Original Research Article

Risk Factors Associated with Pregnancy Induced Hypertension in the Hohoe Municipality of Ghana

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Abstract

Background: Pregnancy-induced hypertension develops as a result of pregnancy and generally regresses after delivery. This study determined the risk factors associated with Pregnancy-induced hypertension among pregnant women attending antenatal care clinic at the Hohoe Municipal hospital.

Methods: An unmatched case-control study involving 108 cases and 108 controls were recruited from the Antenatal care clinic. Face-to-face interviews using a pre-tested semi-structure questionnaire was used to collect information from the pregnant women. Information on blood pressure and other clinical measurements was extracted from the maternal health record book. Chi square test and Logistic regression were used to determine the association and strength of association between risk factors and Pregnancy-induced hypertension. A p-value <0.05 was declared significant.

Results: Advanced maternal age of 35-39 years, consumption of trans fatty food, a family history of hypertension and history of previous pre-term delivery were found to be significantly associated with Pregnancy-induced hypertension (AOR 3.53, p=0.048), (AOR= 4.43, p< 0.001), (AOR= 3.42, p=0.012) and (AOR= 5.14, p=0.017) respectively.

Conclusion: Maternal age, high consumption of trans fatty food, a family history of hypertension and history of previous pre-term delivery were factors found to be associated with of pregnancy-induced hypertension. Health educational programmes on causes of Pregnancy-induced hypertension need to be intensified.

Abbreviations: HDP: Hypertensive Disorders of Pregnancy; **BP:** Blood Pressure; **PIH:** Pregnancy Induced Hypertension; **HIV:** Human Immunodeficiency Virus; **WHO:** World Health Organization; **UNICEF:** United Nations International Children's Emergency Fund; **SSA:** Sub-Saharan Africa; **BMI:** Body Mass Index; **GHS:** Ghana Health Service; **GSS:** Ghana Statistical Service; **MOH:** Ministry of Health; **IUGR:** Intra-Uterine Growth Restriction; **SIDS:** Sudden Infant Death Syndrome; **ANC:** Antenatal Clinic; **GH:** Gestational Hypertension; **PE:** Preeclampsia; **UNESCO:** United Nations Educational Scientific and Cultural Organization; **LDL:** Low-density lipotrotein; **ACOG:** American Congress of Obstetricians and Gynaecologists; **HMH:** Hohoe Municipal Hospital; **MoH:** Ministry of Health; **GHS:** Ghana Health Service; **ERC:** Ethics Review Committee; **JHS:** Junior High School; **SHS:** Senior High School; **ISSHP:** International Society for the Study of Hypertension in Pregnancy

INTRODUCTION

Pregnancy-induced hypertension (PIH) is defined as the elevation of the blood pressure to ≥140/90 mm Hg with or without proteinuria, which emerges after 20 weeks of gestation and normally resolves by 12 weeks postpartum [1,2]. It increases the likelihood of progression into preeclampsia or adverse pregnancy outcome such as premature delivery [3].

Preeclampsia and eclampsia happen to be the commonest complication of pregnancy in Sub-Saharan Africa (SSA) with over 50% pregnant women being affected [4]. According to the World Health Organization (WHO), of all the hypertensive disorders of pregnancy, preeclampsia was also found to have

an adverse impact on maternal and neonatal health with no definite treatment except for the termination of pregnancy/expulsion of the foetus [5]. Of the 99% maternal deaths occurring in developing countries, especially Africa, PIH was found to be a major cause of maternal mortality [5,6]. Preeclampsia affects 2-8% of all pregnancies worldwide causing about one-third of maternal deaths with over 6 million perinatal deaths and 8 million preterm births [7-10].

Despite the recognition of preeclampsia in ancient times, it was not found to be significant until the late 1800s when an association between hypertension, edema, proteinuria, and eclampsia was established [11]. The pathogenesis was not fully understood but was thought to be associated with placental

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disturbance in the early periods of pregnancy, with subsequent inflammation and progressive damage [5].

