Prevalence and Associated Risk Factors of Gestational Hypertension Among Pregnant Women in Iraq

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Abstract

Background: Gestational hypertension is one of the most prevalent pregnancy-related complications and poses significant risks to maternal and fetal health. The purpose of this study is to determine the prevalence of gestational hypertension in Iraqi pregnant women and to examine potential risk factors for its occurrence.

Materials and Methods: This case-control research comprised 200 pregnant women in total (114 with normal blood pressure and 86 with gestational hypertension). During their prenatal clinic appointments, eligible participants were recruited using a non-random (convenience) sampling technique. Blood pressure and BMI were evaluated, and a systematic questionnaire was used to gather medical and personal information. With a significance level of $p < 0.05$, descriptive statistics, the Chi-square test, the t-test, and binary logistic regression were used in the analysis of the data using SPSS.

Results: Gestational hypertension was identified in 43% of the study population, which is a relatively high rate that highlights the critical importance of treating this illness in basic healthcare programs. Significant correlations between prenatal hypertension and a number of characteristics, such as maternal age, gestational age, BMI, parity, and a family history of hypertension, were found by statistical analysis. However, there was no significant correlation found between the condition and characteristics like educational attainment, history of miscarriage, gestational diabetes, area of living (rural versus urban), or usage of hormonal contraceptives.

Conclusion: The results imply that obesity are important modifiable factors that contribute to the development of gestational hypertension. Thus, the study highlights the importance of prompt treatment interventions, frequent medical follow-up, and health education as effective preventive measures, especially for high-risk women. The study suggests that in order to improve generalizability and gain a deeper understanding of the factors impacting this condition in pregnant women, larger, more representative samples from different parts of Iraq should be used in future research.

Keywords: Gestational hypertension, Blood pressure, Body mass index, Parity

1. Introduction

A frequent pregnancy complication that puts the health of both the mother and the fetus at grave danger is gestational hypertension (GH). To differentiate it from preeclampsia and other hypertensive disorders of pregnancy, it is defined as new-onset hypertension that develops after 20 weeks of gestation without the presence of proteinuria. About 3–10% of pregnancies worldwide are affected by hypertension disorders, which continue to be one of the main causes of maternal morbidity and mortality(Shi et al., 2021). The frequency and risk factors of gestational hypertension are influenced by regional and population-specific differences in genetics, lifestyle, healthcare quality, and socioeconomic conditions. Despite the paucity of research on gestational hypertension in Iraq, what is known indicates that pregnant women are increasingly dealing with hypertensive issues, which is a sign of more significant regional and global issues (Mahmood et al., 2025).A recent local study revealed high incidence of diabetes and gestational hypertension, underscoring the need for improved screening and maternal health education programs (Alkhateeb et al., 2024).

Numerous risk factors have been closely associated with the beginning of gestational hypertension. Older moms have been consistently linked to increased risk in a number of demographics (Dietl & Farthmann, 2015).Obesity and a high body mass index (BMI) prior to or during pregnancy are additional important modifiable variables(Ganie et al., 2020).Additionally, it has been found that parity influences risk; primiparous women are more likely to be at risk than multiparous women, most likely due to immunological and physiological adaptation mechanisms(Owiredu et al., 2012) .A family history of hypertension is another significant non-modifiable risk factor for the development of gestational hypertension(Adepoju et al., 2021).Other variables, such smoking, numerous pregnancies, and chronic illnesses, have been investigated but exhibit differing levels of correlation in different research (McKillion et al., 2021).

Hypertension had a family history of both conditions, The risk of gestational hypertension and diabetes is greatly increased by advanced mother age, poor attendance at prenatal care, sedentary lifestyle, and unhealthy eating patterns (Mahmood et al., 2025).

A secondary study of the WHO Multicountry Survey on pre-eclampsia, eclampsia, and unfavorable maternal and perinatal outcomes Abalos et al., 2014. demonstrates that a significant portion of maternal mortality worldwide are caused by HDP, which includes gestational hypertension. Pre-eclampsia and other hypertensive disorders of pregnancy epidemiology provides definitions and illustrates how HDP complicates approximately 5–10% of pregnancies worldwide (Abalos et al., 2014).

