**UNIVERSITY FOR DEVELOPMENT STUDIES**

# RISK FACTORS OF HYPERTENSION DURING PREGNANCY.

# A STUDY OF TAMALE METROPOLITAN ASSEMBLY.

**MOHAMMED ABDUL - SABUR SUGLO**

**2022**

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## A STUDY OF TAMALE METROPOLITAN ASSEMBLY.

**BY**

**MOHAMMED ABDUL - SABUR SUGLO**

**BA SOCIOLOGY AND LINGUISTICS**

**(UDS/CHD/0004/19)**

**A THESIS SUBMITTED TO THE DEPARTMENT OF SOCIAL AND BEHAVIOURAL CHANGE, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN COMMUNITY HEALTH AND DEVELOPMENT.**

**APRIL, 2022**

## DECLARATION

I, Abdul Sabur Suglo Mohammed, hereby declare that the results of my project work "**Risk factors of hypertension during pregnancy in Tamale**" is my own work and that no previous submission for a degree has been done on the topic in this University or elsewhere. Also, the works of others which served as a source of information have been duly acknowledged by making references to the authors.

Candidate's Signature: _____ Date: 10th April 2023

Name: Abdul Sabur Suglo Mohammed (UDS/MCHAD/0004/19)

**Supervisor's Declaration**

I hereby declare that the preparation and presentation of this thesis were supervised by me in accordance with the guidelines on supervision of thesis as laid down by the University for Development Studies:

Supervisor 's Signature: _____ Date: 10th April 2023

Name: **Prof. Abukari Abdulai**

## ABSTRACT

Maternal mortality has been one of the key problems in public health over the decades. This is because about 585,500 women lose their lives annually through maternal mortality. According to the World Health Organization, more than 14% of the world's deaths among pregnant women are attributed to hypertension-related to pregnancy. This predicament hinders the efforts in reaching sustainable development goal three (3) which seeks to end preventable deaths of new-borns and children under five years of age. The aim of this study was to assess the risk factors of hypertension during pregnancy in the Tamale Metropolis. An analytical cross-sectional study was conducted among 424 pregnant women randomly sampled in three hospitals within the Tamale Metropolis. A structured questionnaire was used to collect data on socio-demographic, factors associated with elevated blood pressure and prevelance of Hypertension Induced Preganancy among pregnant women. Data was analysed in SPSS version 21. Bivariate logistic regression and multivariate logistic regression were used to determine associations and strength of associations, respectively, at a significant threshold of $P < 0.05$. In all 67 (15.7%) pregnant women were diagnosed with hypertension. The results further detailed that some of the pontential factors associated with hypertension include age ($x^2 = 11.62$, $p = 0.009$) , occupation ($x^2 = 12.61$, $p = 0.027$), family history of hypertension ($x^2 = 42.85$, $p < 0.001$) and history of smoking .In a multivariate logistic regression, only history of smoking ( aOR = 3.97, CI = 1.4-11.1, p = 0.009) was statistically associated with hypertension. Pregnancy-Induced Hypertension is becoming increasingly recognized as a highly complex multisystem disorder with numerous contributing factors**.** Ghana Health Service should implement public education policy across all health facilities on the risk factors of Hypertension During Pregnancy to women before pregnancy to reduce the rate of HDP.

## ACKNOWLEDGEMENTS

I am most grateful to Almighty Allah for the life, good health and all the blessings bestowed on me through my entire study. My profound gratitude goes to my supervisor, Associate Professor Abukari Abdulai, senior lecturer, Department of Global Public Health Sciences, University for Development Studies.I am grateful for the support of Mr Abdulmuizz M. Tikumah , an assistant lecturer and faculty member in the Department of Environmental and Occupational Health at the School of Public Health at University of Development Studies

I am also grateful to my lovely sister, Aarifa Mohammed for her encouragement and immeasurable support throughout my study. I appreciate again the support and the role played two good friends Robert Rexford Anim and Yakubu Mubaric

I am grateful to the Northern Region Health Directorate, the Tamale Teaching Hospital, Tamale West Hospital and the Tamale Central Hospital for their support and cooperation during my research.