Complications arising from PIH could affect both the mother and the baby. Complications affecting the mother include renal failure, liver failure and neurological sequelae [12], while potential complications to the fetus include preterm birth, respiratory distress syndrome, and fetal growth restriction [13].

Although the cause of PIH remains unknown, some risk factors such as nulliparity, a history of preeclampsia, diabetes mellitus, renal disease, obesity, severe anemia, malaria and HIV have been reported to be associated with this complication [14-20]. Advance in maternal age was also found to be a risk factor of PIH [21,22]. Women between the ages of 13 and 16 were found to be at risk of PIH likewise women age 35 or more [14,23].

A two-stage model which was developed to explain the mechanisms of PIH revealed that abnormal implantation, reduced placental perfusion and subsequent vascular remodeling interacts with maternal constituents (genetic, behavioral, or environmental) leading to the maternal syndrome [24,25]. In Ghana, PIH is identified as one of the commonest cause of pregnancy complications with 7.0% incidence rate of preeclampsia [26]. In the Hohoe Municipality, there is no available data on PIH. This study was set out to determine risk factors associated with PIH among pregnant women attending antenatal care (ANC) at the Hohoe Municipal Hospital (HMH).

MATERIALS AND METHODS

Study area

The study was carried out at the Hohoe Municipal Hospital (HMH) in the Hohoe Municipality which is one of the 25 administrative districts/Municipalities in the Volta Region. The Municipality shares boundaries with the Republic of Togo to the east, Jasikan district to the north, Kpando district to the west, and Afadjato-South district to the south. The municipality has one hundred and two communities with a projected population of 167,687 from the 2010 National Population and Housing Census. The municipality has been divided into seven sub-Municipalities namely; Akpafu/Santokofi, Alavanyo, Agumatsa, Lolobi, Gbi-Rural, Likpe and Hohoe sub-Municipality. There 21 health facilities including a hospital, 14 health centers and 7 CHPS compounds. The HMH has a 178-bed capacity, serving as the referral point for the clinics within and outside the Municipality. Focused ANC services are provided on daily basis at the hospital.

Study population

The study population was pregnant women aged between 17-45 years attending Antenatal Clinic (ANC) at the Hohoe Municipal hospital (HMH) in February 2017. Pregnant women with hypertension within the gestational age of ≥ 20-42 weeks with or without proteinuria were included as cases and those without hypertension with gestational age ≥ 20 weeks and consented to participate were included as controls. Pregnant women whose gestational age were less than 20 weeks and were seriously ill requiring hospital admission or did not consent to participate were excluded from the study. Also, pregnant women less than 17 years and more than 45 years were also excluded from the study.

Study Design

The study was an unmatched case-control study involving pregnant women with gestation 20 weeks and above. Those with PIH were recruited as cases and those without PIH as controls. Information was collected using face-to-face interviews with a pre-tested semi-structured questionnaire. Information collected included background characteristics, socio-economic and lifestyle of the pregnant women.

Information was specifically collected on the consumption of industrial trans fatty foods (artificial fats) such as biscuits, pies, cakes, doughnut and crackers. Information on clinical measurements such as blood pressure (BP), blood glucose and haemoglobin level was extracted from the maternal health record book.

Sample Size Determination

Sample size was determined by using OpenEpi, Version 3, open source calculator--SSCC with the assumption that, n = sample size for cases, 80% power, for 0.05 significance level and equal number of cases and controls (The Odds ratio of control must be less than or equal to 1, assume OR =0.35 and $Pcase$exp = 24.9%, n = 108. Therefore, the minimum number of participants was 216 (108 cases, 108 controls).

Sampling

Participants (cases) were recruited based on blood pressure readings extracted from their maternal health record book for their previous and current visit. These blood pressure readings were recorded at the ANC while the participants were still pregnant. A sampling frame was then obtained from the anternatal care register for all pregnant women who attended clinic the same day and did not have any indication of PIH. Simple random sampling by ballot was then used to select a control for each case from the sampling frame obtained.

