous study done by Kumar[20] et al wherein the risk of preeclampsia was found to be four times higher in age less than 20yr. This might be due to inadequate antenatal care given to teenage pregnant girls. Increased risk of preeclampsia in women with age more than 30 may be explained by the increased villous reaction. The study done by Shamsi[14] et al in Pakistan observed no significant differences between cases and controls regarding the maternal age. However, Hou[31] et al found that age was positively correlated with the risk of hypertensive disorders of pregnancy, the relative risk was 1.356. After taking illiterate as reference, risk of pre-eclampsia was lower in wife educated till primary school, middle school, high school, graduate/postgraduate with odds ratio of 0.007(0 to 0.119), 0.021(0.001 to 0.375), 0.025(0.001 to 0.464) and 0.043(0.002 to 1.137) respectively.

Table 5 Multivariate step wise forward logistic regression to find out independent significant risk factors of pre-eclampsia.

Variables	Beta coefficient	Standard error	P value	Odds ratio	Odds ratio Lower bound -95%	Odds ratio Upper bound (95%)
Perceived stress scale	0.247	0.067	0	1.281	1.123	1.46
History of hypertension disorder in previous pregnancy	3.918	0.895	<0.0001	50.294	8.696	290.87
GDM	2.052	0.896	0.022	7.784	1.345	45.062
Family history of pre	1.655	0.933	0.076	5.233	0.84	32.591
Eclampsia						
Maternal hypothyroid	1.343	0.773	0.082	3.831	0.842	17.439
Autoimmune disease	1.732	1.054	0.1	5.651	0.716	44.63
Food habit						
Vegetarian				1		
Non vegetarian	1.971	0.731 28	0.007	7.178	30.095	1.712

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Mohanty[23]et al also had similar findings wherein it was found that a low level of education in pregnant women contribute to an increased risk of preeclampsia due to low level of health education and lack of awareness or hesitation in seeking medical care. After taking illiterate as reference, risk of pre-eclampsia was lower in husband educated till middle school, high school, graduate/postgraduate with odds ratio of 0.906(0.013 to 62.673), 0.033(0.002 to 0.66) and 0.056(0.003 to 1.221) respectively. The study by Verma[22]et al and Stitterich[32]et al also had similar findings. The present study found no significant association between the occupations of the husband and wife and the risk of preeclampsia. The study by Verma[22] et al found no association between the occupation of the wife and preeclampsia. This finding was also supported by previous studies conducted by Bej[17] et al (OR 95%CI=1) and Kumar[20] et al (p-0.39). In contrast, the study by Stitterich[32] et al found housewives to be at a higher risk of preeclampsia (p-value <0.001).

The present study found that multigravida have lower risk of preeclampsia with odds ratio of 0.523(0.308 to 0.889).

Proportion of women with parity:- P0 was significantly higher in group A as compared to group B. (P0:- 65.18% vs 41.07% respectively). (p value <0.0001) After taking P0 as reference, risk of pre-eclampsia was significantly lower in P2 with odds ratio of 0.263(0.146 to 0.471) hence nulliparity had significant association with preeclampsia which is similar to previous study done by Hinkosa[26]et. al (AOR:4.35,95%CI2.36-8.03). Median (25th-75th percentile) of period of gestation(weeks) in cases was 37(36-37.75) and in controls was 38(34-38) with no significant association between them. (p value=0.949). The study by Shamsi[14] et al reported there to be significant association between gestational age and preeclampsia. The mean age in cases was 36.2±2.2 while in controls it was 37.0±1.2 (p value <0.001). Distribution of preconception use of condom was comparable in cases and controls. (No:- 47.32% vs 50% respectively, Yes:- 52.68% vs 50% respectively) (p value=0.688).).Our finding was in contrast to previous study done by Reyes[16] et al (ODD RATIO 95%CI 1.24- 4.24)and consistent with Shamsi[14] et al (p-0.954). This discrepancy in previous studies need further research to consider preconception use of condom as risk factor.

Inter pregnancy interval(years) in group A was 10(7-11)yr which was significantly higher as compared to group B(2(1-2.75)yr), (p value <.0001) Women with longer inter pregnancy interval(years) had high risk of pre-eclampsia with odds ratio of 2.424(1.699 to 3.458). Duration of cohabitation (years) in group B was 6(4-8) which was significantly higher as compared to group A (0.75(0.5-7.25)), (p value <.0001). Women with longer duration of cohabitation (years) had low risk of pre-eclampsia with odds ratio of 0.888(0.835 to 0.944). This finding was corroborated by a study conducted by Mekie[25] et al. There was no statistically significant relationship between the season of conception and the month of preeclampsia in pregnant women in our study as it is found to be comparable with group A and B (p value=0.575) which is in line with the study conducted by Shahgheibi[34] et al (p value=0.67).

