

Seasonal variation in the prevalence of preeclampsia

Fatemeh Janani¹, Farahnaz Changae¹

¹Social Determinants of Health Research Center, Faculty of Nursing and Midwifery, Lorestan University of Medical Sciences, Khorramabad, Iran

ABSTRACT

Introduction: Hypertension in pregnancy is one of the three factors of maternal mortality. Etiology of the disease is unknown, but the many factors contributing to the identification and control of it can be taken a step to prevent and reduce the symptoms of the disease. The purpose of this study was to determine the prevalence of preeclampsia (high-blood pressure) in different seasons of the year. **Methods:** The present retrospective cross-sectional study was conducted on more than 8,000 pregnant women visiting Assali specialized hospital from 2011 to 2013. Required data was collected through questionnaire checklist. The Chi-square test with multiple comparisons was used to compare the frequencies of pregnancy-induced hypertension (PIH) according to the month of year, and adjustment of multiplicity was conducted using Bonferroni's method. Student's *t*-test was used to compare the means of PIH prevalence rates. In all analyses, $P < 0.05$ was taken to indicate statistical significance. **Results:** In these 8000 woman admitted to labor, overall prevalence of PIH was $3.8 \pm 0.6\%$. The prevalence rate of PIH was highest in the summer (4.5%) and lowest frequent in the winter (2.7%), respectively. In July, the prevalence rate was significantly higher than those for any other month (4.7%), and in March, it was lower prevalence than for any month (2.2%), respectively. Using the Chi-square test, a significant difference between the incidence of disease was observed in summer and winter ($P < 0.001$). **Conclusion:** The prevalence rate of PIH was higher for delivery in summer and early spring and lowest for winter delivery among Khorramabad women based on these results; it seems that changes in temperature and humidity in different seasons can affect preeclampsia, and preeclampsia increases with increasing frequency temperature.

Keywords: Humidity, preeclampsia prevalence, seasonal variation, temperature

Introduction

Hypertensive disorders of pregnancy are a common problem worldwide^[1-3] and one of the three factors of maternal mortality in the reproductive age.^[4] According to studies in America, 18.2% of maternal deaths occur due to hypertensive disorders in pregnancy.^[5] Pregnancy can be a cause or aggravate hypertension.^[6]

Hypertensive disorders in pregnancy are only common types of blood pressure, preeclampsia, and eclampsia. Gestational hypertension is defined as blood pressure of 140/90 mmHg or

more. Preeclampsia is associated with proteinuria (of at least 300 mg/24 h), blood pressure with or without edema.^[7,8] Eclampsia is defined as preeclampsia with seizures or coma.^[9] Pre-eclampsia is a serious medical condition which can cause several problems and complications, including placental abruption, HELLP syndrome (hemolysis, elevated liver enzymes and thrombocytopenia), and renal failure, in different organs of the body.^[10] If not diagnosed and treated, early preeclampsia-eclampsia can become further maternal and fetal death.^[11]

Today, many risk factors for preeclampsia include previous history of the disease, early and late reproductive age pregnancy, previous vascular disease, and environmental factors.^[12] Identifying the causes of disease, in addition to reducing maternal mortality, is an important indicator of health around the world; should this disease be diagnosed in early stages, it can prevent

Address for correspondence: Dr. Farahnaz Changae, Social Determinants of Health Research Center, Faculty of Nursing and Midwifery, Lorestan University of Medical Sciences, Khorramabad, Iran.
E-mail: janani37@gmail.com

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_132_17

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Janani F, Changae F. Seasonal variation in the prevalence of preeclampsia. J Family Med Prim Care 2017;6:766-9.

further complications and high costs of treatment. Although the incidence of the disease varies in different parts of the world, environmental factors, such as temperature and humidity, and can be responsible for the incidence of 5% of this disorder all around the world.^[13] According to studies, the incidence of disease in nulliparous women (not pregnant) who received daily calcium and healthy women who have a higher socioeconomic status is lower than other people.^[14] Seasonal variation in the prevalence of pregnancy-induced hypertension (PIH) has been reported from many countries with nontropical climates including Australia,^[15] China,^[11] and Israel.^[16] Studies have shown that nutritional interventions can reduce the risk of preeclampsia.^[16] Some studies suggest that seasonal changes in preeclampsia can be mainly traced back to increasing temperature and decreasing humidity.^[17]

Methods

This study was a retrospective investigation of women with singleton pregnancies who were admitted in the Assali hospital in Khorramabad city of April 2011 to March 2013 for delivery. Questionnaire and checklist included demographic and reproductive characteristics, risk factors, health outcomes, and the expenditure for disease. The available information from the system included date of delivery, expected date of confinement, gestational age at delivery, maternal age, parity, sex of newborn, birth weight, live birth/stillbirth, type of delivery, use of assisted reproductive techniques, and maternal complications such as eclampsia, PIH (including gestational hypertension and preeclampsia). Data collection was done by the researcher and colleagues after permission from the hospital authorities and the legal process. Data analysis used descriptive statistics and was analyzed using SPSS software (IBM, Armonk, NY, United States of America). The Chi-square test with multiple comparisons was used to compare the frequencies of PIH according to month of year and adjustment of multiplicity was conducted using Bonferroni's method. Student's *t*-test was used to compare the means of PIH prevalence rates. In all analyses, $P < 0.05$ was taken to indicate statistical significance.