Data Collection Procedure

Data was collected by midwives who were recruited from the hospital and trained. Face to face interviews using the pre-tested questionnaire was used to collect information on demographic characteristics, family history of hypertension and diabetes, dietary habit and history of pre-term deliveries. Data on Blood pressure, haemoglobin levels and blood glucose were extracted from the maternal health record book.

Definitions

Gestational hypertension as defined by WHO as having systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg, measured on two occasions at least four hours apart, after 20 weeks of gestation in a previously normotensive woman.

Figure 1. Questionnaire

BACKGROUND INFORMATION

1. Name of respondent: _____
2. Area of residence: _____
3. Age (years): _____
4. Educational background:
   (1) No education (2) Primary education
   (3) JHS (4) SHS (5) Tertiary
5. Occupation: _____
6. How many hours do you work?
7. Marital status:
   (1) Single (2) Married
   (3) Divorced/separate
8. How many children do you have?
9. Gravidity: _____

MATERNAL HEALTH

10. Weight (Kg): _____
11. Height (m): _____
12. Blood pressure reading:
    a) Previous visit: _____
    b) Current visit: _____
    Have you had any miscarriages?
    (1) Yes (2) No *If no skip to Q15*
13. If yes, how many? _____
    Have you heard any still births?
    (1) Yes (2) No *If no skip to Q17*
14. If yes how many? _____
15. Have you had any induced abortion?
    (1) Yes (2) No *If no skip to Q19*
16. If yes, how many? _____
17. Have you had any abortion?
    (1) Yes (2) No *If no skip to Q21*
18. If yes, how many? _____
19. Have you had any preterm delivery?
    (1) Yes (2) No *If no skip to Q23*
20. If yes, how many? _____
21. How old is this pregnancy (weeks)?
22. How many months pregnant were you
    when you first visited the antenatal clinic
    for this pregnancy?
23. How many times have you received
    antenatal care for this pregnancy?
24. Are you a known hypertensive?
    (1) Yes (2) No
25. Have you noticed any signs of pregnancy
    complications so far?
    (1) Yes (2) No *If no skip to Q29*
26. If yes, what complications: _____
27. Have you changed husbands before this
    pregnancy?   (1) Yes   (2) No

Do you have any of these? Tick all that apply

28. Hypertension   (1) Yes   (2) No
29. Diabetes(1) Yes   (2) No
30. Cardiac disease   (1) Yes   (2) No
31. Renal disease   (1) Yes   (2) No
32. Anaemia(1) Yes   (2) No
33. Have you ever been diagnosed of any
    before this pregnancy? (1) Yes   (2) No
    if no skip to Q37
34. If yes, which _____
35. When was the first time you were
    diagnosed of this condition?
36. Has a medical practitioner diagnosed you to
    have of condition at moment? (1) Yes (2) No
    if no skip to Q40
37. If yes, which? _____
38. Have you ever been on contraceptives? (1)
    Yes (2) No *if no skip to Q42*
39. If yes, which? _____

NUTRITION LIFESTYLE

40. Do you eat fatty food such as sweets, gum,
    fried chicken, potato chips, ice cream, salty
    snacks, doughnuts, cakes, pie, "kelewele",
    sugary drinks and fried rice regularly? (1)
    Yes   (2) No
41. How is your salt consumption? (1) No salt
    (2) moderate amount (3) High amount
42. Do you exercise? (1) Yes (2) No *if no, skip to
    Q46*
43. If yes, how often do you exercise?
44. Do you currently smoke? (1) Yes   (2) No
45. Do you currently drink alcohol?
    (1) Yes (2) No

