OPEN ACCESS

Scholars International Journal of Obstetrics and Gynecology

Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Socio-Demographic Profile and Risk Factors Associated with Pre-eclampsia at a Tertiary Care Center: A Case-Control Study

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DOI: https://doi.org/10.36348/sijog.2025.v08i11.004 | **Received:** 13.09.2025 | **Accepted:** 10.11.2025 | **Published:** 13.11.2025

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Abstract

Background: Pre-eclampsia is a hypertensive disorder of pregnancy associated with significant maternal and fetal morbidity. Identifying socio-demographic, obstetric, and biochemical risk factors is crucial for early detection and management. ***Objective:*** This study aimed to assess the socio-demographic profile and risk factors associated with pre-eclampsia at a tertiary care center in Bangladesh. ***Methods:*** This case-control study was conducted in the Department of Obstetrics and Gynecology, Institute of Child and Mother Health (ICMH), Dhaka, Bangladesh, from March 2023 to February 2024. In this study, A total of 70 pregnant women with a gestational age of 20–40 weeks, attending the Department of Obstetrics & Gynecology, ICMH, Dhaka, during the study period, were included in this study. Among them, 35 women diagnosed with pre-eclampsia were assigned as cases, and 35 normotensive pregnant women were taken as controls. ***Results:*** Most participants were aged 18–28 years, with no significant difference in mean age between cases (26.09 ± 5.39 years) and controls (24.94 ± 4.08 years; $p = 0.321$). Educational level and occupation were comparable between groups ($p > 0.05$). Mean parity, gravidity, and gestational age were also similar ($p > 0.05$). Serum CRP levels were significantly higher among cases (25.37 ± 14.70 mg/dL) than controls (4.22 ± 0.92 mg/dL; $p < 0.001$). Significant risk factors for pre-eclampsia included family history of hypertension (37.1% vs 14.3%; $p = 0.030$), obesity (BMI ≥ 27 kg/m², 45.7% vs 22.9%; $p = 0.046$), prior history of pre-eclampsia (17.1% vs 2.9%; $p = 0.049$), and elevated CRP (≥6 mg/dL, 80% vs 0%; $p < 0.0001$). Primigravidity showed borderline significance (57.1% vs 34.3%; $p = 0.057$). ***Conclusion:*** Elevated CRP, obesity, family history of hypertension, primigravidity, and prior pre-eclampsia are important risk factors for pre-eclampsia. Early identification of these factors may aid in risk stratification and timely intervention.

Keywords: Pre-eclampsia, Risk factors, Socio-demographic profile, C-reactive protein.

INTRODUCTION

Hypertensive disorders of pregnancy remain among the leading global causes of maternal and perinatal morbidity and mortality [1]. Pre-eclampsia, a pregnancy-specific hypertensive disorder, is characterized by the new onset of persistent hypertension after 20 weeks of gestation [1]. It is often accompanied by 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 is notably higher in low- and middle-income countries, where women may face up to a sevenfold greater risk of developing the condition compared to those in developed regions [1,2]. The mortality risk is particularly alarming.

Women from underdeveloped countries have been reported to be 300 times more likely to die from pre-eclampsia than those from developed nations [1].

Pre-eclampsia is a multisystem disorder of uncertain etiology, defined by a blood pressure of ≥140/90 mmHg and the presence of proteinuria in a previously normotensive and non-proteinuric woman after the 20th week of gestation. Eclampsia represents its most severe form, characterized by generalized tonic-clonic seizures or coma in a woman with pre-eclampsia [4]. These conditions are strongly associated with adverse outcomes, including intrauterine growth restriction, preterm birth, and significant maternal and perinatal morbidity and mortality. According to the World Health Organization, approximately 70,000 maternal deaths occur worldwide each year as a result of pre-eclampsia and eclampsia [5].

Globally, the incidence of pre-eclampsia varies between 2–10%, depending on the population studied and the diagnostic criteria used, and it affects approximately 4–7% of pregnant women worldwide [6,7]. Several risk factors have been implicated in the development of pre-eclampsia, including a personal or family history of the disorder, advanced maternal age, chronic hypertension, diabetes mellitus, obesity, hypocalcemia, multiple gestation, and autoimmune or thrombotic vascular diseases [3]. Previous studies have highlighted the influence of these factors, with primiparity, obesity, and chronic hypertension being consistently identified as strong predictors. However, in many developing countries, including Bangladesh, data on the magnitude and determinants of pre-eclampsia remain limited and often inconsistent [8-11].

