ORIGINAL ARTICLE

Socio-Demographic and General Physical Risk Factors of Pre-Eclampsia in Pakistan

Bushra Iftikhar[1*], Syed Imran Ali Shah[2], Mirza Ameer Faizan Ali[3], Mehwish Iftikhar[1], Mehwish Rana[4]

ABSTRACT

Objective: Multiple factors are known to increase the risk of developing pre-eclampsia, a major obstetric complication, but local data are limited. The present study was conducted to determine the risk factors of pre-eclampsia in pregnant women from the local population.

Study Design: Cross-sectional study.

Place and Duration of Study: The study was carried out in Lahore, Pakistan, at University of Health Sciences and partnering institutes from 1st July 2017 to 30th October 2021.

Materials and Methods: Pregnant females with pre-eclampsia (study group, n=45) and healthy pregnant women (control group, n=45) whose gestational age was between 30-34 weeks were selected. Socio-demographic and general physical characteristics were noted. Mean ± Standard Deviation (SD) and Median ± Inter Quartile Range (IQR) were given based on normality distribution, and group comparisons were made using normality-appropriate statistical tests. Categorical variables were expressed as frequencies and percentages. The chi-square test was applied to observe an association between categorical variables. A *p*-value of < 0.05 was analyzed as significant.

Results: Pre-eclamptic women had higher mean weight (kg, 73.48±6.35 vs.70.48±5.45, *p*= 0.018) and BMI (kg/m^2, 28.8±1.42 vs. 27.5±1.48, *p* =0.000). Similarly, blood pressures (mmHg)-both systolic and diastolic were also elevated in study females (systolic 156.86±8.27 vs. 112.8±10.62, *p*=0.000; diastolic 106.9±11.66 vs. 74.0±10.27, *p*=0.000). Living in an extended family, being a housewife, less outdoor activity, insufficient dairy consumption, the prevalence of hypertension, diabetes mellitus in the family, and proteinuria and edema were significantly more frequent in the study group.

Conclusion: Multiple risk factors related to social standing, demography, and anthropometry are associated with pre-eclampsia. There is a need for social and health policies aimed at eliminating these risk factors to reduce the incidence of pre-eclampsia and related health-economic burdens in the local population.

Keywords: *Hypertension, Pre-Eclampsia, Pregnancy.*

How to cite this: *Iftikhar B, Shah SIA, Ali MAF, Iftikhar M, Rana M. Socio-Demographic and General Physical Risk Factors of Pre-Eclampsia in Pakistan. 2023; 4(3): 297-303. doi: http://doi.org/10.37185/LnS.1.1.309*

[1]*Department of Biochemistry*
Azra Naheed Medical College, Lahore, Pakistan
[2]*Department of Biochemistry*
CMH Lahore Medical College and Institute of Dentistry
Lahore, Pakistan
[3]*Department of Pathology*
Al-Aleem Medical College, Lahore, Pakistan
[4]*Department of Physiology*
Abu Umara Medical and Dental College, Lahore, Pakistan

Correspondence:
Dr. Bushra Iftikhar
Assistant Professor, Biochemistry
Azra Naheed Medical College, Lahore, Pakistan
E-mail: bushra.iftikhar14@gmail.com

Funding Source: NIL; Conflict of Interest: NIL
Received: Nov 04, 2022; Revised: Feb 05, 2023
Accepted: Mar 10, 2023

Introduction

Hypertensive disorders of pregnancy are one of the major global causes of maternal and perinatal mortality.[1] Pre-eclampsia is a pregnancy-specific hypertensive disorder characterized by persistent new-onset hypertension occurring after 20 weeks of gestation.[1] Other associated clinical manifestations include proteinuria, edema, headache, nausea, vomiting, visual disturbances, thrombocytopenia, renal insufficiency, impaired hepatic function, pulmonary edema, and shortness of breath.[1-3] The incidence of pre-eclampsia has been shown to be higher in middle- and low-income countries, with

some studies reporting women having up to a seven-fold higher risk of developing the complication in some regions.[1-2] The mortality risk associated with pre-eclampsia has been estimated to be three hundred times higher in women from underdeveloped countries compared to those from the developed world.[1] A recent study reported the incidence of pre-eclampsia in Pakistani women at 2.4%.[1] Pre-eclampsia predisposes both the mother and the fetus to a number of adverse complications, including abruption of the placenta, premature delivery, fetal cerebral bleed, low birth weight baby, and restricted growth of the fetus.[2]

