Prevalence and Risk Factors of Pregnancy Induced Hypertension among Pregnant Mothers Attending Antenatal Care in Wachemo University, Nigist Eleni Mohammed Memorial Comprehensive and Specialized Hospital, Hadiya Zone, Southern Ethiopia: A Cross-Sectional Study

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Citation: Larebo YM (2021) Prevalence and Risk Factors of Pregnancy Induced Hypertension among Pregnant Mothers Attending Antenatal Care in Wachemo University, Nigist Eleni Mohammed Memorial Comprehensive and Specialized Hospital, Hadiya Zone, Southern Ethiopia: A Cross-Sectional Study. J Health Commun. Vol.6 No.S4: 18.

Abstract

Introduction: The leading cause of maternal and perinatal morbidity and mortality is pregnancy-induced hypertension. In developed countries, it complicates 10% of all births. Pregnancy-induced hypertension kills half a million women per year, mainly in developing countries. The aim of this study was to determine whether antenatal care attendants in Nigist Eleni Mohammed Memorial Comprehensive and Specialized Hospital in Southern Ethiopia had pregnancy-induced hypertension.

Methods: A hospital-based cross-sectional study was conducted in Wachemo University Nigist Eleni Mohammed Memorial comprehensive and specialized Hospital from December 30, 2020, to February 2021. Finally, *via* the systematic random sampling process, the study subjects were chosen from a chart review from June 2019 to May 2020. Bivariate and multivariate analyses were used to identify factors associated with pregnancy-induced hypertension. A P-value less than 0.05 were considered statistically significant.

Results: The prevalence of Pregnancy-Induced Hypertension was 23.42% with 95% CI (21.8, 30.5). Age in years 25 to 35; (AOR=6.189; 95%CI; 2.232, 7.164), urban residence (AOR=2.103; 95%CI=1.046, 4.234), primigravida (AOR=2.6; 95%CI=1.642, 2.611), gestational age 20 to 37 weeks (AOR=5.278; 95%CI=1.852, 6.038) and past history of pregnancy induced hypertension (AOR=1.358; 95%CI; 1.756, 4.351) and past history of diabetes mellitus (AOR=7.344; 95%CI=1.344, 9.372) were statistically significant with Pregnancy-Induced Hypertension.

Conclusion: In this study the prevalence of pregnancy-induced hypertension was high. Age, urban residence, primigravida, gestational age in weeks, history of pregnancy-induced hypertension, and history of Diabetes Mellitus were statistically significant with Pregnancy Induced Hypertension. To enhance maternal and child health, improving screening, treatment, and prevention strategies for PIH is necessary.

Keywords: Pregnancy induced hypertension; Antenatal care service; Diabetes; Women

Introduction

Pregnancy-Induced Hypertension (PIH) is defined as a systolic blood pressure of less than 140 millimetres of mercury and a diastolic blood pressure of less than 90 millimetres of mercury, or both. PIH is a form of hypertension that develops after 20 weeks of pregnancy in women who previously had normal blood pressure. Along with infection and postpartum haemorrhage, it has long been one of the most serious issues for mothers

during pregnancy. Gestational hypertension, preeclampsia, and Eclampsia are the three broad categories of PIH [1,2].

Gestational hypertension is diagnosed in women whose blood pressures rise to 140/90 mm Hg or higher for the first time after 20 weeks of pregnancy, but who do not have proteinuria. Preeclampsia is characterized as blood pressure of 140/90 mmHg with or without Proteinuria (300 mg/24 hours) that appears after 20 weeks of pregnancy but resolves up to 12 weeks after delivery and Eclampsia is defined as a convulsion that cannot be attributed to another cause in a woman with preeclampsia. Seizures are generalized and can occur prior to, during, or after labour. The percentage of women who do not have seizures until 48 hours after giving birth is about 10%. Any chronic hypertensive disease, regardless of the cause, puts a woman at risk for developing superimposed preeclampsia syndrome [1,3].

