ORIGINAL ARTICLE

EFFECT OF CLIMATE CHANGE ON THE PREVALENCE OF HYPERTENSIVE DISORDERS IN PREGNANCY AND ITS COMPLICATIONS

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Background: The impact of climate change on a number of diseases, in particular hypertensive disorders in pregnancy (HDP), has become a major public health concern. The objective of this study was to determine the Effect of climate change on the prevalence of Hypertensive disorders in pregnancy and its complications. **Methods:** The current retrospective cross-sectional study was carried out at the department of obstetrics and gynaecology, Aga Khan secondary hospital, Hyderabad from 2019 to 2023 after taking permission from the ethical committee of the institute. Data was collected by reviewing hospital records of the patients delivered during the study period. Seasonal changes included in the study were extremes of weather, including summer (May, June, July, august) and Winter (Nov, Dec, Jan, Feb), the extreme temperature during these months, and the temperature on the day the patients presented to our hospital were recorded from the data taken from the Regional Meteorological department, Karachi. The collected data were analyzed by SPSS-26. Frequency and percentages were calculated for booking status, PIH, Pre-eclampsia, mode of delivery, seasonality, and foetal outcomes. **Results:** In the current retrospective study, the medical records of 15928 pregnant women were reviewed from 2019 to 2023 to the determine hypertensive disorders in pregnancy in the department of obstetrics and gynaecology, Aga Khan secondary hospital, Hyderabad. The overall prevalence of hypertension was 932 (5.85%). Pregnancy-Induced Hypertension was found to be the most prevalent condition, affecting 57% of the total study population followed by Preeclampsia 42.90%. Out of the total participants 686 (73.59%) underwent caesarean sections while 246 (26.41%) had normal vaginal deliveries**.** The participants were categorized based on their exposure to varying climatic conditions, particularly seasonal temperature fluctuations. Hypertensive disorders were more common in summer season as compared to winter season during the study period. **Conclusion:** The current study concluded that the prevalence of hypertension disorders and the problems they cause during pregnancy have been significantly affected by climate change.

Keywords: Climate change; Hypertensive disorders in pregnancy; Preeclampsia

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INTRODUCTION

Preeclampsia and gestational hypertension are the two forms of hypertensive diseases of pregnancy that are a significant cause of morbidity and death for both the mother and the foetus.[1] The pathogenesis of preeclampsia has been suggested to be caused by abnormal placental implantation with reduced placental perfusion, which is characterized by oxidative stress and the production of inflammatory cytokines. However, the exact cause of preeclampsia is still primarily unidentified.[2] Primiparity, multifetal gestation, persistent hypertension, a personal or family history of preeclampsia, gestational diabetes mellitus (GDM), and thrombophilia are risk factors for hypertensive diseases during pregnancy.[3] Along with the risk factors listed above, environmental variables are also likely to contribute to the pathophysiology of HDP. Studies have looked at seasonal variations in HDP prevalence in an effort to better understand environmental risk factors for HDP.[4] Research on the seasonal variation of prenatal blood pressure and HDP5, has shown contrasting results[,.5-6] Our review of the literature found a great deal of variation in research on the seasonality of HDP, with more cases of HDP occurring in winter in countries with primarily cold climates and PIH and pre-eclampsia occurring in summer in locations with more moderate climates.[7-8] Hyderabad is situated in Pakistan's south-east, in the south central part of Sind province. The city has two distinct

seasons: summer and winter. Hyderabad's climate is defined by lengthy, hot summers that span from mid-April to late-June and a pleasant winter that typically lasts from December to February. In addition to serving the medical requirements of residents from Hyderabad and its surrounding regions, Aga Khan Secondary Hospital has 85 beds and performs about 5000 deliveries a year. It also accepts referrals from other medical facilities located in rural Sind. Therefore, the current study was carried out to find out the effect of seasonal change in the prevalence of hypertensive disorders of pregnancy and its complications in women presented at Aga Khan maternal and childcare hospital.