Results

Out of 8000 studied subjects, 346 patients, the data of 319 individuals of whom was reviewed and analyzed and 27 cases were excluded because of incomplete data, were diagnosed with pre-eclampsia. The results showed that the mean age of the samples was 28.2 ± 12 years. Based on the findings of the present study, women aged 35 years or older were extremely frequent and women with normal pregnancy and those suffering from the studied disorder differed significantly in terms of following factors: preterm birth, low birth weight infant, nulliparity, male infant and stillbirth. Although the majority of studied pregnant women were literate or college educated, 26.7% were either poorly educated or had not attended college. 22% were employed and moderately independent in terms of economics and 87% of them were husband employed, with a household income over 3000 \$. Demographic characteristics are shown in Table 1.

Most nulliparous women (prime gravida), and only 13.4% were grand multipara (more than four pregnancies). More than 60% have a vaginal delivery. Nearly 58% of cases were male sex fetus and 42% were female. Almost 13.5% of fetuses or infants had died. The mean birth weight was 2850 ± 730 g. The mean duration of hospitalization due to illness was 5 ± 3 days. Medical expenses including insurance contributions were from 145 to 200 \$ in vaginal birth and 250–600 \$ in caesarean section. Furthermore, 32% of patients were delivered by cesarean section [Table 2].

Results showed that the prevalence rate of preeclampsia was a change in different seasons and temperature. In this study, the prevalence rate of preeclampsia was highest among women with deliveries in summer and the most frequent in July (4.7%) and August (4.5%). The prevalence rate of PIH was lowest among women with deliveries in winter and between different months of March (2.7%) with the use of Chi-square test, significant

Table 1: Demographic characteristics Patients

	Frequency	Percent
Age		
<20	134	42
20-35	64	20
>35	121	38
Literacy		
Illiterate (or less than Diploma)	83	26
Literate	236	74
Income(\$)		
<3000	42	13
>3000	277	87
Employ		
No employ	249	78
Employ	70	22
Socio-economic statuses		
Low	58	18
Moderate	207	65
High	54	17

Table 2: Reproductive characteristics

	Non preeclampsia	Preeclampsia	P
Prime para	3980 (52%)	200 (62.7%)	<0.0001
Age (years)	29.8±12	28.6±5.4	<0.0001
≥35	2143 (27.9%)	118 (37.1%)	<0.0001
Mean of GA at delivery	38.2±2.7	36.1±3.7	<0.0001
<37	9490 (12.4%)	136 (42.7%)	<0.0001
<34	390 (5.1%)	65 (20.5%)	<0.0001
Birth weight	2.881±567	2.326±822	<0.0001
<2500 g	5485 (16.7%)	144 (52.4%)	<0.0001
<1500 g	252 (3.3%)	58 (18.3%)	<0.0001
Infant sex			
Male	3904 (51.6%)	185 (58%)	<0.0001
Female	3750 (48.4%)	134 (52%)	<0.0001
Stillbirth	6 (0.8%)	4 (1.2%)	<0.0001
Type of delivery			<0.0001
Vaginal	3448 (45%)	198 (62.2%)	<0.0001
C/S	4206 (55%)	121 (38.8%)	<0.0001

Table 3: Prevalence rate of preeclampsia in different seasons & month

Season & Month	Prevalence in 2011-12	Prevalence in 2012-13
Spring		
Apr	4.1%	3.8%
May	4%	3.9%
Jun	4.2%	3.8%
Summer		
Jul	4.6%	4.8%
Aug	4.6%	4.4%
Sep	4.3%	4.1%
Autumn		
Oct	3.8%	3.9%
Nov	3.7%	3.7%
Dec	3.8%	3.8%
Winter		
Jan	3.3%	3.2%
Feb	2.5%	2.5%
Mar	2.3%	2.2%

difference between the incidence of disease was observed in summer and winter ($P < 0.001$). The difference of prevalence rate between July and August and other months was confirmed with the Chi-square test with Bonferroni's method [Table 3].

Discussion

The purpose of this study was to determine the seasonal changes of preeclampsia. The results show a higher frequency of preeclampsia in the summer when the weather is warmer, and the humidity is too low. A study by Ali *et al.* in this area, with consistent results. In their study, the highest incidence of preeclampsia in summer and in June the high temperatures and humidity levels were low.^[18] In other studies including a study by Morikawa *et al.* found different results, as the prevalence rate of PIH was higher for delivery in winter and early spring and lowest for summer delivery among Japanese women.^[19] As stated before, environmental factors and climate may affect disease and this might be the main cause of difference between findings of various studies.^[17]

The results of Elongi *et al.* (2011) study were, also, compatible with what the present research yielded. According to their study, the incidence rate of preeclampsia are 6% and 13% in cold and hot seasons of the year.^[20] Other studies, including Wellington *et al.* (2012) and Pitakkarnkul *et al.* (2011) researches have achieved different results and the lowest occurrence of pre-eclampsia has turned out to be in warm seasons.^[11,16] Since the fluctuation of the incidence rate of preeclampsia was observed in, almost, all studies, it seems that environmental factors, such as air temperature and humidity, are quite effective; however, further studies are required to determine how and when this effect is larger.