In 2013, approximately 289,000 people died worldwide as a result of pregnancy-related causes, with 99% of deaths occurring in developing countries. Sub-Saharan African countries account for about 56% of all maternal deaths worldwide. In developing countries, a woman's lifetime risk of dying from pregnancy-related complications is 14 times higher than in developed countries [4,5].

According to a population-based study in South Africa, hypertensive disorders of pregnancy affect 12% of pregnant women, and they are the leading cause of maternal death, accounting for 20.7% of all maternal deaths [3]. Ten percent of all births are complicated by pregnancy-induced hypertension. Every year, approximately 40,000 people, mostly from developing countries, die as a result of PIH. Preeclampsia is thought to be responsible for 40-60% of maternal deaths in developed countries [2,3].

Many of these health issues are widespread in developing countries such as Ethiopia. As a result, our country's maternal mortality rate is 676 per 100,000 live births, compared to 12 per 100,000 live births in most developed countries [4,5].

According to a United Nations (UN) report, Ethiopia is one of the five countries that together account for 50% of the world's maternal death and rural areas mostly contribute to maternal death [4]. A study conducted in Addis Ababa indicated that the prevalence of Hypertensive Disorders of Pregnancy (HDP) among diagnosed pregnant were 5.5% of which the majorities were due to preeclampsia [6].

The cause for hypertension is unknown, there does appear to be certain Risk factors postulated to influence the risk of Pregnancy-induced hypertension Null parity, multiple pregnancies, history of chronic hypertension, gestational diabetes, fetal malformation, obesity, extreme maternal age less than 20 or over 40 years, history of PIH in previous pregnancies and chronic diseases like renal disease, diabetes mellitus, cardiac disease, unrecognized chronic hypertension, positive family history of PIH which shows genetic susceptibility, psychological stress, alcohol use, rheumatic arthritis, extreme underweight and overweight, asthma and low level of socio-economic status are the risk factors for PIH [7,8].

PIH is a major pregnancy complication associated with premature delivery, Intra-Uterine Growth Retardation (IUGR), abruptio placentae, and intrauterine death, as well as maternal mortality and morbidity [9,10].

Ante-Natal Care (ANC) is one of the maternal services in Ethiopia. Blood pressure measurement, urine tests for Proteinuria and UTI, HBsAg, VDRL, blood group and RH, PICT, and CBC are among the component of routine ANC. According to 2019, EMDHS results show that 74% of women who gave birth in the 5 years preceding the survey received antenatal care from a skilled provider at least once for their last pregnancy [11].

Hypertension caused by pregnancy is the leading cause of maternal and perinatal morbidity and mortality. However, while a few studies are looking into the prevalence and associated factors of PIH in Ethiopia, none have been done in our study field. As a result, the aim of this study is to find out how common pregnancy-induced hypertension is and what factors contribute to it.

Materials and Methods

Study period and setting

The study was conducted in Wachemo University Nigist Eleni Mohammed Memorial comprehensive and specialized hospital. The hospital is found in Hossaena town, Hadiya Zone, Southern Ethiopia, at 7°c 3' 19"-7°c 56'13" east longitudinal line. The town is located 232 km south of Addis Ababa. The hospital provides preventive, curative, and rehabilitative clinical services organized in four case teams an outpatient, inpatient, emergency, and critical care, maternal, child health and obstetrics and operation theatre, with a capacity of accommodating 250 beds and 499 health professional and 382 supportive stuff. The study was conducted from December 30, 2020, to February 2021 [12-14].

Study design and period

A hospital-based cross-sectional study design was conducted at Wachemo University Nigist Eleni Mohammed Memorial comprehensive and specialized Hospital.

Source population

All pregnant women who had ANC follow up in Wachemo University Nigist Eleni Mohammed Memorial comprehensive and specialized Hospital.

Study population

Selected pregnant women who had ANC follow-up and who fulfil the inclusion criteria.