MATERIAL AND METHODS

The current retrospective cross-sectional study was carried out at the department of obstetrics and gynaecology, Aga Khan secondary hospital, Hyderabad from 2019 to 2023 after taking permission from the ethical committee of the institute. Data was collected by reviewing hospital records of the patients delivered during the study period. Random sampling technique was used and the sample size was calculated through WHO calculator. Individuals presented with hypertensive disorders of pregnancy, presenting after 20 weeks of gestation during the study period were included while Patient with multiple pregnancy, with preexisting hypertension, cardiovascular disease, diabetes mellitus, renal disease, metabolic diseases, and systemic lupus erythematosus were excluded. Patient fulfilling the inclusion criteria were enrolled and the information including demographic data, including age, weight, height, BMI, address, gestational age at delivery, were recorded. Maternal outcomes were included maternal complications like pre-eclampsia, eclampsia, HELLP syndrome, gestational diabetes, preterm delivery and referral to tertiary care for ICU and maternal death. Mode of delivery and type of labour (spontaneous or induced) were included. Birth and fetal variables studied were conditioned at birth (live birth/ still birth), APGAR score, foetal sex, foetal weight in grams and gestation age at birth were recorded. Seasonal changes included in the study were extremes of weather, including summer (May, June, July, august) and Winter (Nov, Dec, Jan, Feb), the extreme temperature during these months, and the temperature on the day the patients presented to our hospital were recorded from the data taken from the Regional Meteorological department, Karachi.

The collected data were analyzed by SPSS software version 26. The descriptive statistics were analyzed and generated with a 95% confidence interval. Mean/Median ±SD were calculated for age, parity, gestational age, BMI. Frequency and percentages were calculated for booking status, PIH, Pre-eclampsia, mode of delivery, seasonality, and foetal outcomes. Multivariate logistic regression were applied to control explanatory variables 5% level of significance.

RESULTS

In the current retrospective study, the medical records of 15928 pregnant women were reviewed from 2019 to 2023 to the determine hypertensive disorders in pregnancy in the department of obstetrics and gynaecology, Aga Khan secondary hospital, Hyderabad. The overall prevalence of hypertension was 932 (5.85%). Pregnancy-Induced Hypertension was found to be the most prevalent condition, affecting 57 % of the total study population followed by Preeclampsia 42.90%. Out of the total participants 686(73.59%) underwent caesarean sections while 246(26.41%) had normal vaginal deliveries as presented in table 1. The participants were categorized based on their exposure to varying climatic conditions, particularly seasonal temperature fluctuations. During the summer of 2019, 1695 deliveries were reviewed. 27% of them were normal deliveries, and 72% were Caesarean sections. Of these, 7% had overall hypertension, 5.91 percent had pregnancy-induced hypertension, and 3% had pre-eclampsia. The overall incidence of hypertensive disorders decreased in the winter as presented in table 2. 73 percent of the 1496 deliveries that were examined in the summer of 2020 were caesarean sections, whereas 26% of them were normal deliveries. 9% of these deliveries had hypertension, 4 percent had pregnancy-induced hypertension, and 5 percent had pre-eclampsia but these disorders were not very common in winter season as given in table 3. In 2021, there were 5% of cases of overall hypertension, 3% of cases of pregnancy-induced hypertension, and 1% of cases of pre-eclampsia in the summer while in winter these cases were decreased. (Table 4.) The study assessed 1572 deliveries in the summer of 2022, of which 74% were caesarean sections and 25% were normal deliveries. 8.5% of these had overall hypertension, 4.4% had pregnancy-induced hypertension, and 4.1% had pre-eclampsia. Similarly, as table 5 illustrates, the percentage of births and hypertensive problems decreased throughout the winter. Similar results of hypertensive disorders in the pregnant women were observed in the summer and winter seasons of 2023 and 2024 as presented in table 6.

Table-1: Over all Prevalence of Hypertensive Disorders in Pregnancy N= 15928

Parameter	Frequency	Percentage
Total Hypertension Cases	932	(5.58%)
Pre-eclampsia	400	(42.90%)
PIH (Pregnancy-Induced Hypertension	532	(57.10%)
LSCS (Caesarean Sections)	686	(73.59%)
NVD (Normal Vaginal Delivery)	246	(26.41%)

Table-2: Prevalence rate of Hypertensive Disorders in from summer 2019 to winter 2020

Parameter	Summer (May–Aug 2019)	Winter (Nov 2019–Feb 2020)
Total Deliveries	**1695**	**1723**
Total Hypertension Cases	120 (7.08%)	73 (4.23%)
- Pre-eclampsia	49 (3.89%)	20 (1.37%)
- PIH (Pregnancy-Induced Hypertension)	71 (5.91%)	53 (3.65%)
LSCS (Caesarean Sections)	87 (72.50%)	56 (76.71%)
NVD (Normal Vaginal Delivery)	33 (27.50%)	17 (23.29%)

Table-3: Prevalence rate of Hypertensive Disorders in from summer 2020 to winter 2021

Parameter	Summer 2020	Winter (Nov 2020–Feb 2021)
Total Deliveries	**1496**	**1655**
Total Hypertension Cases	149 (9.96%)	55 (3.33%)
- Pre-eclampsia	86 (5.75%)	30 (1.81%)
- PIH (Pregnancy-Induced Hypertension)	63 (4.21%)	25 (1.51%)
LSCS (Caesarean Sections)	109 (73.15%)	40 (72.73%)
NVD (Normal Vaginal Delivery)	40 (26.85%)	15 (27.27%)