To the entire class of 2019 Community Health and Development, my gratitude goes to all for the wonderful co-existence and resourcefulness throughout the period.

May the Almighty Allah bless each and every one who contributed in one way or the other towards the completion of this thesis

## DEDICATION

This work is dedicated to my beloved father, Mr. Osman Mohammed Abdel-Amin for he has been there for me and supporting me through every aspect of my life, and to my siblings especially Miss Aarifa Mohammed for her immense support throughout this course.

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## ABBREVIATIONS

| | |
|---|---|
| ACOG | AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS |
| ANC | ANTENATAL CARE |
| BMI | BODY MASS INDEX |
| BP | BLOOD PRESSURE |
| GDC | GUIDELINE DEVELOPMENT GROUP |
| GSS | GHANA STATISTICAL SERVICE |
| HDPH | HYPERTENSIVE DISORDERS OF PREGNANCY |
| HEELP | HAEMOLYSIS-ELEVATED-LIVER ENZYMES-LOW PLATELETS SYNDROME. |
| HT | HEIGHT |
| ISSHP | INTERNATIONAL SOCIETY FOR THE STUDY OF HYPERTENSION IN PREGNANCY |
| WT | WEIGHT |
| PE | PREECLAMPSIA |
| PI | PONDERAL INDEX |
| PIH | PREGNANCY-INDUCED HYPERTENSION |
| SSA | SUB-SAHARAN AFRICA |
| THR | HEAD CIRCUMFERENCE RATIO |
| WHO | WORLD HEALTH ORGANIZATION |
| WHR | WAIST-TO-HIP RATIO |

# CHAPTER ONE

# GENERAL INTRODUCTION

This chapter presents a background development establishing the purpose of the study. It also establishes the problem that led to the need for the study, research questions and objectives, study's relevance and potential impact on maternal health in Ghana. It presents the scope, content and significance of this study. The summary of the methodological approach used to examine the research problem is described as well as the operationalized definition of key concepts.

## 1.0 Background of this Study

Maternal mortality has been one of the key problems in public health over the decades. This is because about 585,500 women lose their lives annually through maternal mortality (Ahenkorah, 2017). Out of this number, 98% occur in less-developed countries such as Ghana (Ahenkorah, 2017; Owiredu et al., 2012). Various factors such as pregnancy complications and unsafe abortions have been named as origins of maternal deaths (WHO, 1994 cited by Owiredu et al., 2012). One other major cause of this increased mortality rate is hypertension associated with pregnancy. According to the World Health Organization, more than 14% of the world's deaths among pregnant women are attributed to hypertension-related to pregnancy (Say et al., 2014). Hypertensive disorders of pregnancy (HDP) (Meazaw et al., 2020; Antwi et al., 2016) includes pregnancy-induced hypertension (PIH), pre-eclampsia, eclampsia and the Haemolysis-Elevated-Liver Enzymes-Low Platelets (HELLP) syndrome. Out of the total deaths among pregnant women recorded in Latin-American and the Caribbean, more than 25.7% were caused by

hypertension related to pregnancy. Additionally, the canker accounts for more than 9.1% of maternal deaths in Asia and Africa. In sub-Saharan Africa, it contributed to 16% of maternal deaths (Khan et al., 2006). Currently, the higher risk of maternal death due to pregnancy-related hypertension is approximately 300 times higher in developing countries than in developing countries (Gashe, & Ayele, 2018).

According to Saudan *et al.* (1998 cited by Owiredu et al., 2012), hypertension is the commonest medical complication associated with pregnancy. It is also the major cause of maternal and perinatal morbidity and mortality (Meazaw et al., 2020; Antwi et al., 2016). This occurs in 3% to 10% of all pregnancies. In Ghana, the prevalence of hypertension during pregnancies is one of the topmost five leading causes of maternal and neonatal deaths (Der, 2013). Also, Osei-Nketiah, (2001) found that hypertensive pregnancy was among the four major risk factors associated with forty per cent (40%) of maternal deaths in Ghana. Thus, HDP accounts for nine per cent (9%) of maternal deaths (Owiredu et al., 2012).