Conclusion

The results of this study were consistent with those studies that introduced preeclampsia as a dangerous and highly morbid

condition for mother and fetus. We recommend for sick women threatened by preeclampsia to pay close attention to the time of delivery in order to reduce the risk of Maternal and infant mortality. In addition to reducing maternal and child mortality, taking required measures helps pregnant women feel safe and enjoy a healthy motherhood. One important limitation of the present study was the removal of several cases due to insufficient data.

Acknowledgment

Hereby, our deepest gratitude goes to the staffs of Lorestan University of Medical Sciences, Haj Karim Assali Specialized Hospital, participating subjects, and all those who collaborated in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Allen R, Rogozinska E, Sivarajasingam P, Khan KS, Thangaratinam S. Effect of diet-and lifestyle-based metabolic risk-modifying interventions on preeclampsia: A meta-analysis. *Acta Obstet Gynecol Scand* 2014;93:973-85.
- Chaiworapongsa T, Chaemsaitong P, Korzeniewski SJ, Yeo L, Romero R. Pre-eclampsia part 2: Prediction, prevention and management. *Nat Rev Nephrol* 2014;10:531-40.
- Winer N, Tsasaris V. Latest developments: Management and treatment of preeclampsia. *J Gynecol Obstet Biol Reprod (Paris)* 2008;37:5-15.
- Landau R, Irion O. Recent data on the physiopathology of preeclampsia and recommendations for treatment. *Rev Med Suisse* 2005;1:290, 292-5.
- Gul A, Cebeci A, Aslan H, Polat I, Ozdemir A, Ceylan Y, *et al.* Perinatal outcomes in severe preeclampsia-eclampsia with and without HELLP syndrome. *Gynecol Obstet Invest* 2005;59:113-8.
- Phillips JK, Bernstein IM, Mongeon JA, Badger GJ. Seasonal variation in preeclampsia based on timing of conception. *Obstet Gynecol* 2004;104:1015-20.
- Yackerson NS, Piura B, Friger M. The influence of weather state on the incidence of preeclampsia and placental abruption in semi-arid areas. *Clin Exp Obstet Gynecol* 2007;34:27-30.
- Bodnar LM, Catov JM, Roberts JM. Racial/ethnic differences in the monthly variation of preeclampsia incidence. *Am J Obstet Gynecol* 2007;196:324.e1-5.
- Subramaniam V. Seasonal variation in the incidence of preeclampsia and eclampsia in tropical climatic conditions. *BMC Womens Health* 2007;7:18.
- Immink A, Scherjon S, Wolterbeek R, Steyn DW. Seasonal influence on the admittance of pre-eclampsia patients in Tygerberg Hospital. *Acta Obstet Gynecol Scand* 2008;87:36-42.
- Wellington K, Mulla ZD. Seasonal trend in the occurrence of preeclampsia and eclampsia in texas. *Am J Hypertens* 2012;25:115-9.

12. Anya SE. Seasonal variation in the risk and causes of maternal death in the Gambia: Malaria appears to be an important factor. *Am J Trop Med Hyg* 2004;70:510-3.
13. Kalichava DG, Chkhaidze TK. Correlation between frequency of gestosis onset and the change of seasonal biorhythms and diagnostic value of dopplerometry. *Georgian Med News* 2006;(138):62-5.
14. Brunelli VB, Prefumo F. Quality of first trimester risk prediction models for pre-eclampsia: A systematic review. *BJOG* 2015;122:904-14.
15. Melo B, Amorim M, Katz L, Coutinho I, Figueiroa JN. Hypertension, pregnancy and weather: Is seasonality involved? *Rev Assoc Med Bras* 2014;60:105-10.
16. Pitakkarnkul S, Phalopprakarn C, Wiriyasirivaj B, Manusirivithaya S, Tangjitgamol S. Seasonal variation in the prevalence of preeclampsia. *J Med Assoc Thai* 2011;94:1293-8.
17. Magnus P, Eskild A. Seasonal variation in the occurrence of pre-eclampsia. *BJOG* 2001;108:1116-9.
18. Ali AA, Adam GK, Abdallah TM. Seasonal variation and hypertensive disorders of pregnancy in eastern sudan. *J Obstet Gynaecol* 2015;35:153-4.
19. Morikawa M, Yamada T, Yamada T, Cho K, Sato S, Minakami H, *et al.* Seasonal variation in the prevalence of pregnancy-induced hypertension in Japanese women. *J Obstet Gynaecol Res* 2014;40:926-31.
20. Elongi JP, Tandu B, Spitz B, Verdonck F. Influence of the seasonal variation on the prevalence of pre-eclampsia in Kinshasa. *Gynecol Obstet Fertil* 2011;39:132-5.