FAMILY HISTORY OF DISEASES

Do you have any of these? Tick all that apply

46. Diabetes   (1) Yes   (2) No
47. Hypertension   (1) Yes   (2) No
48. Cardiac disease   (1) Yes   (2) No
49. Renal disease   (1) Yes   (2) No
50. Sickle cell disease(1) Yes   (2) No
51. Has any relative of yours been diagnosed
    with pregnancy-induced hypertension?
             (1) Yes   (2) No

Does any relative or relation

52. Smoke?   (1) Yes   (2) No
53. Drink alcohol?   (1) Yes   (2) No

These criteria plus the presence of proteinuria (defined as two or more dipstick readings of ≥2+, one catheter sample reading of ≥1+, or a 24-hour urine collection containing at least 300 mg of protein) were used to identify women with PIH which is in accordance with the criteria of the International Society for the Study of Hypertension in Pregnancy (ISSHP) and American Congress of Obstetricians and Gynaecologists (ACOG).

Maternal educational level was categorized according to the UNESCO International Standard Classification of Educational level into one of five level; No education (0 years), Primary education (1-5 years), Lower secondary education (7-9 years or 'JHS' in Ghana), Upper secondary education (10-12 years or 'SHS' in Ghana), and Post-secondary/ Tertiary education (more than 12 years).

Trans fatty food as defined by [27] is a type of fat that is created when hydrogen is added to the chemical structure of a fat, typically vegetable oil to prevent it from going bad. This fat increases the low-density lipoprotein (LDL) cholesterol in the blood. Naturally occurring trans fatty foods are cheese, milk, cream, lamb, pork and beef. Industrial trans fatty foods (artificial fats) are baked foods like biscuits, pies, cakes, doughnut and crackers.

Data Analysis

Data collected were checked for consistency, coded and entered using Epi Data 3.1 software. Data were cleaned and transferred to STATA version 14.1 for analysis. The frequency distributions in the maternal socio-demographic, medical and obstetric histories were compared between cases and controls. Means of continuous variables (age of women) were determined using t-test. Chi-square test to determine association between dependent (PIH) and independent variables (level of education, marital status, smoking, alcohol intake etc.) between cases and controls. Univariate and multivariate logistic regression analysis were used to determine the strength of the association between dependent and independent variables. The effect was considered significant if the p-value was less than 0.05.

Ethical Issues

Ethical approval was obtained from the Ministry of Health/ Ghana Health Service (MoH/GHS) Ethics Review Committee (ERC) with approval number (GHS-ERC: 14/03/2017). Before commencement of the study, permission was sought from the HMH. A written informed consent was obtained from each recruited participant. It was explained to them that the study would not cause any physical pain or harm to them. They were also informed that, their information would be used for the purposes of research only and that, published findings would not reveal their identity. Participants were also informed that, the study was voluntary, and they were at liberty to withdraw from the study and were assured that, should they decide not to participate, it would not affect their future access to hospital services in any way. In this study, all eligible participants who were approached were willing and consented to participate.

RESULTS

Demographic characteristics of respondents

A total of 216 pregnant women (respondents) were recruited for the study, with 108 cases and 108 controls. The overall mean age was 28.5±11.9 years. The mean age of the cases and controls were 29.72±6.5 years and 27.22±5.6 years respectively.

With respect to education, 14.4% had no formal education, of which 16.7% were cases and 13 12.0% were controls. A little less than half (46.3%) attained Junior High School (JHS) level of education with 42.6% cases and 50.0% controls. Respondents who had attained Senior High School (SHS) level education were 12.5%, comprising 14.8% cases and 10.2% controls. Respondents who attained tertiary level education were 9.7%, out of which 7.4% were cases with the remaining 12.0% being controls.

Out of the 216 respondents, 29.6% were traders of which 29.6% were cases and 29.6% were controls. Farmers formed (23.2%of the total number of respondents, of which 29.6% were cases and 16.7% controls. Respondents who were artisans were 14.8%, out of which 13.0% were cases and 16.7% controls. Those who were civil servants were 13.0% for both cases and controls. A substantial proportion of the respondents 19.4% were, however, unemployed with 14.8% cases and 24.0% controls.