Table-4: Prevalence rate of Hypertensive Disorders in from summer 2021 to winter 2021

Parameter	Summer 2021 (May–Aug)	Winter 2021 (Nov–Feb)
Total Deliveries	**1660**	**1695**
Total Hypertension Cases	85 (5.12%)	65 (3.83%)
- Pre-eclampsia	32 (1.93%)	18 (1.06%)
- PIH (Pregnancy-Induced Hypertension)	53 (3.19%)	47 (2.77%)
LSCS (Caesarean Sections)	62 (72.94%)	52 (80%)
NVD (Normal Vaginal Delivery)	23 (27.06%)	13 (20%)

Table-5: Prevalence rate of Hypertensive Disorders in from summer 2022 to winter 2022-2023

Parameter	Summer 2022 (May–Aug)	Winter 2022–2023 (Nov–Feb)
Total Deliveries	1572	1521
Total Hypertension Cases	135 (8.59%)	70 (4.60%)
- Pre-eclampsia	65 (4.13%)	30 (1.97%)
- PIH (Pregnancy-Induced Hypertension)	70 (4.45%)	40 (2.63%)
LSCS (Caesarean Sections)	100 (74.07%)	50 (71.43%)
NVD (Normal Vaginal Delivery)	35 (25.93%)	20 (28.57%)

Table-6: Prevalence rate of Hypertensive Disorders in from summer 2023 to winter 2023-2024

Parameter	Summer 2023 (May–Aug)	Winter 2023–2024 (Nov–Feb)
Total Deliveries	1423	1488
Total Hypertension Cases	120 (8.44%)	60 (4.04%)
- Pre-eclampsia	50 (3.51%)	20 (1.34%)
- PIH (Pregnancy-Induced Hypertension)	70 (4.91%)	40 (2.68%)
LSCS (Caesarean Sections)	85 (70.83%)	45 (75%)
NVD (Normal Vaginal Delivery)	35 (29.17%)	15 (25%)

DISCUSSION

Pregnancy-induced hypertension and preeclampsia, and are among the hypertensive disorders in pregnancy (HDP) that are becoming more common due to climate change, according to the study's findings. These diseases seemed to have become more common as a result of changing climatic circumstances, harsh weather, and rising global temperatures, which eventually affected the health of both mothers and foetuses.[9] According to the findings, preeclampsia is more common in the summer whenever temperatures are higher. Research conducted in this area by Ali *et al*[10] with confirmed results. According to their research, preeclampsia was most common in the summer, when temperatures were high and humidity was low in June. According to other studies, such as a study by Morikawa *et al*[11], the prevalence rate of hypertensive disorders among

Japanese women was lowest during the summer and highest during the winter and early spring. These findings are not similar to our study. Furthermore, the findings of the current study were consistent with those of the Elongi *et al*. (2011) study. According to their research, the incidence rates of preeclampsia throughout the year's cold and hot seasons are 6% and 13%, respectively.[12] Other studies, such as Wellington *et al*[13] & Pitakkarnkul *et al*[14] have produced varying findings, with the warm seasons showing the lowest incidence of pre-eclampsia and pregnancy induced hypertension. The relationship between exposure to heat & blood pressure dysregulation was one noteworthy finding. Long-term exposure to high temperatures during pregnancy raised the risk of hypertension in pregnant women, potentially as a result of dehydration, elevated circulatory strain, and systemic inflammation. A recognized predisposing factor to hypertension disorders, endothelial dysfunction may have been made worse by the physiological stress brought on by extreme heat.[15] It appears that environmental variables like air temperature and humidity are highly effective since variations in the incidence rate of hypertensive disorders were noted in nearly all studies. The results of the study reinforced the substantial influence of climate change on the incidence and consequences of hypertension problems during pregnancy. Extreme weather events, air pollution, and rising temperatures all seemed to enhance the hazards for both mothers and foetuses. In a time of climate ambiguity, protecting mother and newborn health required addressing these environmental issues through legislative measures and medical interventions.

CONCLUSION

The current study concluded that the prevalence of hypertension disorders and the problems they cause during pregnancy have been significantly affected by climate change. Extreme weather events and higher temperatures have been associated with a higher incidence of preeclampsia and gestational hypertension, which can have a negative impact on both the mother and the foetus.

AUTHORS' CONTRIBUTION

SU, PM: Concept, literature search, write-up. H, MK, RA, P: Data collection, data analysis, data interpretation, proof reading.

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