In our study, women with change of paternity were significantly higher in group A as compared to group B (19.64% vs 7.14% respectively),(p value =0.006) .Our finding supported by Tubbergen[35] et al (p<0.0001)who found that change of paternity raises the risk for preeclampsia in subsequent pregnancies. Sex of baby was not associated to preeclampsia based on our study where distribution of gender of baby was comparable with group A and B (Boy: - 40.18% vs 49.11% respectively, Girl:- 59.82% vs 50.89% respectively) (p value=0.179). This is in line with the findings by Shamsi[14] et al (p value=0.628). Women born as SGA (estimated fetal weight less than 10th centile) were significantly higher in group A as compared to group B (58.93% vs 12.50% respectively) (p value <0.0001). We found that the risk of preeclampsia was very high among women who conceived with ART as the women who conceived with ART were significantly higher in group A (34.82%) as compared to group B (16.07%) (p value=0.001). Similar significance was found in the study conducted by Omani-Samani[24] et al (p <0.001).

In this study, distribution of physical activity level was comparable with group A and B. (Light:- 37.50% vs 46.43% respectively, Moderate:- 44.64% vs 42.86% respectively, Heavy:- 17.86% vs 10.71% respectively) (p value=0.212). Hence, there was no statistically significant physical activity level difference observed between case and control which was supported by Shao[38] et al(p-0.796)and in contrary with previous study done by Bej[17] et al where mild physical activity have significant association with development of preeclampsia(p<0.001). In our study Median (25th-75th percentile) of body mass index (kg/m^2) in group A was 28(24.75-30) which was significantly higher as compared to group B 23(22-25)(p value <.0001).

Mean arterial pressure (mmHg) was found to be a significant predictor of preeclampsia based on our study where in group A was 119mmHg (117-125.5) which was significantly higher as compared to group B 80(80-82) mmHg (p value <.0001). women with high mean arterial pressure (mmHg) had significantly high risk of pre-eclampsia with odds ratio of 1.355(1.2 to 1.531) which is similar to study conducted by Mishra[29] et al with MAP>85mmHg (p value <0.001). Distribution of Rh factor was comparable with group A and B. (Rh negative:- 1.79% vs 0% respectively, Rh positive:- 98.21% vs 100% respectively) (p value=0.498) and Distribution of blood group was comparable with group A and B. (A+:- 9.82% vs 4.46% respectively, AB+:- 8.93% vs 16.07% respectively, B+:- 23.21% vs 19.64% respectively,

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O-:- 1.79% vs 0% respectively, O+:- 56.25% vs 59.82% respectively) (p value=0.136). This finding was consistent with a previous similar study by Shamsi[14]et al (p-0.326) that also found no association between blood group, Rh factor and preeclampsia. Hemoglobin (g/dL) in group B was 13(12-14) which was significantly higher as compared to group A (9(7-10)), (p value <.0001).Women with high hemoglobin(g/dL) had significantly low risk of pre-eclampsia with odds ratio of 0.292(0.211 to 0.403). This was similar to previous studies done by Verma[22]etal (p value =.034) and Jaboi[39]et al (p-0.003) which stated that anemia (Hb<10gm%) had significant association with preeclampsia.

Women with serum lipid profile (Serum triglyceride and total cholesterol): - raised was significantly higher in group A as compared to group B. (Raised:- 61.61% vs 0% respectively). Proportion of women with serum lipid profile (Serum triglyceride + total cholesterol):- WNL was significantly lower in group A as compared to group B (WNL:- 38.39% vs 100% respectively), (p value <0.0001). Women with history of hypertensive disorder in previous pregnancy was significantly higher in group A as compared to group B (70.54% vs 1.79% respectively), (p value <0.0001). Proportion of women with GDM was significantly higher in group A as compared to group B (55.36% vs 5.36% respectively), (p value <0.0001). In present study, GDM was independent significant high risk factor of pre-eclampsia with AOR 7.784(1.345-45.062). Proportion of women with multi fetal pregnancy was significantly higher in group A as compared to group B (40.18% vs 10.71% respectively) (p value <0.0001).Women with multi fetal pregnancy had significantly high risk of pre-eclampsia with odds ratio of 5.416(2.681 to 10.942). Our finding was similar to previous study done by Hinkosa[26] et al (p-0.04), Mishra[29] et al(p-<0.001) and Belay [42]et al ,which indicates that multiple pregnancy enhanced the odds five fold of developing preeclampsia compared to singleton pregnancy.