Given the burden of pre-eclampsia and the paucity of local evidence, there is a pressing need to identify the sociodemographic and clinical risk factors contributing to its occurrence. Therefore, the present study was conducted to assess the socio-demographic profile and risk factors associated with pre-eclampsia among pregnant women attending a tertiary care hospital.

METHODOLOGY & MATERIALS

This case-control study was conducted in the Department of Obstetrics and Gynecology, Institute of Child and Mother Health (ICMH), Dhaka, Bangladesh, from March 2023 to February 2024. In this study, A total of 70 pregnant women with a gestational age of 20–40 weeks, attending the Department of Obstetrics & Gynecology, ICMH, Dhaka, during the study period, were included in this study. Among them, 35 women diagnosed with pre-eclampsia were assigned as cases, and 35 normotensive pregnant women were taken as controls.

These were the following criteria for eligibility as study participants:

Inclusion Criteria

- Pregnant women with a gestational age of 20–40 weeks.
- Pregnant women diagnosed with pre-eclampsia, as well as normotensive, non-proteinuric pregnant women attending the Department of Obstetrics & Gynecology, ICMH, during the study period.
- Singleton pregnancy.
- Patients willing to provide informed written consent.

Exclusion Criteria

- Multiple pregnancies.
- Pregnancies complicated by chronic medical conditions, such as diabetes mellitus, renal disease, asthma, cardiac disease, chronic hypertension, or hemorrhagic disorders.
- Pregnancies with acute medical illnesses, including urinary tract infections, viral infections, tuberculosis, or other significant infections.

Data Collection Procedure:

Participant selection was conducted using purposive sampling based on predefined inclusion and exclusion criteria. The study population comprised pregnant women with a gestational age of 20–40 weeks, including both pre-eclamptic and normotensive participants, who attended the Department of Obstetrics and Gynecology, Institute of Child and Mother Health (ICMH), Dhaka, Bangladesh, during the study period.

After confirming eligibility, informed written consent was obtained from all participants. Primary data, including sociodemographic characteristics and obstetric and gynecological history, were collected through structured interviews and review of patient records. Subsequently, venous blood samples were obtained for the measurement of serum C-reactive protein (CRP) levels. Laboratory reports were recorded for both study groups for subsequent analysis. Data collection was conducted using a semi-structured, pre-tested questionnaire, incorporating history taking, physical examination, and laboratory investigations.

Statistical Analysis:

All data were recorded systematically in a pre-formatted data collection form. Continuous variables were summarized as means with standard deviations, while categorical variables were presented as frequencies and percentages. The difference between the findings were ascertained by obtaining p-values from t-test for continuous variables and from Chi-square for categorical variables. A p-value <0.05 was considered significant. Statistical analysis was performed by using SPSS 26 (Statistical Package for Social Sciences). This

study was ethically approved by the Institutional Review Board (IRB) of Institute of Child and Mother Health (ICMH), Dhaka, Bangladesh.

RESULTS

Table 1: Distribution of Respondents by Socio-demographic Characteristics (n = 70)

Variables	Cases (n=35) f (%)	Controls (n=35) f (%)	P-value
Age			
18-28	23 (65.7)	29 (82.9)	[a]0.101[ns]
29-39	12 (34.3)	6 (17.1)	
Total	35 (100.0)	35 (100.0)	
Mean±SD	26.09±5.39	24.94±4.08	[c]0.321[ns]
Mean height(cm)	154.77±3.91	152.94±3.73	[c]0.050[s]
Mean weight(kg)	67.46±9.85	57.26±9.27	[c]0.001[s]
Mean BMI (kg/m²)	28.15±4.35	24.49±4.14	[c]0.001[*]
Religion			
Islam	34 (97.1)	35 (100.0)	[a]0.314[ns]
Hindu	1 (2.9)	0 (0.0)	
Total	35 (100.0)	35 (100.0)	
Monthly income (taka)			
<20,000	17 (48.6)	24 (68.6)	[a]0.089[ns]
>20,000	18 (51.4)	11 (31.4)	
Total	35 (100.0)	35 (100.0)	
Mean±SD	18942.86±4940.48	15857.14±4215.81	[c]0.006[s]

a= Chi square test, c= independent sample-t test, ns= not significant, s= significant