Although evidence shows that hypertension during pregnancy has no definite cause, some studies have focused on risk factors across the globe, and common risk factors during pregnancy have been identified (Wolde et al. 2011). Available literature reveals that risk factors of hypertensive pregnancies include socio-demographic, personal and lifestyle characteristics of pregnant women. In Ghana, several studies including Owiredu et al. (2012) concluded that HDP risk factors include family history, contraceptives usage, and use of condoms during coitus, change of partners. Also, Deborah van Middendorp et al. (2013) found that women in urban settings were at increased danger of developing maternal hypertension than women in rural areas. Larry Jones et al. (2017) added maternal age, unemployment and marital status, food with high fats, family history of pregnancy hypertension and history of preterm delivery were the main factors linked

to HDP. Additionally, Owiredu et al. (2012) added obesity, age, use of contraceptives as well as patients' family history as the causes of HDP in urban areas (Owiredu et al., 2012).

The American College of Obstetricians and Gynaecologists (ACOG) define "hypertension in pregnancy as systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg in two occasions at least 6 h apart after the fifth month of gestation for pregnancy-induced hypertension or before pregnancy/before 20 weeks of gestation for chronic hypertension" (ACOG, 2013). HDP represents a group of disorders associated with high blood pressure during pregnancy, proteinuria and in some cases convulsions (Lowe et al., 2014). One significant finding of pregnancy-related to pregnancy is that HDP can advance to an adverse stage of maternal hypertension known as eclampsia (Wallis et al., 2013). Wallis et al. (2013) reiterate that eclampsia can affect foetal development which can intensify the risk of heart and brain diseases, cause preterm birth, etc.

The psychosocial well-being of pregnant women is also an issue of concern (Omidvar et al., 2018). It has a key effect on pregnancy outcomes (Woods et al, 2010), a significant pace toward improving women's health and birth outcomes (Lapp, 2000). Social and psychological factors such as stigma, discrimination, anxiety, depression and quality of life are related to healthy behaviours in pregnant women (Omidvar et al., 2018). Existing literature has revealed that patients' awareness about their state affects their compliance with treatment which improves complications accompanying the disease**.** In Ghana, one of the hurdles in combating hypertension during pregnancies is the delay in visiting health facilities after discovering its symptoms as well as limited knowledge of risk factors associated with it (Fondjo et al., 2019). Out of 5,247 deaths reported by Der et al. (2013) among women between the ages of 15 and 49, 12.1% (634) are from pregnancy-related complications. Also, 79.5% of these deaths are related to obstetric causes

including HDP. The main conclusion was the late start of ante-natal care and community-based studies to look into maternal associated complications and death.

This study would be conducted in the Northern Ghanaian population, assessing risk factors associated with hypertension during pregnancy in 3 hospitals in the Tamale Metropolis of Ghana.

### 1.1 Problem Statement

Hypertensive disorders are a worldwide public health concern in both advanced and third world countries (NICE, 2010; Fondjo et al., 2019). It has contributed to about 16% of maternal deaths in sub-Saharan African countries, Ghana inclusive (Say et al., 2014). Early detection of pregnancy-related complications can reduce the number of levels of preventable causes of maternal deaths. However, one of the major hurdles in combating hypertension during pregnancy in Ghana is; reporting of women to healthcare centres, and the lack of awareness of risk factors (Fondjo et al., 2019). This predicament hinders the efforts in reaching sustainable development goal three (3.1) seeks to "end preventable deaths of new-borns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-five mortality to at least as low as 25 per 1000 live births".

The generalisability of much-published research on this issue is problematic. This is because many studies have indicated several risk factors of which findings were not conclusive (Kahsay, 2018; Der, 2013). There have been reports of discrepancies between populaces and ethno-geographic groups. Albeit, the link between hypertension related to pregnancy and maternal mortality and morbidity is established, what is not yet clear is the dearth of proof of the level of risk in literature (Meazaw, 2020). Additionally, there are geographical variations in the

occurrence and frequency of HDP in the sub-Saharan region (WHO, 1988; Antwi et al., 2016). In assessing the geographical disparities in the occurrence of the disease, Antwi et al. (2016), established that the recorded disparities are caused by urbanisation and lifestyle changes. This was also confirmed by the Ghana Maternal Health Review undertaken in the year 2007 which found that HDP was more common in highly urbanised areas (GSS, 2007). Another study undertaken at the Komfo Anokye Teaching Hospital in Ghana established that hypertension-related to pregnancy was the leading cause of maternal mortality recorded by the institution (Lee et al., 2012).