Several risk factors have been attributed to the development of pre-eclampsia, such as past history of recurrent pre-eclampsia and eclampsia, family history, older maternal age at the time of conception, hypertension, diabetes mellitus, obesity, hypocalcemia, multiple pregnancies, and autoimmune or thrombotic vascular disease.[3] Local data on the risk factors of pre-eclampsia are inconsistent. There is a need to highlight the determinants of an increased risk of pre-eclampsia at the community level to mitigate the adverse outcomes associated with this multisystem disorder. The present study was conducted to determine the socio-demographic and general physical risk factors of pre-eclampsia in the local setting.

Materials and Methods

A cross-sectional comparative study design was adopted for this study. The collaborative work was carried out in Lahore, Pakistan, with partnering institutes, including the University of Health Sciences, Azra Naheed Medical College, CMH Lahore Medical College and Institute of Dentistry, Al-Aleem Medical College and Abu Amara Medical and Dental College from 1st July 2017 to 30th October 2021.

The study received approval from the ethical review committee for medical and biomedical research, University of Health Sciences, Lahore, in line with the declaration of Helsinki guidelines vide letter dated 14-08-2016. From July 2017 to October 2017, a total of 90 subjects were recruited from the gynecology units of two major public sector tertiary care hospitals (Jinnah Hospital and Lady Willingdon Hospital) in Lahore, Pakistan using non-random convenience sampling after obtaining written informed consent.

Inclusion Criteria: Pregnant females (n=45) diagnosed as cases of primigravida pre-eclampsia based on American College of Obstetricians and Gynecologists guidelines[4] having gestational age between 30 to 34 weeks were enrolled in the study group. Age-matched normotensive (systolic range 115±12mmHg, diastolic range 69±9 mmHg) primigravida pregnant females (n=45) having gestational age from 30 to 34 weeks without any signs and symptoms of urinary tract disorder /infection/proteinuria were included in the control group.

Exclusion Criteria: Subjects whose gestational age was under 30 weeks or beyond 34 weeks, with twins or multiple pregnancies, gestational diabetes, history of smoking, previously diagnosed hypertension, diabetes mellitus, neuro-endocrinological, hepatic, renal, immunological, or any other major systemic disease including malignancy, inflammatory disease; pregnancy with fetal congenital disabilities/disorders were excluded from the study.

Each participant's socio-demographic information, clinical history, and dietary habits were recorded on a specifically designed subject data sheet. A general physical examination was carried out, and findings were recorded. An automated instrument (Certeza Arm digital blood pressure monitor; model number CR-407) was used to measure the blood pressure of the enrolled subjects. Before taking the measurement, each individual was asked to be seated and relax for 5-10 minutes. Anthropometric measurements, including height and weight, were done. A stadiometer (Model: Seca 216) measured the standing height. Height was taken in centimeters and then converted to meters by dividing the obtained value in centimeters by 100. A weighing scale was used for measuring weight. Weight was measured in kilograms with minimum clothing and without shoes. All instruments were calibrated to zero before taking measurements. Weight in kilograms was divided by height in meter square to determine the body mass index.[5] Midstream urine sample was collected, and a urine dipstick test was done to estimate proteinuria.[6]

Statistical Analysis

Data recording and analysis were done using SPSS version 22.0 (statistical package for social sciences). Categorical variables were presented as frequencies and percentages. Shapiro-Wilk's statistics were used to check the normality of the data. Mean ± Standard Deviation (SD) and Median ± Inter Quartile Range (IQR) were given for normally distributed (age, weight, BMI) and non-normally distributed (gestational age, height, pulse, systolic BP, diastolic BP) quantitative variables, respectively. For comparing groups of the normally distributed data, a student t-test was applied. The Mann-Whitney U test was used to compare groups for non-normally distributed quantitative variables. To check the association between the categorical data of the two groups, the Chi-square test was applied. The chi-square value (*X*2) was expressed in numbers, and the significance level was defined in the form of probability. The chi-square X2 greater than or equal to the critical value was stated as a significant difference, and X2 less than the critical value was deemed a non-significant difference between the groups. A *p*-value of < 0.05 was considered statistically significant for all purposes.