Pathogenesis and Mechanisms. The involvement of oxidative stress, angiogenesis, and imbalances in factors like VEGF, among others, in vascular disease and angiogenesis. These pertain to the processes that underlie hypertension diseases. (Note: GH + sFlt-1 + PlGF, as your paragraph indicates, is not specifically mentioned in the sources I found in my search; you might need a special publication on GH mechanisms, although the literature on preeclampsia mechanisms frequently cites those (Gruslin & Lemyre, 2011).

Regional variances and worldwide prevalence. A prospective population-level investigation of the prevalence of pregnant hypertension in Nigeria, Pakistan, India, and Mozambique reveals that it is common in a number of low- and middle-income nations. Global, regional, and national epidemiological patterns of maternal hypertensive disorders of pregnancy BMC provide variations among regions and changes with time(Wang et al., 2021).

The impact of prenatal care on maternal and fetal outcomes in women with hypertensive disorders of pregnancy reveals links between HDP and unfavorable fetal outcomes (preterm,

low birth weight, etc.). Although the focus is on preeclampsia, the prognosis for newborns following the mother's condition also discusses risks such as IUGR, preterm birth, and perinatal death, which are frequently comparable to or overlap with risks associated with gestational hypertension if it worsens. Additionally, The likelihood of poor maternal outcomes with HDP is indicated by the prevalence of hypertensive disorders of pregnancy at or after 39 weeks (Barbosa et al., 2015).
Risk factors and determinants that can be changed. Risk variables like maternal age and parity are included in the prevalence of pregnant hypertension in Nigeria, Pakistan,India, and Mozambique. Trends in epidemiological Age and sociodemographic variables are associated with (BMC, global/regional) (Umesawa & Kobashi, 2017). Iraq and the surrounding area There were no Iraq-specific studies (Al-Khazraji, Ali, etc.) in this set of sources that I could quote from Google Scholar that I had confirmed. In contrast, the Middle East and North Africa (MENA) A scoping study of the prevalence of pre-eclampsia in women in the Middle East provides definitions, regional prevalence, and other information (Hegazy et al., 2024). At 14% of all maternal deaths worldwide, hypertensive disorders of pregnancy (HDPs) rank among the top direct causes of maternal mortality. Between 4 and 25% of people worldwide are thought to have HDPs, with LMICs having the highest incidence (Dzakpasu et al., 2024).

PREGNANCY'S NORMAL PHYSIOLOGICAL RESPONSE

Hemodynamic adaptations and metabolic demand increase significantly during pregnancy, a dynamic process that varies by trimester and returns to normal during the postpartum phase (Fig. 1). During pregnancy, the main changes in maternal hemodynamics are a decrease in systemic vascular resistance and an increase in cardiac output and plasma volume. Pregnancy is frequently seen as a physiological stress test due to these quick and dynamic changes, as inadequate responses lead to sickness and mortality in both the mother and the fetus (Mustafa et al., 2012).

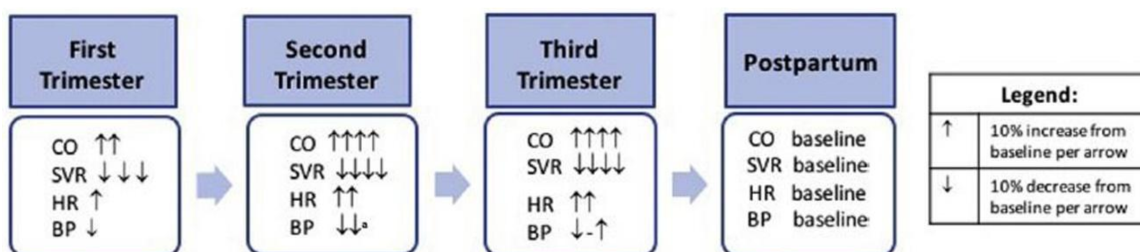

Figure 1: Hormonal vasodilation (progesterone, estrogen, and relaxin) lowers systemic vascular resistance in the early stages of pregnancy, which lowers blood pressure and increases renal flow