Sample size determination

The sample size was calculated using the single population proportion formula, considering the following assumptions and taking the prevalence of the proportion of PIH 45.5% which was a study conducted in Jimma University Specialized Hospital, West Ethiopia [15].

$$n = \frac{\left(\frac{z\alpha}{2}\right)^2 p(1-p)}{d^2} \tag{1}$$

Where n=the desired sample size P=prevalence of PIH=45.5% (which was taken from a study conducted at Jimma University Specialized Hospital, west Ethiopia, 2011) Z1-α/2=Critical value at 95% confidence level (1.96) d=the margin of error=5% $n=(1.96)^2.0.455(1-0.455)/(0.05)^2=381$. Since our source population (N), is below 10,000, we used correction formula.

$$n f = \frac{n}{1 + (n/N)} \qquad (2)$$

Where N is source population, nf was the final sample size,

$$nf - \frac{381}{\left(1 + \left(\frac{381}{1472}\right)\right)} = 303$$

Therefore, by taking a non-response rate of 10%, the final sample size was 333.

Sampling procedure

A systematic random sampling technique was used to select the study participants from the chart review. The sampling interval (k) was determined by dividing the total number of pregnant recorded data who seek ANC at the previous half of a year with gestational age>20 weeks June 2019 to May 2020, which was 1472 by the calculated sample size 333. The first pregnant woman data was selected by lottery method among the ANC service user within the study period and the rest was selected by the interval 3 **(Figure 1)**.

Study variables

Dependent variables: Prevalence of pregnancy-induced hypertension (1: yes, 0: no)

Independent variables: Sociodemographic-related characteristics of respondents like age, marital status, educational status, and occupational status.

Obstetrics history-related characteristics of respondents like gravidity, parity, the multiplicity of pregnancy, prior PIH, prior gestational DM.

General medical history related characteristics of respondents like DM, HTN, kidney disease, cardiac illness, and substance abuse.
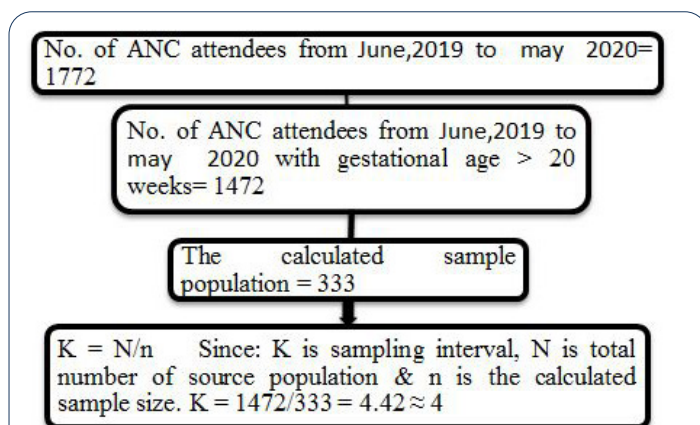
Figure 1: Schematic presentation of sampling procedure pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern nation nationality people region (n=333).

Current pregnancy-related characteristics of respondents like weight, lab results, signs, and symptoms.

Data collection procedures

Data was collected using a structured questionnaire for recorded review developed for this study. Since the registration was prepared in the English language, the checklist was also prepared in English. So, data were collected by group members, and data collection was done in the hospital. Data collectors were agreed on how to collect data and discussed the tool in detail before actual data collection.

All relevant information regarding demographic data, clinical findings, and laboratory results were collected. Data about antenatal care were extracted from the attendance history file and antenatal card.

Inclusion and exclusion criteria

All pregnant women attending antenatal care service with complete recorded data with gestational age is ≥ 20 weeks were included and data not fully recorded were excluded.

Operational definition

Pregnancy-Induced Hypertension (PIH): A pregnant woman attending delivery service with high blood pressure (140/90 mmHg) after 28 weeks of gestation was measured two times six hours apart by trained data collectors and with or without proteinuria. The diagnosis of PIH was confirmed by a physician working in the labor ward. Pregnancy-induced hypertension includes gestational hypertension, pre-eclampsia and eclampsia [15].

Proteinuria: The presence of an excess of serum proteins in the urine which is diagnosed by dipstick ≥ +1 [5].