Over the past years Antwi et al., (2016) has emphasised the need for further scientific enquiry may be required to corroborate or refute existing research findings. There is enough evidence for the call for studies into risk factors of pregnancy and related complications such as HDP to help reduce preventable maternal mortality, more importantly; there is currently limited study that evaluates risk factors of hypertension during pregnancy in Northern Ghana. According to Antwi et al., (2016), no study was identified to have documented the experiences of pregnant women diagnosed with HDP. Woods et al. (2010) posit that psychological issues have not regularly been measured in everyday obstetric practice.

There have been several epidemiological studies that have looked into the relationship between maternal demographic variables and the risk of hypertensive disorders during pregnancy (HDP). There have been reports of discrepancies between populaces and ethno-geographic groups. Albeit, the link between hypertension related to pregnancy and maternal mortality and morbidity is established, what is not yet clear is the dearth of proof of the level of risk in literature (Meazaw, 2020). Additionally, there are geographical variations in the occurrence and frequency of HDP in the sub-Saharan region (WHO, 1988; Antwi et al., 2016).

Although there exist some studies in the local setting, this study seeks to address the local variation in HDP prevalence and understand its psychological and social impact of it on those diagnosed. This study assessed five potential risk factors including prenatal bonding, marriage status, social support, socioeconomic status, stress and intimate partner violence (Woods et al., 2010; Mathibe-Neke and Masitenyane, 2018) and their association with HDP among pregnant women in three public hospitals of Tamale Metropolis.

## 1.2 Research Questions

1. What is the prevalence of elevated blood pressure among pregnant women in the Tamale Metropolis?
2. What are the risk factors associated with elevated blood pressure among pregnant women in the Tamale metropolis?

## 1.3 Research Objectives

### 1.3.1 Main Objective

This study was designed to assess the risk factors of hypertension during pregnancy in the Tamale Metropolis.

### 1.3.2 Specific Objectives

1. To assess the prevalence of elevated blood pressure among pregnant women.
2. To determine the risk factors associated with elevated blood pressure among pregnant women.

### 1.4 Significance of this Study

The findings of this study would be useful in terms of helping clinicians to identify the risk of HDP among pregnant women.

Also, the findings from this study add to the body of research and scholarly works and generate further interest in the research field to improve the situation of hypertension during pregnancy in Tamale Metropolis and Ghana as a whole.

### 1.5 Study Scope

This study would be undertaken geographically in the Tamale Metropolis. The metropolis is home to about 233,252 people according to the 2010 population and housing census. The metropolis is highly urbanised with 80.08% of the population living in urban areas compared to 19.1% in rural localities. Specifically, the study would be conducted in the three main hospitals in the metropolis i.e., Tamale Teaching Hospital, West and the Central Hospitals which largely serve the population in Tamale.

The study population would be pregnant women who seek antenatal services at the Tamale Teaching, Central and West hospitals. The sample size for this study would be 424 anticipating a 10% non-response rate.

### 1.7 Operational Definitions

**Hypertensive disorders of pregnancy**: HDP is a medical condition where a pregnant woman is diagnosed with any form of hypertension. This includes gestational, chronic hypertension with superimposed preeclampsia, preeclampsia-eclampsia and chronic hypertension.

**Gestational hypertension**: During the first twenty weeks of pregnancy, gestational hypertension is defined as blood pressure recordings greater than 140 mmHg (systolic) and/or blood pressure greater than 90 mmHg (diastolic) measured on two separate occasions at least four hours apart on the absence of proteinuria or other systemic symptoms.