pregnancy-related alterations in hemodynamics. A At 18.6 weeks, the blood pressure nadir was attained. SVR is for systemic vascular resistance; HR stands for heart rate; CO for cardiac output; and BP for blood pressure.
There is a about 10% general drop in blood pressure throughout the first trimester, which lasts from conception to 13 weeks and 6 days of gestation. Around week five of pregnancy marks the onset of significant vasodilation of the peripheral vasculature, which is partly brought on

by increases in progesterone and estrogen levels. Furthermore, the level of relaxin in the blood rises and reaches its maximum around the end of the first trimester. A peptide hormone called relaxin has a vasodilatory effect that is dependent on the endothelium and leads to increased generation of nitric oxide (Fisher et al., 2002).
As a result of these modifications, blood pressure and systemic vascular resistance significantly drop, and by the end of the first trimester, renal flow and glomerular filtration rates rise by 50%. Other hemodynamic modifications in the mother occur to maintain appropriate blood pressure in this situation. Both maternal and sympathetic baroreceptor sensitivity are elevated. Furthermore, the activation of the renin-angiotensin-aldosterone system results in an increase in heart rate and cardiac output, which counteracts the loss of salt and water due to renal vasodilatation (Lumbers & Pringle, 2014).
There is a plateau in the lowering of systemic vascular resistance during the second trimester, which is 14–27 weeks and 6 days of gestation. This is because, after the uteroplacental circulation is established, relaxin falls to an intermediate value, creating a sink of low vascular resistance. Furthermore, whereas cardiac output continues to rise to 45% above baseline by 24 weeks, arterial pressures decrease during the second trimester. After 20 weeks of pregnancy, excessive sympathetic activity is believed to be linked to preeclampsia or gestational hypertension.
Around week five of pregnancy marks the onset of significant vasodilation of the peripheral vasculature, which is partly brought on by increases in progesterone and estrogen levels. Furthermore, the level of relaxin in the blood rises and reaches its maximum around the end of the first trimester. A peptide hormone called relaxin has a vasodilatory action that is dependent on the endothelium and leads to increased generation of nitric oxide (Fisher et al., 2002).
By the conclusion of the first trimester, these alterations lead to a 50% rise in renal flow and glomerular filtration rates, as well as a considerable drop in blood pressure and systemic vascular resistance. In this situation, extra maternal hemodynamic adjustments occur to maintain appropriate blood pressure. Both maternal baroreceptor sensitivity and sympathetic sensitivity are elevated. Furthermore, an increase in heart rate and cardiac output results from the activation of the renin-angiotensin-aldosterone system, which counteracts the salt and water loss caused by renal vasodilatation (Lumbers & Pringle, 2014).
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From 28 weeks and 0 days of gestation until delivery, the third trimester lasts. Early in the third trimester, cardiac output peaks, and blood pressure starts to rise again to its starting point. Furthermore, at 30 to 34 weeks, the ratio of plasma volume to red cell mass peaks, causing physiologic anemia. Improved placental perfusion to support the developing fetus is made possible by the resulting drop in blood viscosity, which also lessens flow resistance. Furthermore, short term, plasma volume rises to 50% higher than nonpregnant levels, providing a buffer against blood loss after delivery.
The late third trimester is when heart rate peaks, rising 20% to 25% over baseline. Systolic and diastolic blood pressure can rise by an extra 15% to 25% and 10% to 15%, respectively, during

vigorous labor. Early labor increases cardiac output by 15%, while the active phase increases it by 25% (Mustafa et al., 2012).

In order to ascertain the prevalence of gestational hypertension and its risk factors among Iraqi pregnant women, this study was conducted.

2. Materials and Methods

2.1 Study Design and Participants

We split the 200 pregnant women in our case-control study into two groups: 114 pregnant women with normotension (controls) and 86 pregnant women with gestational hypertension (cases). It can be formulated Similar epidemiological studies ... are in line with this methodology hypertension problems during pregnancy are in line with this methodology.

2.2 Inclusion and exclusion criteria

Eligibility criteria were used to select the women in both groups. Singleton pregnancy, gestational age ≥ 20 weeks, and the lack of prenatal chronic hypertension were among the inclusion criteria. Multiple pregnancies, diabetic mellitus, pre-existing renal disease, and other systemic disorders were among the exclusion criteria.