Data quality assurance

To ensure the consistency of the data, the nature of the data collection tool was emphasized for its simplicity and uniform group rating scales, validity and reliability were taken into account and data collectors were educated. To check the accuracy, the questionnaire was prepared in English and then translated into the local Hadiya language and back-translated into English.

To check the accuracy, the questionnaire was pre-tested on 17 mothers in Worabe Hospitals outside the study area, and the interview was carried out in private. Throughout the collection of data, interviewers were tracked at each location, daily meetings were held between the data collectors, the supervisor, and the principal investigator in which concerns resulting from interviews performed and errors discovered during editing were addressed and decisions were made. Until data entry, the collected data were inspected and tested for completeness; incomplete data was discarded. The prototype for the data entry format was developed and programmed.

Data processing and analysis

Data were tested, coded, and entered in EPI Data version 3.1 and

exported for analysis to Statistical Package for Social Sciences (SPSS) version 20. The key investigator was responsible for data entry. The variable description was performed and presented in frequency, using tables, graphs, charts, and chi-square statistics (χ^2). Adjusted Odds Ratios (AOR) and a 95% confidence interval using logistic regression were used to verify the existence and intensity of the correlation between independent and dependent variables. In the bivariate analysis, variables having P-values less than 0.25 were entered into the multivariate analysis using backward elimination. The fitness of the model was tested using the 0.796 Hosmer and Lemeshow test. Based on their relationship of importance (i.e., p<0.05), the final result was interpreted.

Results

Characteristics of respondents

A total of 333 pregnant women charts were incorporated into the study. This made the response rate 100%.

Out of 333 women included in the study, above half the 184 (55.3%) respondents were urban residents. The majority, 199(59.8%), was 25-35 years old **(Table 1)**.

Basic obstetric and clinical characteristics were assessed in this study. Out of 333, pregnant women who were participated in this study almost half 168(50, 5%) of pregnancy were primigravida, regarding parity of the women, 166(49.85%), 142(42.64%), and 25(7.5%) were nulliparous, multipara and grand multiparous respectively **(Figure 2)**. The majority, 236(70.9%) of mothers were gestational ages between 20 to 37 weeks, majority 329(98.8%) of the pregnant mothers who attended for ANC had single multiplicity, 31(9.3%) mothers had a history of PIH, only 11(3.3%) of them were having a history of gestational diabetic Mellitus; while 2(0.6%) of mothers of the pregnancies had a

Table 1: Selected socio-demographic characteristics of the study participants on pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern Ethiopia (n=333).

Variables	Categories	N (%)
Age in years	18-24	74(22.2)
	25-35	199(59.8)
	>35	60(18.0)
Address of women	Urban	184(55.3)
	Rural	148(44.7)
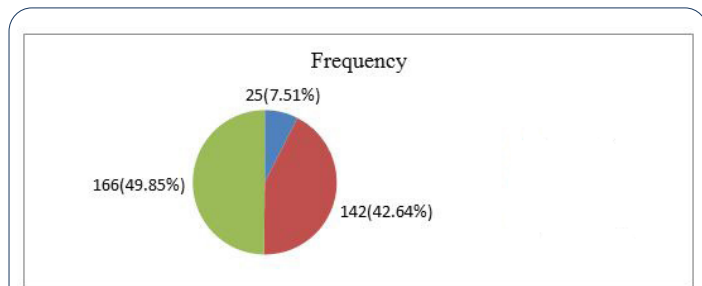
Figure 2: Parity distribution pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern Ethiopia (n=333). (🔴) nulliparous, (🟩) multipara, (🔵) grand multipara.

previous stillbirth and majority of respondents 7(2.1%) mothers were history of previous caesarean section **(Table 2)**.

Of the total 333 pregnant women, 10(3%) of mothers have had a history of DM, and 3(0.9%) of mothers have had a history of renal disease, 4(1.2%) mothers have had a history of cardiac disease,2(0.6%) pregnant mothers have had known substance abuse and 13(3.9%) mothers were had other medical disease like TB, HIV, Malaria **(Table 3)**.