### 1.8 Study Limitation

This study may be limited by data accuracy. The disclosure of information on sexually related matters such as abortion type, contraceptive use, etc. is considered personal and sensitive, thus women may not fully disclose information accurately. This may introduce bias and may render some error components in study findings. Also , the cross-sectional design of this study makes causuality difficult to indentify. Moreover, the operation definition of smoking only covered for pregnant women had a history of active smoking but not passive.Sections of the questionnaire which are self reported in nature may create potential sources of recall and social desirability bias.

### 1.9 Conceptual Framework

This chapter has reviewed thoroughly a ton of literature on hypertensive disorders of pregnancy. The term includes both pregnancies-induced cases known as pregnancy-induced hypertension and chronic cases which are often superimposed to eclampsia. Although no known cause has been cited, HDP is theorised to be prevalent from the presence of some risk factors. The risk factors of hypertension related to pregnancy have been researched. With available literature, this study categorised these in more than six divisions under which various factors have been cited. From figure 1.1 below, the links between the various risk factors have been presented. First of

all, the framework presents the various types of HDP being, pregnancy-induced forms and chronic hypertension cases which are pre-existing before conceiving. Both cases can reach a severe diastolic level that needs urgent treatment. The risk factors include demographic (mostly added to studies because of methodology), general risk factors which include anthropometric measurement (BMI, weight and height), family history, nutrition (fruit and vegetable intake), contraceptive use (hormonal and condom), miscarriage and abortion (which includes preterm and stillbirth) and lifestyle of pregnant women. The psycho-social status of pregnant women involves their physical state of living and the factors that affect such norms such as stress, financial issues, support system etc.