2.3Data collection

Both groups' participants were chosen according to predetermined qualifying requirements. A singleton pregnancy, a gestational age of at least 20 weeks, and the lack of chronic hypertension during pregnancy were the requirements for inclusion. Pre-existing renal illness, diabetes mellitus, numerous pregnancies, and other systemic medical disorders were among the exclusion criteria.

2.4Anthropometric and Clinical Measurements

Blood Pressure Measurement: After the participant had rested for at least five minutes, a standardized sphygmomanometer (or an automated device) was used to measure blood pressure on the right arm at heart level. The average of the two values was collected after two readings were taken five minutes apart.

Body Mass Index (BMI): Standard methods (light clothing, no shoes) were used to measure height and weight. Weight in kilograms divided by height in meters squared (kg/m2) was used to compute BMI. In accordance with the methods employed in earlier case-control studies of hypertensive problems in pregnancy, baseline BMI was calculated from prepreg Nancy or early-pregnancy weight.

Analysis of Statistics

Participant characteristics were summarized using descriptive statistics, such as means, standard deviations, frequencies, and percentages. To compare case and control groups, the chi-square test was utilized for categorical data and the student's t-test for continuous variables. After controlling for pertinent confounders, logistic regression analysis was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for the relationship between blood pressure, BMI, and other putative risk variables and gestational hypertension. Statistical significance was defined as a p-value of less than 0.05.

2.4Measurements clinical

Blood pressure was measured using a standardized sphygmomanometer (or automated device) on the right arm at heart level after the participant had rested for at least five minutes. Two readings were taken five minutes apart, and the average was noted, Body Mass Index (BMI):

Weight and height were assessed using normal protocols (e.g., light clothing and no shoes). Weight in kilograms divided by height in meters squared (kg/m2) was used to compute BMI. In accordance with methods used in other case-control studies on pregnancy-related hypertension diseases, baseline BMI was calculated using pre-pregnancy or early pregnant weight.

2.5 Statistical analysis

The characteristics of the participants were summarized using descriptive statistics, such as means, standard deviations, frequencies, and percentages. The Student's t-test for continuous variables and the chi-square test for categorical variables were used to compare the case and control groups. After controlling for relevant confounders, logistic regression analysis was used to determine odds ratios (ORs) and 95% confidence intervals (CIs) for the relationship between blood pressure, BMI, and other risk variables and gestational hypertension. P-values less than 0.05 were regarded as statistically significant.

3. Results

The Table 3.1. characterization of the medical history based on the questionnaire that was made is demonstrated in Table 3.2. The odds of the risk factors of gestational hypertension are demonstrated in Table 3.3.

Table 3.1: Clinical and demographic details of research subjects

Parameter	Hypertensive (N=86) Mean ±SD	Normotensive (N=114) Mean ±SD	P value
Maternal age (year)	28.7± 6.8	25.4±5.5	0.002
First pregnancy age (year)	22.5±5.9	20.8±3.9	0.03
Gestational age (months)	6.3±1.8	6.0±2.0	0.21
BMI (Kg/m^2)	27.9±3.8	22.1±3.6	0.001 >
Systolic blood pressure (mmHg)	12.5±138.6	118.9±6.2	0.001 >
Diastolic blood pressure (mmHg)	88.4±7.5	78.7±5.6	0.001 >

BMI: Body mass index, N: Number of subjects, SD: Standard deviation. Indicates that women with hypertension had considerably higher blood pressure and BMI ($p < 0.001$).“”

Table 3.2: The research participants' medical histories

Parameter		**Hypertensive (N=86) Frequency (%)**	**normotensive (N=114) Frequency (%)**
Family history of GDM		(31.4%)27	36(31.6)
Family history of DM		44 (46.3)	51 (53.7)
History of taking contraceptives		(45.3%) 39	41 (36%)
History of cesarean section	Yes	43 (50.0)	51 (44.7)
History of abortions	Yes	34 (39.5%)	42 (36.8%)
History of maternal hypertension	Yes	34 (41.4)	43 (58.9)
History of hypertension in previous pregnancy	Yes	32(37.2%)	30 (26.3)
Parity	Non	(22.1%)19	29(25.4%)
	Only one	11(12.8%)	22 (19.3%)