Out of 333 total participants, with headache and blurring of vision was reported by 6(1.8%), 4(1.2%) of the pregnant women had epigastric pain, 3=(0.9%) were with history of shortness of breath, 49(14.7%) mothers with a history of pitting edema, 15(4.5%) mothers were with convulsion or seizure, 71(21.3%) with history of blood pressure between 140/90=160/110 mmHg, 12(3.6%) with platelet count<100000 which is abnormal, the result of dipstick urine test, proteinuria ranges from negative to +++ which was 55(16.5%) and 4(1.2%) mothers were with history of abnormal liver function **(Table 4)**. Out of the total of 78(23.42%) pregnant women who had PIH, 22(28.2%) was gestational hypertension, 28(35.9%) were preeclampsia without

Table 2: Obstetric and clinical characteristics of the study participants on pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern Ethiopia (n=333).

Variables	Categories	N (%)
Gravidity	Primigravida	168(50.5)
	Multigravida	165(49.5)
Gestational age (in the week)	20-37	236(70.9)
	>37	97(29.1)
Multiplicity	Single	329(98.8)
	Multiple	4(1.2)
History of PIH	Yes	31(9.3)
	No	302(90.7)
History of gestational DM	Yes	11(3.3)
	No	322(96.7)
Previous stillbirth	Yes	2(0.6)
	No	331(99.4)
Previous Cesarean surgery	Yes	7(2.1)
	No	326(97.89)

Table 3: Behavioral and Life characteristics of the study participants on pregnancy-induced hypertension among mothers attending antenatal care in Wachemo University, compressive specialized hospital, Hadiya Zone, Southern Nation Nationality People Region (n=333).

Variables	Categories	Frequency
History of diabetes mellitus	Yes	10(3.0)
	No	323(97.0)
History of renal disease	Yes	3(0.9)
	No	330(99.09)
History of cardiac disease	Yes	4(1.2)
	No	329(98.8)
Known substance abuse	Yes	2(0.6)
	No	331(99.4)
Another medical disease like TB, HIV, Malaria	Yes	13(3.9)
	No	320(96.1)
Where: 3 TB, 5 Malaria and 5 HIV cases.		

severity feature, 13(16.7%) were preeclampsia with severity features and 15 (19.23%) were Eclampsia respectively **(Figure 3)**.

Prevalence of pregnancy-induced hypertension of women

The overall prevalence of PIH was 23.42% of the respondents with 95% CI (21.8, 30.5) with a mean of 0.29 and standard deviation of ± 0.44.

Multivariable analysis was used to control potential confounders.

Table 4: Characteristics related to current pregnancy of women on pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern nation nationality people region (n=333).

Variables	Categories	N (%)
Headache and blurring of vision	Yes	6(1.8)
	No	327(98.2)
Epigastric pain	Yes	4(1.2)
	No	329(98.8)
Shortness of breath	Yes	3(0.9)
	No	330(99.1)
Pitting edema	Yes	49(14.7)
	No	284(85.3)
Convulsion or seizure	Yes	15(4.5)
	No	318(95.5)
Blood pressure	<140/90 mmHg	255(76.6)
	140/90-160/110 mmHg	71(21.3)
	>160/110 mmHg	6(1.8)
Platelet count	Normal	321(96.4)
	<100000	12(3.6)
Proteinuria	Yes	55(16.5)
	No	278(83.5)
Liver function normally	Yes	329(98.8)
	No	4(1.2)
Pregnancy-induced hypertension	Yes	78(23.42)
	No	255(76.58)

Accordingly, Age 25 to 35 years (AOR=6.189; 95%CI; 2.232,7.164),urban residence (AOR=2.103; 95%CI; 1.046, 4.234), primigravida (AOR=1.6; 95%CI; 1.642, 2.611),gestational age in weeks (20 to 37 weeks) (AOR=5.278; 95%CI; 1.852, 6.038), past history of PIH(AOR=1.358; 95%CI; 1.756, 4.351) and past history of DM (AOR=7.347; 95%CI; 1.344, 9.372) were found to be independently associated **(Table 5)**.