Table 1 presents the comparison of key socio-demographic variables between pre-eclamptic cases and normotensive controls. The majority of participants in both groups were aged 18–28 years, comprising 65.7% of cases and 82.9% of controls, with no statistically significant difference (p = 0.101). The mean age of cases (26.09 ± 5.39 years) was slightly higher than that of controls (24.94 ± 4.08 years), though the difference was not significant (p = 0.321). Almost all participants were Muslim (97.1% of cases and 100% of controls). Monthly family income was comparatively lower among controls; 68.6% had an income below Tk. 20,000 compared to 48.6% among cases. The mean monthly income difference between groups was statistically significant (p = 0.006).

Table 2: Comparison of Participants' Education Level and Occupation Between Cases and Controls

Variables	Cases (n=35) f (%)	Controls (n=35) f (%)	P-value
Educational level			
Masters	2 (5.7)	1(2.8)	[a]0.913 [ns]
Honors	3 (8.6)	4(11.4)	
HSC	7 (20.0)	8 (22.8)	
SSC	19 (54.3)	17 (48.6)	
Primary	4 (11.4)	5 (14.3)	
Total	**35 (100.0)**	**35 (100.0)**	
Occupation			
Business person	1 (2.9)	1 (2.9)	[a]0.181[ns]
Garment worker	0 (0.0)	1 (2.9)	
Housewife	33 (94.3)	29 (82.9)	
Non-govt employee	1 (2.9)	0 (0.0)	
Student	0 (0.0)	4 (11.4)	
Total	**35 (100.0)**	**35 (100.0)**	

a= Chi square test, ns= not significant

Table 2 presents the distribution of participants according to their educational level and occupation. More than half of the respondents in both groups had completed secondary education (SSC level), accounting for 54.3% of cases and 48.6% of controls. A smaller proportion had completed higher secondary education (HSC), comprising 20.0% of cases and 22.8% of controls, while only a few participants held graduate or

postgraduate degrees. The difference in educational attainment between the two groups was not statistically significant ($p > 0.05$). Regarding occupation, the majority of participants in both groups were housewives—33 (94.3%) among the cases and 29 (82.9%) among the controls. A few participants were engaged in business or service-related occupations, and a small number of controls (11.4%) were students. The association between occupation and pre-eclampsia was not statistically significant ($p > 0.05$).

Table 3: Comparison of Obstetric Profile and Serum CRP Levels Between Cases and Controls (n = 70)

Variables	**Cases (n=35) Mean±SD**	**Controls (n=35) Mean±SD**	**P-value**
Para	1.03±1.15	1.06±1.05	$^{c}0.914^{ns}$
Gravida	2.03±1.15	2.06±1.05	$^{c}0.914^{ns}$
Gestational age (wks)	32.31±4.52	31.37±4.91	$^{c}0.407^{ns}$
Serum CRP (mg/dl)			
Mean±SD	25.37±14.70	4.22±0.92	$^{c}0.001^{s}$

c= independent sample-t test, ns= not significant, s= significant

Table 3 compares the obstetric characteristics and serum C-reactive protein (CRP) levels between pre-eclamptic cases and normotensive controls. The mean parity and gravidity were nearly identical in both groups, with no statistically significant differences ($p > 0.05$). Similarly, the mean gestational age was comparable between cases (32.31 ± 4.52 weeks) and controls (31.37 ± 4.91 weeks), indicating no significant variation. However, serum CRP levels were markedly elevated among cases (25.37 ± 14.70 mg/dL) compared to controls (4.22 ± 0.92 mg/dL), and this difference was statistically significant ($p < 0.001$).

Table 4: Distribution of Identified Risk Factors for Pre-eclampsia Among Respondents (n = 70)

Risk Factors	**Cases (n=35) f (%)**	**Controls (n=35) f (%)**	**p-value**
Family history of hypertension	13 (37.1)	5 (14.3)	$^{a}0.030^{s}$
Family history of diabetes	8 (22.9)	4 (11.4)	$^{a}0.205^{ns}$
Obesity (BMI ≥ 27 kg/m²)	16 (45.7)	8 (22.9)	$^{a}0.046^{s}$
Low socioeconomic status	17 (48.6)	10 (28.6)	$^{a}0.088^{ns}$
Primigravidity	20 (57.1)	12 (34.3)	$^{a}0.057^{s}$
History of pre-eclampsia	6 (17.1)	1 (2.9)	$^{a}0.049^{s}$
Elevated CRP (≥6 mg/dL)	28 (80.0)	0 (0.0)	$^{a}<0.0001^{s}$

a= Chi square test, c= independent sample-t test, ns= not significant, s= significant