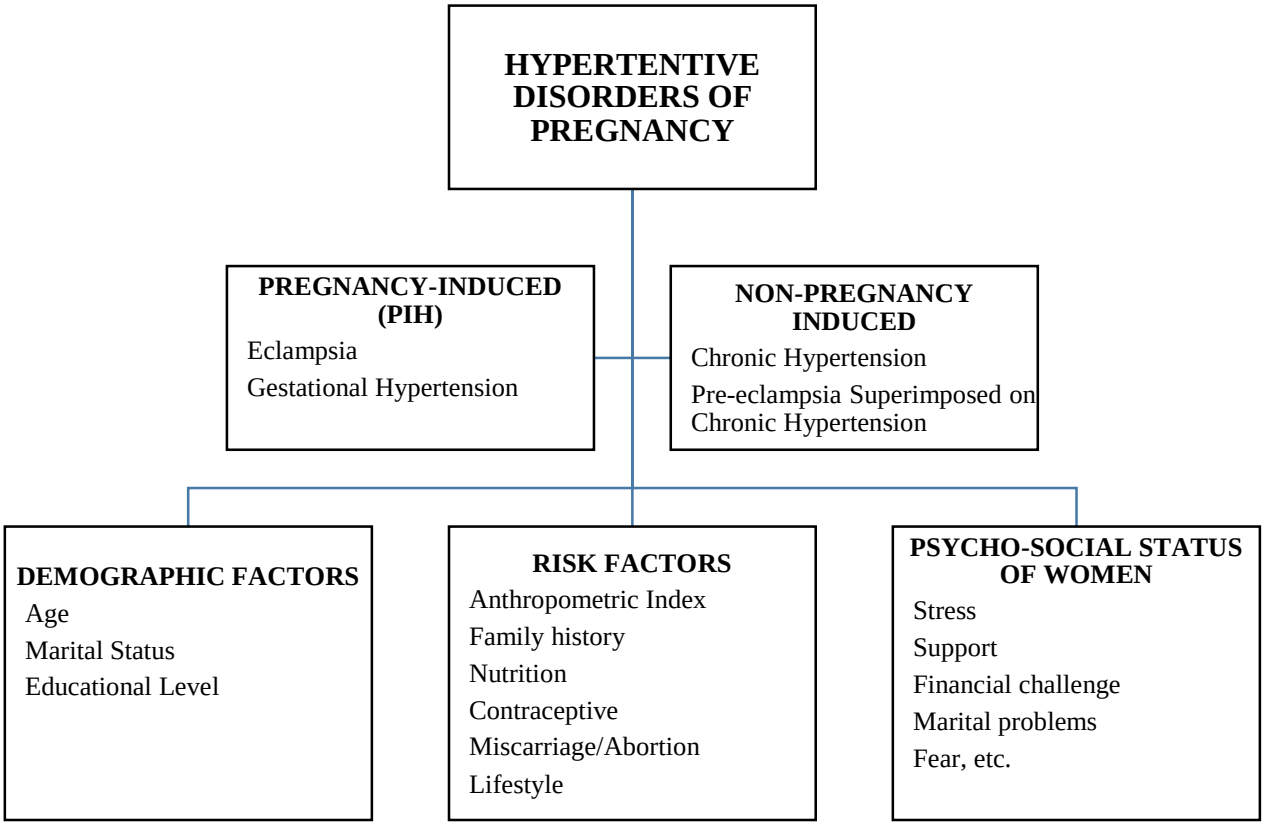


**Figure 1.*1* Conceptual Framework of risks factors associated with HIP**

**Source:** Author's construct, 2021.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Hypertensive disorders related to pregnancy have become a major health concern in developing countries. Although existing literature has revealed its nature, causes, risk factors, geographical variations, types, and other important discoveries of the disease, more is yet to be discovered about HDP. This chapter presents a thorough revision of the literature on hypertension associated with pregnancy. This chapter includes theoretical, conceptual and empirical reviews and a conceptual framework.

This chapter is delivered in four sections. The chapter takes a wider look at the concept and its related literature. The sections, therefore, continue to explore other aspects of the literature such as what theoretical explanations have been put forward, what it means when reference is made to pregnancy-associated hypertension and its related literature, evidence of hypertensive disorders during pregnancy in Ghana and the general conception of the researcher from the literature.

## 2.2 Theoretical Framework

The main theory that underpins this thesis is Prenatal Maternal Disorders. Prenatal developments adversely affect pregnancy and pregnant women. Literature related to theories explaining the development, types, causes and manifestation of hypertensive disorders during pregnancy is scarce. Prenatal disorders are a collection of conditions that pregnant women develop in the various stages of their pregnancy.

### 2.2.1 Prenatal Maternal Disorders

For many women, pregnancy and motherhood increase their risk of disorders such as psychiatric conditions (Carter, 2005; Cantwell and Cox, 2003), genetic disorders (Wilsdon and Eason, 2012), pregnancy-induced hypertension (Der et al., 2013; Agyare, 2018; Antwi et al., 2017; Kaysay et al., 2018 and Njukang et al., 2020), etc. These vulnerabilities become concerns because of two reasons; they may be underdiagnosed and undertreated (Carter, 2005). Carter (2005) adds that some of these disorders are attributed to pregnancy-related changes, therefore, the distinction between normal changes and abnormal changes as a result of prenatal disorders is critical in routine antenatal care (Cantwell and Cox, 2003).

Prenatal disorders are known as common disorders among pregnant women. According to Edwards et al. (2008), prenatal disorders are known to harm mother-child bonding, development and wellbeing more than postnatal disorders. Its prevalence may be high among geographical locations, albeit, its risks are universal. Attention has been drawn to these developments due to their continued effect on foetus development, complications and mother health (Boakye-Yiadom, 2015). Their prevalence, however, has the possibility of causing problems for both the mother and the baby anytime during the pregnancy journey (Edwards et al., 2008). Stress, a prenatal disorder, is known to affect neuroendocrine development in the foetus and the attachment of the mother to the newborn, the way the woman perceives her foetus can affect the socio-emotional development of the child.

These are also proved to hurt mother and baby more than postnatal disorders (Austin and Lumley; Murray et al., cited by Edwards et al., 2008). These disorders are evidenced to leave pregnant women with emotional and psychological troubles such as depression, anxiety, panic, obsessive-

compulsive, blood pressure, hypertensive disorders etc. (Boakye-Yiadom, 2015; Carter, 2005; Edwards et al., 2008). Early diagnosis and detection can contribute greatly to this mother-child development. This would also potentially identify women at high risk, enabling appropriate intervention to be provided.