Results

The two groups were age-matched (Table 1). Higher mean weight (kg) and BMI (kg/m^2) were observed in cases as compared to the controls (Weight 73.48±6.35 vs. 70.48±5.45, *p*= 0.018; BMI 28.8±1.42 vs. 27.5±1.48, =0.000; Table 1). Mean systolic and diastolic blood pressures (mmHg) in the study group were also higher than the control group (systolic 156.86±8.27 vs. 112.8±10.62, *p*=0.000; diastolic 106.9±11.66 vs. 74.0±10.27, *p*=0.000; Table 1).

The association of factors such as being a housewife, living in a joint family, lack of outside activity, less dairy product consumption, family history of type II diabetes and high blood pressure, and edema and proteinuria was significant with pre-eclampsia (Table 2).

Table 1: Comparison of demographic and general physical parameters between the control group and study group

Parameter	Control group (n=45)	Study group (n=45)	*P*-value
	Mean ± SD	Mean ± SD	
	Median (IQR)	Median (IQR)	
Age (years)	22.4 ± 2.85 22 (20-25)	23.5 ± 3.97 23 (20.5-26)	0.148[b]
Gestational Age (weeks)	32 ± 1.44 32 (31-33)	31.68 ± 1.32 32 (30.5-33)	0.179[a]
Height (meters)	1.6 ± 0.04 1.6 (1.57-1.65)	1.59 ± 0.04 1.6 (1.57-1.63)	0.567[a]
Weight (Kg)	70.48 ± 5.45 78 (67-74)	73.48 ± 6.35 75 (67-78)	0.018*[b]
BMI (Kg/meters^2)	27.5 ± 1.48 27.6 (26.45-28.1)	28.8 ± 1.42 28.76 (27.7-29.76)	0.000*[b]
Pulse/minute	78.3 ± 6.63 78 (73-86)	79.9 ± 7.2 78 (74.5-86)	0.320[a]
Blood pressure- Systolic (mm Hg)	112.80 ± 10.62 112 (102-123)	156.86 ± 8.27 156 (150-164)	0.000*[a]
Blood Pressure- Diastolic (mm Hg)	74.01 ± 10.27 72 (65-83)	106.9 ± 11.66 106 (96-118)	0.000*[a]

[a] *p*-value generated by Mann-Whitney U Test

[b] *p*-value generated by Independent Sample "t"-Test

**p*-value ≤ 0.05 is considered statistically significant

**X2 greater than critical value

Table 2: Comparison of frequencies of categorical variables between the two groups

Characteristics		Control group (n=45)	Study group (n=45)	Statistics	
		Frequency/ percentage	Frequency/ percentage	X^2	*P*-value
Education Level	Illiterate	12 (26.7)	13 (28.9)	3.53	0.316
	Primary	12 (26.7)	19 (42.2)		
	Secondary	19 (42.2)	12 (26.7)		
	Above	02 (4.4)	01 (2.2)		
Housewife		24 (53.3)	33 (73.3)	3.87**	0.049*
Joint Family		21 (47.8)	32 (71.1)	5.55**	0.018*
Cousin Marriage		9 (20)	13 (28.9)	0.963	0.327
Smokers		3 (6.7)	5 (11.1)	0.549	0.459
Outdoor Activity		33 (73.3)	24 (53.3)	3.87**	0.048**
Daily Dairy Product Intake		15 (32.6)	6 (13.3)	5.031**	0.025*
Family History of Pre-eclampsia		5 (11.1)	10 (22.2)	2.03	0.154
Family History of Hypertension		20 (44.4)	29(64.4)	3.629**	0.05*
Family history of Diabetes Mellitus		10 (22.2)	21 (46.7)	5.95**	0.015*
Vitamin intake		24 (53.3)	16 (35.6)	2.88	0.09
Pallor		35 (77.8)	36 (80)	0.067	0.796
Proteinuria	+	0 (0)	14 (31.1)		0.000*
	++	0 (0)	15 (33.3)		
	+++	0 (0)	16 (35.6)		
Edema		4 (8.9)	39 (86.7)	62.25**	0.000*