A significant proportion of the respondents 64.4% were married, of which 27.8% were cases and 56.5% were controls (Table 1).

Association between demographic factors and pregnancy induced hypertension

Table 2 shows that, there was a significant association between maternal age, marital status and PIH (χ^2 =9.76, p=0.045) and (χ^2 =8.89, p=0.012) respectively. It was found that a family history of hypertension and a family history of diabetes independently had a significant association with PIH (χ^2 =25.99, p<0.001) and (χ^2 =16.47, p<0.001) respectively. Association between a family history of PIH and PIH was also significant (χ^2 =5.06, p=0.024). Those who reported that fat was a major part of their diets were significantly associated with PIH (χ^2 =25.97, p<0.001). History of previous preterm delivery was significantly associated with PIH (χ^2 = 6.41, p= 0.041).

Risk factors of pregnancy induced hypertension

Pregnant women who consumed high amounts of trans fatty food were 4.42 times more likely to develop PIH as compared to those who did not and the effect was statistically significant (AOR = 4.42; 95% CI = 2.25-8.66; p<0.001).

Pregnant women with a family history of hypertension were 4.41 times more likely to develop PIH and the effect was statistically significant (AOR = 4.41; 95% CI = 1.83-10.58; p= 0.001). Pregnant women with a history of previous preterm delivery were 4.66 times more likely to develop PIH and the effect was also statistically significant (AOR = 4.66; 95% CI = 1.37-

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15.86; p=0.014).

DISCUSSION

Pregnancy-induced hypertension (PIH) complicates many pregnancies, especially in the developing world. The cause of this condition is not clear. Several studies have therefore sought to evaluate the risk factors of PIH in different parts of the world. Some risk factors have been commonly reported in the developed world while others are common to the developing countries. Since the cause of PIH is not clear, primary prevention largely depends on the identification of its risk factors. This study, therefore, sought to identify the risk factors of PIH in the Hohoe Municipality.

In this study, women with a family history of hypertension were at a significantly increased risk of developing PIH. This corroborates with other epidemiological studies in which a family history of chronic hypertension was reported as an independent risk factor for PIH [19]. Additionally, history of previous preterm delivery was found to be a significant risk factor in this study. Several studies have maintained that PIH, intra uterine growth restriction (IUGR), and preterm delivery are overlapping and closely related clinical phenomena [28,29].

Table 1: Demographic characteristics of the respondents

Characteristic	Cases [N=108] n (%)	Controls [N=108] n (%)	Total [N=216] n (%)
Mean age (SD) (years)	29.7 (6.5)	27.2 (5.6)	28.5(11.9)
Age (years)			
Below 25	28 (25.9)	39 (36.1)	67 (31.0)
25-29	26 (24.1)	31 (28.7)	57 (26.4)
30-34	23 (21.3)	25 (23.2)	48 (22.2)
35-39	25 (23.2)	10 (9.3)	35 (16.2)
40-45	6 (5.6)	3 (2.8)	9 (4.2)
Education			
Never	18(16.7)	13 (12.0)	31 (14.4)
Primary	20 (18.5)	17 (15.7)	37 (17.1)
JHS	46 (42.6)	54 (50.0)	100 (46.3)
SHS	16 (14.8)	11 (10.2)	27 (12.5)
Tertiary	8 (7.4)	13 (12.0)	21 (9.7)
Occupation			
Unemployed	16(14.8)	26 (24.1)	42 (19.4)
Farming	32 (29.6)	18 (16.7)	50 (23.2)
Trader	32 (29.6)	32 (29.6)	64 (29.6)
Artisan	14(13.0)	18 (16.7)	32(14.8)
Civil Servant	14 (13.0)	14 (13.0)	28 (13.0)
Marital Status			
Single	30 (27.8)	47 (43.5)	75 (35.7)
Married	78 (72.2)	61 (56.5)	139 (64.4)

Also, this could be explained that a history of preterm delivery could have been caused as a result of an undiagnosed PIH. Thus, mothers with previous history of preterm delivery are more likely to develop PIH as a result of the previous condition. Dietary patterns characterized by high consumption of trans fatty foods was also found to be a risk factor in this study. Reports by [27] have shown that, the trans fatty acids increases the low-density lipoprotein (LDL) cholesterol in the blood which pre-disposes them to cardiovascular diseases such as hypertension. While this relationship awaits further clarifications, pregnant women are advised to adhere to recommended dietary patterns.