### 2.3 Hypertensive Disorders in Pregnancy (HDP)

Hypertension related to pregnancy has received much attention in the literature. Also, proliferation in the African continent has increased in the past decade with Ghana's case as evidence. Several other studies have been undertaken elsewhere in Africa. For example, a thorough literature review in sub-Saharan Africa (SSA) by Meazaw et al. (2020) found 47 papers on the subject. Most of the studies were conducted in Ethiopia, Nigeria and Ghana. More than 13,589 expectant women in the region were revealed to have been understudies over the decades.

The terms HDP (Ahenkorah, 2009; Owiredu et al., 2012 Antwi et al., 2018) and pregnancy-induced hypertension (PIH) (Der et al., 2013; Agyare, 2018; Antwi et al., 2017; Kaysay et al., 2018 and Njukang et al., 2020) have continually been used in most studies. Although this may be confusing, various researchers have expanded the concepts to make them clearer and more convincing. Ahenkorah (2009) for example, defended that the term pregnancy-induced hypertension (PIH) is popular in literature because preeclampsia cases related to pregnancy progress to develop eclampsia.

To explain, Ahenkorah **(**2009) added that PIH is referred to as a hypertension diagnosis caused by pregnancy while HDP is referred to as the general issue of hypertension during pregnancy among women. Thus, PIH is primarily caused by pregnancy-related factors while HDP includes

both pregnancy-induced and pre-existing conditions (Roberts et al., 2015). Pregnancy–Induced Hypertension (PIH) is referred to as high blood pressure diagnosed after twenty (20) weeks of gestation in a woman who has not been had preceding hypertension (National High Blood Pressure Education Group cited by Ahenkorah, 2009; Owiredu et al., 2012) while Hypertensive disorders of pregnancy (HDP) refer to conditions in gestation with diagnosed characteristics of high BP either by gestation induced or chronic cases. PIH regresses after delivery (Owiredu et al., 2012).

The term hypertension, according to the American college of obstetricians and gynaecologists (ACOG) is "Systolic blood pressure (BP) greater than or equal to 140 mm Hg and/or diastolic blood pressure of 90 mm Hg or greater" (ACOG, 2013). Hypertension is seen as normal till the systolic blood pressure level and diastolic BP level reach 110 mm Hg and 160 mm Hg correspondingly. Albeit, both systolic and diastolic levels above 140 mm Hg and 90 mm Hg are diagnosed as hypertension, a severe level of blood pressure that calls for serious action should be above or equal to 170 mmHg (systolic) and 110 mmHg (diastolic). At this level, Martin et al. (2005) advise the danger of a possible illness and death of a mother. This is because other adverse medical conditions can be recorded afterwards. According to Wagner (2011), severe hypertension can cause cerebral perfusion pressure which can cause brain damage. It is therefore important for patients diagnosed with severe hypertension to receive medical attention and lowered quickly to avert such problems. Severe cases require antihypertensive treatment (Lowe et al., 2015).

To be certain of hypertension diagnosis, ACOG recommends that diagnosis should be undertaken twice at least four hours (ACOG, 2013) to six hours (Njukang et al., 2020; Antwi et al., 2017; Kahsay et al., 2018) away from each other albeit, severe cases can be detected in minutes.

Diagnosis of Pregnancy-induced hypertension should be undertaken after five months (20 weeks) of pregnancy while chronic cases should be done before 20 weeks of gestation (Njukang et al., 2020). This is to give enough evidence to support the diagnosis of pregnancy-induced cases. Chronic diagnosis after pregnancy can be mistaken as gestation induced and affect appropriate treatment which can also affect foetal developments.

### 2.3.1 Classification of HDP

A professional organisation in public health has cited different classifications of HDP in the literature, which they believe are accurate (Meazaw, 2020). Several classifications were identified in the literature during this study. Preeclampsia with chronic hypertension and gestational hypertension, on the other hand, predominated in the majority of the classifications, often superimposed on chronic hypertension. The American College of Obstetricians and Gynecologists acknowledges that differences in terminology in the literature continue to confound healthcare professionals and that a consensus on the HDP classification is required to advance research and clinical practice. The International Society for the Study of Hypertension in Pregnancy (ISSHP), the Society of Obstetric Medicine of Australia and New Zealand, and the Task Force on Hypertension in Pregnancy of the American College of Obstetricians and Gynecologists have classified pregnancy-related hypertension into four categories. Preeclampsia-de Novo or superimposed on chronic hypertension is classified as white coat hypertension (Antwi et al., 2017). Gestational hypertension and new hypertensive effects were both added to the list of factors that could cause hypertension during gestation by the National High Blood Pressure Education Program Working Group (2000) as well as the Canadian Hypertensive Disorders of Pregnancy Working Group (Butalia et al., quoted by Lowe et al., 2015).