Discussion

The overall prevalence of pregnancy-induced hypertension 23.42%, which indicates that a significant number of women attending ANC services at Wachemo University, Nigist Eleni Mohammed Memorial comprehensive and specialized hospital. This might increase the morbidity and mortality of the mother and the fetus. If appropriate preventive measures are not taken for the risk of pregnant women, in long term, it might be the first cause of maternal mortality. The prevalence of PIH in this study is greater than the study conducted in Jimma University Specialized Hospital which was 8.48%, Karamara hospital which was 19%
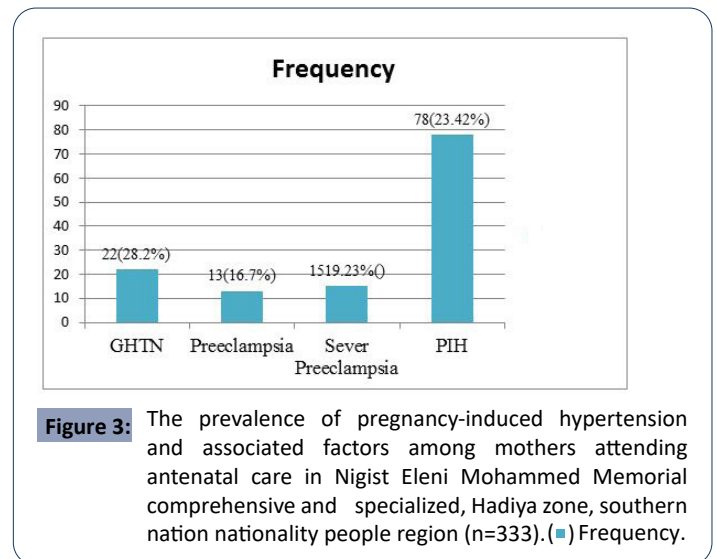
Figure 3: The prevalence of pregnancy-induced hypertension and associated factors among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern nation nationality people region (n=333). (■) Frequency.

Table 5: The final multivariable binary logistic regression model showing risk factors independently pregnancy-induced hypertension among mothers attending antenatal care in Nigist Eleni Mohammed Memorial comprehensive and specialized, Hadiya zone, southern nation nationality people region (n=333).

Variable		Pregnancy-induced hypertension		OR (95% CI)	
		Yes	No	COR (95%)	AOR (95%)
Age in years	18 to 24	16	32	1.302 (0.605, 0.2801)	4.728 (1.585, 9.103) *
	25 to 35	34	180	3.447 (1.891, 6.286)	6.189 (2.232, 7.164) *
	>35	28	43	1	1
Residency	Urban	37	154	1.690 (1.014, 2.815)	2.103 (1.046, 4.234)*
	Rural	41	101	1	1
Gravidity	Primigravida	42	84	0.421 (0.251, 0.705)	1.6 (1.642, 2.611)*
	Multigravida	36	171	1	1
Gestational age (in week)	20 to 37	58	163	0.611 (0.396, 1.079)	5.278 (1.852, 6.038)*
	>37	20	92	1	1
History of PIH	Yes	24	7	0.064 (0.026, 0.155)	1.358 (1.756, 4.351)*
	No	54	248	1	1
History of DM	Yes	6	4	5.229 (1.437, 19.034)	7.344 (1.344–9.372)*
	No	72	251	1	1
Where 1=Reference,*shows the variable significance at p-value ≤ 0.05 in multivariable analysis					

and Dessie Referal Hospital which was 8.4% respectively [16,17]. The prevalence of PIH in this study lowers when compared to the prospective cohort study conducted in Tigray regional state, Ethiopia which was 66.4% [2].

This difference might be attributed to differences in the study period and study design. The population might also be different in lifestyle and culture. However, the prevalence in this study is still greater than the study done in Ethiopia at Tikur Anbessa Hospital which was 5.3%, and Mettu Karl Hospital, 2.4% respectively [18,19].