[a]*p*-value generated by Mann-Whitney U Test

[b]*p*-value generated by Independent Sample "t"-Test

**p*-value ≤ 0.05 is considered statistically significant

**X2 greater than critical value

Discussion

Pre-eclampsia is a menacing intricacy of pregnancy worldwide, which can be fatal for both the mother and the fetus.[7] Extremes of maternal age, multiple gestation, pre-existing diabetes, hypertension, and obesity are some of the significant health risks of pre-eclampsia.[8] In the present study, women with pre-eclampsia were found to be heavier with higher BMI than those with healthy pregnancies. This is concordant with several previous studies.[9,10] Furthermore, most of the pre-eclamptic females in the present study were housewives and had sedentary lifestyles, which could account for the higher BMI, thereby corroborating the heightened risk of pre-eclampsia associated with physical inactivity and sedentary lifestyle.[11]

The patients also had reduced outdoor activity levels, which may be interpreted as less physical activity contributing to higher BMI. Outdoor sunlight exposure is also important for cutaneous vitamin D production, which is now known to modulate a wide variety of systemic responses.[12,18] These women are thus vulnerable to vitamin D deficiency which itself has been linked with pre-eclampsia.[19,20] Low dairy product intake observed in the pre-eclamptic women suggests the possibility of inadequate calcium in the diet. Low serum calcium levels have previously been reported in pre-eclamptic women.[10,11] Most of the patients were also living in a joint family system which may indirectly increase the predisposition to pre-eclampsia due to malnutrition and compromised antenatal care.

Our data reflects that females who belong to a family having a history of hypertension and type II diabetes have a greater chance of pre-eclampsia, as has been reported previously.[21] The observed frequencies of consanguineous marriages and family history of pre-eclampsia were also higher (though not statistically significant) in the primigravida preeclampsia females compared to women with healthy pregnancies. These findings highlight the potential involvement of genetic and environmental factors that may contribute to women's increased predilection toward developing pre-eclampsia.[22] Our results did not demonstrate any difference in smoking status between pre-eclamptic patients and healthy pregnant women. Previously, studies have revealed an inverse relationship between the incidence of pre-eclampsia and smoking.[23,24] In the present work, a very negligible number of females were smokers (n=5/90) to demonstrate any such difference in smoking during pre-eclampsia. The clinical findings of edema and proteinuria were predominantly observed in pre-eclamptic primigravida females in the present study. In addition to new-onset hypertension, proteinuria, and edema are two of pre-eclampsia's most consistently seen clinical features.[25]

It was observed that most of the pregnant females visiting the government hospitals had a low socio-economic status and were not well-educated. Low socioeconomic status acts a risk factor for maternal and child health complications, including pre-eclampsia, and is associated with reduced antenatal care, unhygienic sanitary conditions, and nutritional issues, all of which contribute to the heightened risk.[26] A Mexican study reported that low socio-economic status doubled the risk of developing pre-eclampsia and eclampsia.[27] Most of the females (pregnant) enrolled in this study were anemic, possibly owing to poverty, limited awareness of a balanced diet in pregnancy and lack of proper antenatal care among others. These observations are in line with previously reported data on pregnant women.[28,29] The women with pre-eclampsia were less literate than healthy pregnant women, although the difference was not statistically significant. Literacy and health education may help improve understanding nutritional requirements during pregnancy and antenatal care to mitigate the risk of developing pre-eclampsia.

The study is limited by its cross-sectional design, which does not allow the determination of a cause-and-effect relationship between the identified multiple associated risk factors and pre-eclampsia and the condition. Moreover, the relatively small sample size also limits the generalization of the results to the larger population. Future studies with larger sample sizes and prospective designs are required to extrapolate the present study's findings.

Conclusion

In conclusion, the present study suggests that factors such as obesity, sedentary lifestyle, inadequate calcium intake, and genetic predisposition may contribute to developing pre-eclampsia. Further research is warranted to explore the interplay of these factors and their impact on the onset and progression of pre-eclampsia to develop effective preventive and management strategies. The risk factors of pre-eclampsia contribute to the maternal and child health burden of the already overwhelmed health system of a developing country like Pakistan. Creating awareness about these risk factors and adopting social strategies and health policies aimed at minimizing them may help mitigate the incidence of pre-eclampsia.