Table 4 shows that a family history of hypertension was reported in 37.1% of cases compared to 14.3% of controls, showing a statistically significant association with pre-eclampsia ($p = 0.030$). Obesity (BMI ≥ 27 kg/m²) was observed in 45.7% of cases versus 22.9% of controls, also showing a significant relationship ($p = 0.046$). A history of pre-eclampsia was more frequent among cases (17.1%) than controls (2.9%), with a significant difference ($p = 0.049$). Other factors, including family history of diabetes and low socioeconomic status, did not reach statistical significance ($p > 0.05$). Primigravidity showed a borderline significance (57.1% in cases vs 34.3% in controls; $p = 0.057$). Notably, elevated CRP (≥6 mg/dL) was observed in 80% of cases and none of the controls, indicating a highly significant association with pre-eclampsia ($p < 0.0001$).

DISCUSSION

In the present study, most participants were between 18 and 28 years of age, and there was no significant difference in mean age between the pre-eclamptic (26.09 ± 5.39 years) and normotensive (24.94 ± 4.08 years) groups ($p = 0.321$). Educational level and occupation were also comparable between the two groups ($p > 0.05$). These findings are consistent with those of Ramesh *et al.*,[11], who reported similar age patterns among cases (21.16 years) and controls (23.56 years) and found no significant differences in education or occupation.

In this study, the majority of participants in both groups were housewives—33 (94.3%) among the cases and 29 (82.9%) among the controls. Iftikhar *et al.*, similarly observed that most pre-eclamptic women were housewives and led sedentary lifestyles, which may contribute to increased body mass index (BMI) and hence a greater risk of pre-eclampsia. This suggests that physical inactivity and sedentary behavior may play a role in disease pathogenesis [12,13].

The major risk factors identified in the present study included a family history of hypertension, obesity, a previous history of pre-eclampsia, and elevated C-reactive protein (CRP) levels. Other factors, such as a family history of diabetes and low socioeconomic status, were not statistically significant, while primigravidity showed borderline significance. Ramesh *et al.*,[11]

previously reported similar associations, highlighting age at pregnancy, low socioeconomic status, and family history of hypertension or diabetes as important predictors of pre-eclampsia, with a previous history of the condition being the most significant risk factor.

A family history of hypertension was found in 37.1% of cases and 14.3% of controls (p = 0.030), confirming a significant association. Iftikhar *et al.*, also demonstrated that women with hypertensive or diabetic family histories were more likely to develop pre-eclampsia, emphasizing a potential genetic predisposition [12,14]. In contrast, although a family history of diabetes was not significantly associated in our study, Ramesh *et al.*, reported a higher prevalence among pre-eclamptic mothers. It has been suggested that insulin resistance, which often precedes diabetes, may contribute to the pathophysiology of pre-eclampsia [15,16].

Obesity (BMI ≥ 27 kg/m²) was significantly more common among cases (45.7%) than controls (22.9%), consistent with prior studies identifying obesity as a key modifiable risk factor. Kashanian *et al.*,[17] and Tuuri *et al.*,[18] reported similar positive associations in women with BMI values above 24–28 kg/m², while Motedayen *et al.*,[19] confirmed in a systematic review and meta-analysis that increased BMI is significantly linked with pre-eclampsia.

A previous history of pre-eclampsia was observed in 17.1% of cases versus 2.9% of controls (p = 0.049), highlighting a strong recurrence tendency. Iftikhar *et al.*,[12] found similar results, suggesting both genetic and environmental contributions. Indeed, a history of pre-eclampsia in a prior pregnancy has long been recognized as one of the strongest predictors of recurrence [20–24].

Although low socioeconomic status is widely regarded as a risk factor for maternal complications due to poor nutrition, limited antenatal care, and inadequate hygiene [25], our findings did not demonstrate a significant association. A study from Mexico reported that women from low socioeconomic backgrounds had nearly twice the risk of developing pre-eclampsia and eclampsia [26], while an Australian study suggested that working women may also have an elevated risk compared to non-working women [27]. These discrepancies may reflect differences in population characteristics and healthcare accessibility.