This discrepancy might be because of differences in the study period, study design, and health-seeking behaviours of pregnant women. Besides, the gap might be due to the current health policy which focuses on the implementation of focused ANC and exempted service for maternal care which increases the health care seeking behaviour of pregnant women which increases detection of the case.

In this study, women having lower age categories 25 to 35 years, almost 6.2 times more likely to develop PIH than age greater than 35 years. Likewise, those women aged 18 to 24 years had 4.73 times more likely to develop PIH than age greater than 35 years. This finding similar to the study conducted in Dessie Referal Hospital [5]. This could be explained as women get older she is more likely to have cardiovascular problems. This would particularly happen due to gradual loss of compliance of the cardiovascular vessels that is mainly associated with ageing of the uterine blood vessels and arterial stiffness. Besides, when the woman gets older, the hemodynamic adaption during pregnancy becomes more difficult [5].

In this study, an urban residence was 2 times more likely to develop PIH than from rural residences. This finding might be due to having those mothers who live in urban they experienced different lifestyle than rural ones.

In our sample, mothers with a history of primigravida, 1.6 times compared to Multigravida, a similar finding was recorded in the study conducted in Karamara Hospital, Jijiga, Eastern Ethiopia.

A pregnant mother with a history of small gestational age in weeks almost 5 times more likely was linked with the occurrence of PIH than large for gestational age, which showed that women with a gestational age greater than or equal to 37 weeks were less likely to develop pregnancy-induced hypertension than women with gestational age less than 37 weeks. This might be because the population of this study was women attending delivery service so that more women with PIH might be delivered before and around 37 weeks of gestational age to reduce the risk of maternal and fetal complication. The study was similar to the study conducted in Tigray regional state, Ethiopia, and was also similarly conducted of the Omo district hospitals, Southern Ethiopia [2,20].

Those women with a history of PIH 1.4 times more, likely to develop PIH than those without a history of PIH. This might have occurred due to genetic factors that contribute to the physiologic predisposition of PIH [5].

Those women with a history of DM 7 times more, likely to develop PIH than without the PIH. This study also showed that women who had DM are at more risk to develop pregnancy-induced hypertension than those who did not have DM. This is in line with the study conducted in New York and Canada and similar to the study conducted was also similarly conducted of the Omo district hospitals, Southern Ethiopia [20-22]. This might be due to genetic factors that predispose women to an increased risk of PIH and recent studies done during pregnancy noted that mothers with a history of diabetes mellitus may involve in the development of PIH in which insulin resistance may play a role in the cause of PIH [20].

Conclusion

The prevalence of PIH among women receiving antenatal care at Wachemo University's Nigist Eleni Mohammed Memorial comprehensive and advanced Hospital was higher than in other studies. Age, urban residence, primigravida, gestational age in weeks (20 to 37 weeks), PIH history, and DM history were all found to be significantly linked to PIH. Improving PIH screening, care, and preventive strategies is important to improve maternal and child health.

Acknowledgments

Authors' Contributions

YM participated in the study design, undertook the field study, analyzed data, and wrote the manuscript.

Funding

Ethics Approval and Consent to Participate

The study was conducted after ethical approval was obtained from the Institutional Review Board (IRB) of the Wachemo University (WCU) College of Medicine and Health Sciences. Permission from the Hadiya Public Health Institute and the health authorities of the study sites was also received before the start of the study. Before enrolment, participants were informed about the study, its aims, effects, and importance of screening. Written consent was obtained by trained data collectors. Then, participants were subjected to full history taking through clinical examinations and laboratory investigations. All information was made anonymous to maintain confidentiality. Participants diagnosed with GDM were referred to health providers and get possible treatment options in their respective public Hospitals.

Consent

The author and the organizations listed here have agreed to be

named and recognized. The confidentiality of the information was also anonymously guaranteed and collected.

Availability of Data and Materials

The datasets used and analyzed during the current research are available upon request from the corresponding author.

Conflicts of Interest

The writer notes that they do not have any conflicting interests.

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Before the article can be processed, all authors must sign the "submission form" agreement and we all agreed to submit the manuscript in your journal.

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