	Two	17 (19.8%)	23(20.2%)
	Three	23 (26.7)	24 (21.1%)
	More than three	16 (18.6%)	16 (14.0%)
Trimester	First	7 (8.1%)	16 (14.0%)
	Second	35 (40.7%)	43 (37.7%)
	Third	44 (51.2)	55 (48.3%)
Level of education	Illiterate	25 (29.1%)	34 (29.8%)
	Primary school	31 (36.0%)	39 (34.2%)
	Secondary school	18 (20.9%)	26(22.8%)
	College	12 (14.0%)	15 (13.2%)
Residency	Urban	55 (43.7%)	71 (56.3%)
	Rural	33(38.4%)	45(39.5%)

GDM: Gestational diabetes mellitus, N: Number of subjects.

Table 3.3: The link between gestational hypertension and medical history

Parameter	Chi square	Odds ratio	P value
Family history of GDM	0.29	1.08	0. 7 6
Family history of DM	0.84	1.12	0.36
History of taking contraceptives	4.15	1.89	0.04
History of cesarean section	0.14	1.17	0.52
History of abortions	0.69	1.23	0.41
History of maternal hypertension	4.95	1.98	0.03
History of hypertension in previous pregnancy	5.24	2.01	0.02
Parity	18.4	……….	0.001
Trimester	1.12	……….	0.29
Level of education	1.55	……….	0.68
Residency	0.22	1.09	0.64

GDM: Gestational diabetes mellitus, DM: Diabetes mellitus.

4. Discussion

Compared to many other publications in the literature, our study's 43% prevalence of gestational hypertension is noticeably higher, The critical need for targeted prevention and treatment strategies in primary maternity care facilities. Routine prenatal care should include early screening, health education, and risk-based monitoring to identify high-risk mothers and take appropriate action (Umesawa & Kobashi, 2017).

We discovered that age was a major predictor of gestational hypertension and that the mean maternal age of hypertensive women was substantially greater (28.7 years) than that of normotensive women (25.4). This is in line with earlier research showing that older or more mature mothers are more likely to experience hypertensive problems during pregnancy, potentially through mechanisms linked to endothelial dysfunction, elevated oxidative stress, and the gradual accumulation of vascular damage (Tanner et al., 2019). After controlling for confounders, some research, however, reveals weak or erratic correlations (for example, older

women's pregnancies frequently parallel greater BMI or comorbidities)(Wang et al., 2021).Our findings indicate that people with hypertension
We found that the mean BMI of hypertensive women was approximately 27.9 kg/m², while that of normotensives was approximately 22.1 kg/m² ($p = 0.001$). This is in line with several research that indicate maternal overweight/obesity as a significant risk factor. In multivariate models, BMI before or during the first trimester of pregnancy is really one of the best indicators of prenatal hypertension or preeclampsia.
Adding BMI categories to prediction models even enhanced classification more than many other factors, according to one study (Pavlidou et al., 2023). The study found that 43% of women had a diagnosis of gestational hypertension, a significant incidence that highlights the critical need for focused interventions in primary maternity care settings. Maternal age, gestational age, BMI, parity, and a positive family history of hypertension were found to be significant risk factors for the illness using statistical analysis. These findings are in line with other research that found comparable correlations; for instance, Wu et al. stressed the relevance of a family history of hypertension, while Musa et al. highlighted the role of parity in hypertensive problems during pregnancy. The use of hormonal contraceptives, history of gestational diabetes, educational attainment, residential location (rural vs. urban), and history of miscarriage, on the other hand, did not significantly correlate with gestational hypertension. These results are consistent with the findings of Kahsay et al., who found little to no correlation between gestational hypertensive diseases and sociodemographic or reproductive history variables(Zhuang et al., 2019).
The mechanisms underlying hypertensive diseases include insulin resistance, altered vascular reactivity, endothelial dysfunction, and systemic inflammation, all of which are facilitated by excess adiposity (Lewandowska et al., 2020). In our data, parity and gestational hypertension were highly correlated ($\chi^2 = 18.4$, $p = 0.001$). Nulliparity (first pregnancy) is a known risk factor for hypertensive diseases, according to certain research, while multiparity can occasionally have protective or modifying effects, or it can increase the risk in grand multiparas.
However, the association's direction can differ depending on the population. For example, great multiparity itself may involve concerns of vascular stress or alterations in uterine perfusion in high parity populations. Maternal age, the time between pregnancies, and the maternal vascular reserve may all interact with parity to affect risk(Grodzinsky & Schmidt, 2020). We discovered significant relationships ($OR \sim 1.98$, $p \sim 0.03$) between gestational hypertension and maternal or familial history of hypertension. This is consistent with data from epidemiologic and genetic research that demonstrate an increased risk of hypertensive problems during pregnancy in those with a positive family history of preeclampsia or hypertension. The physiologic explanation could be endothelial dysfunction, renal salt management, or a hereditary propensity for vascular reactivity (Pavlidou et al., 2023).