Proportion of women with history of PCOS was significantly higher in group A as compared to group B (50% vs 22.32% respectively). (p value <0.0001). Our finding was consistent with previous similar study done by Mishra[29] et al (increased the odds of preeclampsia by 7.55 times compared to control group resp.). In the present study, family history of pre-eclampsia immerses as an independent significant risk factor AOR 5.233 (0.84 to 32.59) respectively. in our study, women with family history of CVS had significantly high risk of preeclampsia with odds ratio of 11.245(5.368 to 23.559. Proportion of women with pre-gestational diabetes mellitus was significantly higher in group A as compared to group B (41.07% vs 5.36% respectively).Women with pre-gestational diabetes mellitus had significantly high risk of pre-eclampsia with odds ratio of 11.452(4.732 to 27.717). Our study was consistent with previous study done by Shamsi[14]et al(OR 7.36). Proportion of women with chronic hypertension was significantly higher in group A as compared to group B (48.21% vs 3.57% respectively).women with chronic hypertension had significantly high risk of pre-eclampsia with an odds ratio of 22.505(8.107 to 62.475). Our study was supported by previous similar studies done by Bilano[19] et al (AOR-7.75;95%CI 6.77-8.87), Hinkosa[26] et al (p-0.02) and Mishra[29]et al (p-<0.001). Proportion of women with mental disorders was significantly higher in group A as compared to group B. (25% vs 7.14% respectively). (p value=0.0003) our finding supported by Chunfang[43] et al study which stated that mental disorders associated with 2.12 fold increased risk of preeclampsia (95% CI 1.02-4.45). This was seen as hypothalamic-pituitary-adrenal activity, robust pathophysiological findings associated with depression and anxiety disorder, is regarded as one important mechanism for observed association between maternal psychiatric illness and preeclampsia. Proportion of women with maternal hypothyroid was significantly higher in group A as compared to group B. (56.25% vs 11.61% respectively). Our study supported by previous similar studies done by Mishra[29] et al (p-<0.001) and Jaboi[39] et al (p-0.025) which consider maternal hypothyroid as an independent significant risk factor for development of preeclampsia in present study with AOR 3.831.

In our study, the proportion of women with maternal CKD was significantly higher in group A as compared to group B. (38.39% vs 4.46% respectively). (p value <0.0001). Women with maternal CKD had significantly high risk of pre-eclampsia with odds ratio of 12.228(4.748 to 31.492). our finding was similar to previous study done by Ganesh[15] etal (p-0.04), Bilano[19] et al (AOR-2.38)

Proportion of women with autoimmune disease was significantly higher in group A as compared to group B (40.18% vs 6.25% respectively) (p value <0.0001).In our study, autoimmune disease was found to be an independent significant high-risk factor of preeclampsia with odds ratio of 5.651(0.716 to 44.63). Our study supported by previous similar study done by Mishra[29]et al(thrombophilia p-0.007 and SLE/RA p value -0.016). Distribution of history of UTI was comparable with group A and B. (No:- 75% vs 68.75% respectively, Yes:- 25% vs 31.25% respectively) (p value=0.298) our finding is in contrary with previous study done by Bilano[19] et al (AOR 1.1395%CI 1.03-1.24) but supported by similar previous study conducted by Shamsi[14]et al, however further studies are required to determine how and when this effect is larger. Distribution of smoking habit was comparable with group A and B (No:- 66.96% vs 71.43% respectively, Yes:- 33.04% vs 28.57% respectively) (p value=0.469).our finding supported by previous similar study conduct by Shamsi[14]et al (p-0.42)and Reyes[16] et al (p-0.274) as there is no significant difference among cases and control with regard to smoking habit as risk factor.

Conclusion

In the present study, we analyzed forty-three clinico-demographic risk factors of preeclampsia and a significant association was found with twenty-nine of these. The present study found seven independent predictors of preeclampsia - mental stress (PSS) , maternal hypothyroidism, family history of preeclampsia, previous history of hypertension disorder in previous pregnancy, gestational diabetes mellitus, non-veg food habit and autoimmune disorder. A risk factor-based prediction model and scoring system developed using the independent predictors has high sensitivity and specificity for preeclampsia risk prediction in a heavy antenatal OPD in resource constraint government hospitals.

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