REFERENCES

1. Magee LA, Sharma S, Nathan HL, Adetoro OO, Bellad MB, Goudar S, et al. The incidence of pregnancy hypertension in India, Pakistan, Mozambique, and Nigeria: A prospective population-level analysis. PLoS medicine. 2019; 16: e1002783. doi: 10.1371/journal.pmed.1002783
2. Baker AM, Haeri S, Camargo Jr CA, Espinola JA, Stuebe AM. A nested case-control study of midgestation vitamin D deficiency and risk of severe preeclampsia. The Journal of Clinical Endocrinology & Metabolism. 2010; 95: 5105-9. doi: 10.1210/jc.2010-0996
3. Purde MT, Baumann MU, Wiedemann U, Nydegger UE, Risch L, Surbek D, et al. Incidence of preeclampsia in pregnant Swiss women. Swiss medical weekly. 2015; 145: w14175. doi: 10.4414/smw.2015.14175
4. American College of Obstetricians and Gynecologists. Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin Number 222: Gestational Hypertension and Preeclampsia. 2020;135:e237-60.Obstetrics &

Gynecology. 2020; 135: e237-e60. doi: 10.1097/AOG.0000000000003891

5. Tahir FN, Nawaz H, Sikandar MZ, Shah SIA. A comparative study of regular almond consumption's effect on lipid profile in normal, Overweight and Obese adults. The Professional Medical Journal. 2019; 26: 2116-21. doi: 10.29309/TPMJ/2019.26.12.3272
6. Wen CP, Yang YC, Tsai MK, Wen SF. Urine dipstick to detect trace proteinuria: an underused tool for an underappreciated risk marker. American Journal of Kidney Diseases. 2011; 58: 1-3. doi: 10.1053/j.ajkd.2011.05.007
7. Eiland E, Nzerue C, Faulkner M. Preeclampsia 2012. Journal of pregnancy. 2012; 2012: 586578. doi: 10.1155/2012/586578
8. Lisonkova S, Joseph KS. Incidence of preeclampsia: risk factors and outcomes associated with early-versus late-onset disease. American journal of obstetrics and gynecology. 2013; 209: 544-e1. doi: 10.1016/j.ajog.2013.08.019
9. Akhtar S, Begum S, Ferdousi S. Calcium and zinc deficiency in preeclamptic women. Journal of Bangladesh Society of Physiologist. 2011; 6: 94-9. doi: 10.3329/jbsp.v6i2.9758
10. Kanagal DV, Rajesh A, Rao K, Devi UH, Shetty H, Kumari S, et al. Levels of Serum Calcium and Magnesium in Pre-eclamptic and Normal Pregnancy: A Study from Coastal India. Journal of clinical and diagnostic research. 2014; 8: OC01-4. doi: 10.7860/JCDR/2014/8872.4537
11. Aune D, Saugstad OD, Henriksen T, Tonstad S. Physical activity and the risk of preeclampsia: A systematic review and meta-analysis. Epidemiology. 2014; 25: 331-43. doi: 10.1097/EDE.0000000000000036
12. Al-Swailmi FK, Shah SIA, Al-Mazaideh GM, Sikandar MZ. A cross-sectional analysis of serum vitamin D and immunoglobulin E in allergic disorders. Annals of Clinical and Analytical Medicine. 2021; 10: 20439. doi: 10.4328/ACAM.20439
13. Alswailmi FK, Sikandar MZ, Shah SIA. Biological roles of vitamin D and immunoglobulin E: Implications in allergic disorders. Pakistan Journal of Medical & Health Sciences. 2020; 14: 495-8.
14. Alswailmi FK, Shah SIA, Sikandar MZ, Parrey MU, Jelani S. Serum vitamin D, sun exposure and clinical atrributes of local patients with respiratory allergies. Medical Sciences. 2021; 25: 179-84.
15. Shah SIA, Iqbal S, Sikandar MZ, Qazi UY, Haq I. Serum Vitamin D and Cardiometabolic Markers: A Comparative Study in Adult Men Based on Body Mass Index. IIUM Medical Journal Malaysia. 2021; 20. doi.org/10.31436/imjm.v20i2.1640