LIMITATIONS OF THE STUDY

One of the limitations of this study was that information on the consumption of trans fatty foods which was only obtained from the women and was not observed and measured by the researcher and this could affect the outcome. In addition, data on gestational age of onset of PIH as well as PIH during previous pregnancies was not collected.

CONCLUSION

In this study, maternal age group 35-39 years, a family history of hypertension, history of previous pre-term delivery and high consumption of trans fatty foods predisposed women to PIH. Early detection and timely management of PIH and its risk factors at antenatal care would improve maternal and perinatal health. Screening of all pregnant women at ANC to identify potential cases of PIH and initiating timely management would be required. Healthcare providers at ANC should intensify counselling and continuous education on the choice of food during pregnancy.

RECOMMENDATIONS

We recommend that all pregnant women should be screened in order to identify cases of PIH and initiate timely management. Healthcare providers at ANC should intensify counselling on the choice of food. Continuous education on how to manage PIH among cases should be provided. Also, there is the need for further studies to determine types of trans fatty foods consumed by pregnant women in the Hohoe Municipality.

DECLARATIONS

Ethics and consent statement

Ethical clearance was obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC: 14/03/2017) with the approval identity (GHS-ERC). Permission was also sought from the Municipal Health Directorate and the Municipal Assembly. Moreover, the participants themselves consented to be part of the study.

Availability of data and material

Available upon request

Table 2: Association between risk factors and odds of PIH

Characteristic	Cases N=[108] n (%)	Controls N=[108] n (%)	Total [N=216] n (%)	Chi-square (χ^2) (p-value)	COR (95% CI) p-value	AOR (95% CI) p-value
Age(years)				9.76 (0.045)		
Below 25	28 (25.93)	39 (36.11)	67 (31.02)			
25-29	26 (24.07)	31 (28.70)	57 (26.39)		1.17 (0.57, 2.38) 0.669	1.04(0.43, 2.51) 0.938
30-34	23 (21.30)	25 (23.15)	48 (22.22)		1.28 (0.61, 2.70) 0.515	1.36(0.51, 3.67) 0.537
35-39	25 (23.15)	10 (9.26)	35 (16.20)		3.48 (1.45, 8.39) 0.005	3.24(0.96, 10.94) 0.058
40-45	6 (5.56)	3 (2.78)	9 (4.17)		2.79 (0.64,12.10) 0.172	2.10(0.35, 12.75) 0.416
Parity				2.94 (0.401)		
No child	27 (25.00)	33(30.56)	60(27.78)			
1-3	68(62.96)	67(62.04)	135(62.50)		1.24 (0.67, 2.28) 0.489	
4-6	12 (11.11)	6(5.56)	18(8.33)		2.44 (0.8, 7.37) 0.113	
7+	1(0.93)	2 (1.85)	3(1.39)		0.61 (0.05, 7.10) 0.694	
Education				3.81 (0.433)		
Never	18(16.67)	13 (12.04)	31 (14.35)			
Primary	20 (18.52)	17 (15.74)	37 (17.13)		0.85 (0.32, 2.23) 0.740	
JHS	46 (42.59)	54 (50.00)	100 (46.30)		0.62 (0.27, 1.39) 0.242	
SHS	16 (14.81)	11 (10.19)	27 (12.50)		1.05 (0.37, 3.00) 0.927	
Tertiary	8 (7.41)	13 (12.04)	21 (9.72)		0.19 (0.14, 1.38) 0.161	
Occupation				6.80 (0.147)		
Unemployed	16(14.81)	26 (24.07)	42 (19.44)			
Farming	32 (29.63)	18 (16.67)	50 (23.15)		2.89 (1.24, 6.75) 0.014	1.03(0.31, 3.42) 0.964
Trading	32 (29.63)	32 (29.63)	64 (29.63)		1.63 (0.74, 3.59) 0.230	0.87(0.31, 2.45) 0.801
Artisanship	14(12.96)	18 (16.67)	32(14.81)		1.26 (0.50, 3.22) 0.624	0.67(0.20, 2.22) 0.513
Civil Servant	14 (12.96)	14 (12.96)	28 (12.96)		1.63 (0.62, 4.28) 0.325	1.18(0.33, 4.31) 0.797
Marital Status				8.89 (0.012)		
Single	30 (27.78)	47 (43.52)	75 (35.65)			
Married	78 (72.22)	61 (56.48)	139 (64.35)		2.00 (1.14, 3.53) 0.016	1.57(0.73, 3.40) 0.244
Nutrition and Lifestyle						
Smoking				1.02 (0.313)		
No	105(97.22)	107(99.07)	212(98.15)			
Yes	3(2.78)	1(0.93)	4(1.85)		3.06 (0.31, 29.86) 0.337	
Alcohol consumption				0.22 (0.636)		
No	103(97.17)	106 (98.15)	209(97.66)			
Yes	3(2.83)	2(1.85)	5(2.34)		2.57 (0.49, 13.56) 0.265	
Fatty foods				25.97(<0.001)		
No	53 (52.9)	83 (76.85)	136 (62.96)			
Yes	55 (47.1)	25 (23.15)	80 (37.04)		3.45 (1.92, 6.18)<0.001	4.42 (2.25, 8.66) <0.001