Non-significant variables include reproductive history and sociodemographics.

In contrast, factors such as place of residence (urban vs rural), educational level**,** history of gestational diabetes**,** prior miscarriage/abortion, and hormonal contraceptive use did not show significant associations in our study.Many prior studies likewise report weak or inconsistent associations between socio-demographic variables (education, residence) and hypertensive disorders once biological risk factors are accounted for.Regarding gestational diabetes (GDM), some meta-analyses suggest a moderate association between GDM and later hypertension, though not always specifically with gestational hypertension (Liu et al., 2024). Previous abortions or miscarriages have not been well examined and might not have a direct impact on vascular adaptation during pregnancy. Non-significance in our data is conceivable since the history of contraceptive use is contentious; whereas some research suggest hormonal effects

on vascular tone, many do not discover robust relationships after adjustment. According to our research, the percentage of hypertensive women varies by educational attainment: 40.8% are illiterate, 47.8% have completed elementary school, 37.5% have completed secondary school, and 45.5% have completed college. There is no correlation between chi square education and gestational hypertension (Chi square 0.29, p value 0.76).
This finding is comparable to that of a Japanese study that looked at the mediators of the relationship between blood pressure in the early and mid-pregnancy stages of Japanese women and educational attainment as a status indicator. They discovered that the group with less education had higher diastolic (low vs. high, difference = 0.74 mmHg) and systolic (low vs. high, difference = 2.39 mmHg) blood pressure levels. early in pregnancy All three educational groups showed a decrease in blood pressure in the middle of pregnancy, and there was no correlation between educational attainment and pregnancy-induced hypertension. Compared to the mid- or high-education groups, the low-education group of Japanese women had greater blood pressure during pregnancy. The relationship between educational attainment and blood pressure is mediated by pre-pregnancy BMI (Rognmo et al., 2013). Despite the fact that there were slightly more hypertensive women in urban areas than in rural ones, our analysis revealed clear trends in the distribution of hypertensive disorders by residency, with 43.7% of cases occurring in urban areas and 41.9% in rural areas (Chi square 0.29, odd ratio 1.08 Table 3.3). Residency was not linked to gestational hypertension and was not a significant parameter. This study's findings are comparable to those of a Ghanaian study on the differences in blood pressure and pregnancy-induced hypertension between rural and urban areas. Higher mean blood pressure and PIH were seen in Ghana's urban areas . The study's overall findings support the notion that the main factors influencing gestational hypertension are maternal age, obesity, and family background. Preventive measures should use antenatal counseling and early screening to target modifiable risk factors(van Middendorp et al., 2013).

5. Conclusion

The high frequency of gestational hypertension among pregnant Iraqi women indicates the need for improved preventive measures, even though it is still widespread.
To lower maternal morbidity, specific health education and prenatal care initiatives must address Modifiable risk factors include poor stress management, unhealthy eating habits, low levels of physical activity, and obesity. In this study, a sample of Iraqi women was examined for a number of possible risk factors for gestational hypertension. The case and control groups did not differ significantly in terms of gestational age or trimester, but the mother's age and parity There was a notable discrepancy between the mother's body mass index and her history of hypertension. Along with the other characteristics evaluated, there was no significant correlation between gestational hypertension and abortion, caesarean sections, residency, educational attainment, family history of diabetes mellitus, or history of gestational diabetes mellitus. Working together with bigger cohorts and a variety of demographics can improve the findings' generalizability and advance our understanding of the variables affecting gestational hypertension in Iraqi women.

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