One of the most striking findings of the present study was the strong association between elevated CRP levels (≥6 mg/dL) and pre-eclampsia. Elevated CRP was detected in 80% of cases but in none of the controls (p < 0.0001). Previous studies have identified CRP thresholds ranging from 7 to 15 mg/L as indicative of increased pre-eclampsia risk [17,28,29]. This supports the hypothesis that systemic inflammation plays a pivotal role in the pathogenesis of pre-eclampsia.

Increased maternal age has also been reported as a significant risk factor for pre-eclampsia, likely due to vascular and placental changes that occur with aging [22,30]. Conversely, younger maternal age (<20 years) has received less attention despite evidence suggesting increased susceptibility. Nulliparity is another established risk factor, with studies showing that first pregnancies double the risk of pre-eclampsia [21,31,32]. While the current study found that pre-eclampsia was 1.92 times more likely among women pregnant before 30 years, Ramesh *et al.*,[11] observed a fourfold risk among women conceiving before 20 years, consistent with findings from a retrospective study in Finland [30].

Overall, the findings of this study align closely with previous literature, reinforcing the multifactorial etiology of pre-eclampsia involving genetic, metabolic, inflammatory, and environmental determinants.

Limitations of the study

This study has several limitations. First, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to the broader population. Second, some socio-demographic and obstetric information relied on self-reported data, which may be subject to recall bias. Third, confounding factors such as dietary habits, physical activity, and environmental exposures were not controlled, which may influence the observed associations.

CONCLUSION AND RECOMMENDATIONS

The study highlights several key factors associated with pre-eclampsia among pregnant women. Elevated serum CRP, obesity, family history of hypertension, prior history of pre-eclampsia, and primigravidity were significantly more common among cases than controls. These findings underscore the importance of early identification and monitoring of at-risk women to allow timely interventions and reduce adverse maternal and fetal outcomes. Regular antenatal screening for inflammatory markers such as CRP, along with assessment of socio-demographic and obstetric risk factors, may enhance risk stratification and contribute to improved maternal healthcare in resource-limited settings.

Further study with a prospective and longitudinal study design, including a larger sample size, needs to be done to validate the findings of this study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: This study was ethically approved