Characteristic	Cases N=[108] n (%)	Controls N=[108] n (%)	Total [N=216] n (%)	Chi-square (χ^2) (p-value)	COR (95% CI) p-value	AOR (95% CI) p-value
Family history of diabetes				16.47 (<0.001)		
No	82 (77.82)	101 (93.52)	183 (84.72)			
Yes	26 (22.18)	7 (6.48)	33 (15.28)		2.07 (0.68, 6.33) 0.202	
Family history of hypertension				25.99 (<0.001)		
No	75 (72.75)	99 (91.67)	174 (80.56)			
Yes	33 (27.25)	9 (8.33)	42 (19.44)		4.84 (2.18, 10.73) 0.001	4.41 (1.83, 10.58) 0.001
Maternal Health						
Cardiac Disease				1.04 (0.307)		
No	102 (94.44)	105 (97.22)	207 (95.83)			
Yes	6 (5.56)	3 (2.78)	9 (4.17)		1.43 (0.50, 8.45) 0.316	
Anemia				0.74 (0.390)		
No	34 (31.48)	40 (37.04)	74 (34.26)			
Yes	74 (68.52)	68 (62.96)	142 (65.74)		1.28 (0.73, 2.25) 0.390	
Diabetes				2.04 (0.153)		
No	99(91.67)	104 (96.30)	203 (93.98)			
Yes	9 (8.33)	4 (3.70)	13 (6.02)		1.95 (0.35, 10.79) 0.443	
History of Adverse Birth Outcome						
Stillbirth				3.92 (0.141)		
No	89 (84.0)	95 (87.96)	184 (85.19)			
Yes	19 (16.0)	13 (12.04)	32 (14.81)		1.56 (0.73, 3.34) 0.253	
Preterm Delivery				6.41 (0.041)		
No	92 (85.07)	103 (95.37)	195 (90.28)			
Yes	16 (14.94)	5 (4.63)	21 (9.72)		3.58 (1.26, 10.16) 0.016	4.66 (1.37, 15.86) 0.014

DISCLOSURE

The authors declare no conflicts of interest.

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