16. Alswailmi FK, Shah SIA, Nawaz H. Immunomodulatory role of vitamin D: Clinical implications in infections and autoimmune disorders. Gomal Journal of Medical Sciences 2020; 18: 132-8. doi: 10.46903/gjms/18.03.841
17. Shah SIA. Beneficial role of vitamin D in common cancers: Is the evidence compelling enough. World Cancer Research Journal. 2020; 7: e1574. doi: 10.32113/wcrj_20205_1574
18. Iqbal S, Shah SIA, Sikandar MZ, . Relationship between serum vitamin D and insulin resistance in normal weight and overweight or obese men. The Professional Medical Journal. 2019; 26: 1810-4. doi: 10.29309/TPMJ/2019.26.11.237
19. Karpa M, Thakur S, Singh K, Sharma J, Chaudhary H. To compare serum Vitamin D status in pre-eclamptic and non-preeclamptic pregnant women in labour: A tertiary care centre study of Northern India. Clinical Journal of Obstetrics and Gynecology. 2022; 5: 13-8. doi: 10.29328/journal.cjog.1001100
20. Gholami H, Fayazi S, Shirshekan M, Motamed N, Tofighi S. Comparison of Serum level of Vitamin D in Pregnant Women with Preeclampsia and a Control Group in Ayatollah Mousavi Hospital in Zanjan. Journal of Obstetrics, Gynecology and Cancer Research. 2022; 7: 335-40. doi: 10.30699/jogcr.7.4.335
21. Qiu C, Williams MA, Leisenring WM, Sorensen TK, Frederick JO, Dempsey JC, et al. Family history of hypertension and type 2 diabetes in relation to preeclampsia risk. Hypertension. 2003; 41: 408-13. doi: 10.1161/01.HYP.0000056996.25503.F5
22. Nilsson E, Ros HS, Cnattingius S, Lichtenstein P. The importance of genetic and environmental effects for pre-eclampsia and gestational hypertension. BJOG. An International Journal of Obstetrics & Gynaecology. 2004; 111: 200-6. doi: 10.1111/j.1471-0528.2004.00042x.x
23. Wei J, Liu C, Gong T, Wu Q, Wu L. Cigarette smoking during pregnancy and preeclampsia risk: A systematic review and meta-analysis of prospective studies. oncotarget. 2015; 6: 43667-78. doi: 10.18632/oncotarget.6190
24. Alpoim PN, Godoi LC, Pinheiro MDB, Freitas LG, Carvalho MDG, Dusse LM. The unexpected beneficial role of smoking in preeclampsia. Clinica Chimica Acta. 2016; 459: 105-8. doi: 10.1016/j.cca.2016.05.030
25. Wagner LK. Diagnosis and management of preeclampsia. American family physician. 2004; 70: 2317-24.
26. Silva LM, Coolman M, Steegers EA, Jaddoe VW, Moll HA,

Hofman A, et al. Low socioeconomic status is a risk factor for preeclampsia: the Generation R Study. Journal of hypertension. 2008; 26: 1200-8. doi: 10.1097/HJH.0b013e3282fcc36e

27. Cerón-Mireles P, Harlow SD, Sanchez-Carrillo C, Núñez RM. Risk factors for pre-eclampsia/eclampsia among working women in Mexico City. Paediatric and perinatal epidemiology. 2001; 15: 40-6. doi: 10.1046/j.1365-3016.2001.00315.x
28. Mellembakken JR, Aukrust Pl, Olafsen MK, Ueland T, Hestdal K, Videm V. Activation of leukocytes during the uteroplacental passage in preeclampsia. Hypertension. 2002; 39: 155-60. doi: 10.1161/hy0102.100778
29. Akçum S, Zülfikaroğlu E, Eserdağ S, Özcan U. Plasma Calprotectin Levels in Preeclamptic Normotensive Pregnant and Nonpregnant Women. Gynecology Obstetrics & Reproductive Medicine. 2010; 16: 65-9.