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 Med. 2019;16:e1002783.
2. Baker AM, Haeri S, Camargo CA Jr, Espinola JA, Stuebe AM. A nested case-control study of midgestation vitamin D deficiency and risk of severe preeclampsia. J Clin Endocrinol Metab. 2010; 95:5105–9.
3. Purde MT, Baumann MU, Wiedemann U, Nydegger UE, Risch L, Surbek D, *et al.*,Incidence of preeclampsia in pregnant Swiss women. Swiss Med Wkly. 2015;145:w14175.
4. Dutta DC. Textbook of Obstetrics. 7th ed. London: New Central Book Agency (P) Ltd; 2011. p.219–36.
5. Sibai B, Dekker G, Kupferminc M. Preeclampsia. Lancet. 2005; 365:785–99.
6. World Health Organization International Collaborative Study of Hypertensive Disorders of Pregnancy. Geographic variation in the incidence of hypertension in pregnancy. Am J Obstet Gynecol. 1988;158(1):80–3.
7. Landau R, Irion O. Recent data on the physiopathology of preeclampsia and recommendations for treatment. Rev Med Suisse. 2005; 1:292–5.
8. Eskenazi B, Fenster L, Sidney S. A multivariate analysis of risk factors for preeclampsia. JAMA. 1991; 266:237–41.
9. Mahomed K, Williams MA, Woelk GB, Jenkins-Woelk L, Mudzamiri S, Madzime S, *et al.,* Risk factors for preeclampsia-eclampsia among Zimbabwean women: recurrence risk and familial tendency towards hypertension. J Obstet Gynaecol. 1998; 18:218–22.
10. Lee CJ, Hsieh TT, Chiu TH, Chen KC, Lo LM, Hung TH. Risk factors for preeclampsia in an Asian population. Int J Gynaecol Obstet. 2000; 70:327–33.
11. Ramesh K, Gandhi S, Rao V. Socio-demographic and other risk factors of preeclampsia at a tertiary care hospital, Karnataka: case control study. J Clin Diagn Res. 2014;8(9):JC01–3.
12. Iftikhar B, Shah SI, Ali MA, Iftikhar M, Rana M. Socio-demographic and general physical risk factors of pre-eclampsia in Pakistan. Life Sci. 2023;4(3):297–303.
13. 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.
14. 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.
15. Parretti E, Lapolla A, Dalfrà M, Pacini G, Mari A, Cioni R, *et al.*, Pre-eclampsia in lean normotensive normotolerant pregnant women can be predicted by simple insulin sensitivity indexes. Hypertension. 2006;47(3):449–53.
16. Sierra-Laguado J, Garcia RG, Celedón J, Arenas-Mantilla M, Pradilla LP, *et al.,* Determination of insulin resistance using the homeostatic model assessment (HOMA) and its relation with the risk of developing pregnancy-induced hypertension. Am J Hypertens. 2007; 20:437–42.
17. Kashanian M, Aghbali F, Mahali N. Evaluation of the diagnostic value of the first-trimester maternal serum high-sensitivity C-reactive protein level for prediction of pre-eclampsia. J Obstet Gynaecol Res. 2013;39(12):1549–54.
18. Tuuri AL, Jauhiainen MS, Tikkanen MJ, Kaaja RJ. Systolic blood pressure and fatty acid-binding protein 4 predict pregnancy-induced hypertension in overweight nulliparous women. Placenta. 2014;35(10):797–801.
19. Motedayen M, Rafiei M, Tavirani MR, Sayehmiri K, Dousti M. The relationship between body mass index and preeclampsia: a systematic review and meta-analysis. Int J Reprod Biomed. 2019; 17:463–72.
20. Nilsson E, Ros HS, Cnattingius S, Lichtenstein P. The importance of genetic and environmental effects for pre-eclampsia and gestational hypertension. BJOG. 2004; 111:200–6.
21. Hernández-Díaz S, Toh S, Cnattingius S. Risk of pre-eclampsia in first and subsequent pregnancies: prospective cohort study. BMJ. 2009;338:b2255.
22. Duckitt K, Harrington D. Risk factors for pre-eclampsia at antenatal booking: systematic review of controlled studies. BMJ. 2005; 330:565.
23. Leppälahti S, Gissler M, Mentula M, Heikinheimo O. Is teenage pregnancy an obstetric risk in a welfare society? A population-based study in Finland, from 2006 to 2011. BMJ Open. 2013;3(8):e003225.
24. Skjaerven R, Vatten LJ, Wilcox AJ, Rønning T, Irgens LM, Lie RT. Recurrence of pre-eclampsia across generations: exploring fetal and maternal genetic components in a population-based cohort. BMJ. 2005;331(7521):877.
25. 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. J Hypertens. 2008; 26:1200–8.
26. Cerón-Mireles P, Harlow SD, Sanchez-Carrillo C, Núñez RM. Risk factors for pre-eclampsia/eclampsia among working women in Mexico City. Paediatr Perinat Epidemiol. 2001; 15:40–6.
27. Najman JM, Morrison J, Williams GM, *et al.*, Unemployment and reproductive outcome: an Australian study. Br J Obstet Gynaecol. 1989; 96:308–13.
28. Ruma M, Boggess K, Moss K, Jared H, Murtha A, Beck J, *et al.*, Maternal periodontal disease, systemic inflammation, and risk for preeclampsia. Am J Obstet Gynecol. 2008;198(4):389.e1–5.

29. Cheng PJ, Huang SY, Su SY, Hsiao CH, Peng HH, Duan T. Prognostic value of cardiovascular disease risk factors measured in the first trimester on the severity of preeclampsia. Medicine (Baltimore). 2016;95(5):e2653.
30. Lamminpää R, Vehviläinen-Julkunen K, Gissler M, Heinonen S. Preeclampsia complicated by advanced maternal age: a registry-based study on primiparous women in Finland 1997–2008. BMC Pregnancy Childbirth. 2012; 12:47.
31. Conde-Agudelo A, Belizan JM. Risk factors for pre-eclampsia in a large cohort of Latin American and Caribbean women. BJOG. 2000; 107:75–83.
32. Marviel P, Touzart L, Deslandes V, *et al.,* Risk factors of pre-eclampsia in a single pregnancy. J Gynecol Obstet Biol Reprod (Paris). 2008; 37:477–82.