According to Kayhay et al. (2018), HDP is defined as a woman who has been diagnosed with any type of hypertension while pregnant. The classification of HDP used in this study was that of the ACOG. The schema classification system, which was first introduced in literature in 1972, was adopted by the college. It was later modified in 1990 and 2000 as part of a BP training programme. Their classification was based on a precise differentiation into four categories, which they followed. Compared to chronic hypertension, pregnancy-induced hypertension is a more severe condition. In most cases, chronic hypertension is discovered after twenty (20) weeks of pregnancy, but it can last for more than six weeks after the birth of the baby (ACOG cited by Owiredu et al., 2012). According to Owiredu et al. (2012), Gestational Hypertension (GE) and Pre-eclampsia (PE) are referred to as pregnancy-induced hypertension as a group. Untimely delivery, foetal death, and maternal mortality are all associated with PIH, which is a well-known source of pregnancy-related disorders.

#### 2.3.1.1 Preeclampsia-eclampsia

PE is the most common type of hypertension, and it is a multisystem condition that is associated with pregnancy but for which there is no known cause (Fonjo et al., 2020; ACOG, 2013). During the first twenty (20) weeks of pregnancy, preeclampsia begins to manifest itself (Owiredu et al., 2012). Its most notable characteristics are high blood pressure and proteinuria. The clinical sign appears in the twentieth week of pregnancy or later, and it continues to progress after the delivery of the baby (Osungbade cited by Fonjo et al., 2020).

PE is the most common type of high blood pressure (ACOG, 2013). Pre-eclampsia can be classified into two types: early-onset preeclampsia and late-onset preeclampsia. During the early stage of pregnancy, the disease manifests itself before 34 weeks of pregnancy, whereas the late

stage occurs after 34 weeks of pregnancy. In some women, the severity of preeclampsia is not accompanied by proteinuria (ACOG, 2013). Preeclampsia is diagnosed in these situations when symptoms such as pulmonary oedema, among other things, appear (Fonjo et al., 2019). Proteinuria is diagnosed when blood pressure levels are equal to or higher than 300 mg, or when the protein to water ratio in a patient's urine exceeds 0.5.

#### 2.3.1.2 Eclampsia

Eclampsia is an uncontrollable stage of PE and is seen as a severe stage of hypertension (ACOG, 2013; National Institute for Health and Clinical Excellence, 2010). Often diagnosed as a convulsive stage of PE, PE can progress to eclampsia (Fonjo et al., 2019). Thus, the development of PE can reach a severity level which is then called eclampsia. Kahsay et al. (2018) add that a woman who is diagnosed with PE is likely to develop eclampsia. The severity of eclampsia is that women who are diagnosed are fourteen (14) times more likely to die of it (Kahsay et al., 2018). Eclampsia is often preceded by signs such as severe headache and hyperreflexia. Its biochemical markers are an increased manifestation of complications for patients (ACOG, 2013).

#### 2.3.1.3 Gestational Hypertension (PH)

It is hypertension diagnosed after twenty (20) weeks of pregnancy without an earlier diagnosis of any high blood pressure (Fonjo et al., 2020). Gestational hypertension develops after 20 weeks of pregnancy deprived of other signs of preeclampsia and significant proteinuria (Owiredu et al., 2012). Gestational and other PIH suppress postpartum, therefore, any hypertension diagnosis that fails to normalise after delivery is a misdiagnosis and requires altering it to a chronic diagnosis (ACOG, 2013).

#### 2.3.1.4 Chronic Hypertension

Chronic hypertension, also referred to as essential hypertension, predates pregnancy or is detected 20 weeks after pregnancy (Ahenkorah, 2009; ACOG, 2013). Chronic hypertension is defined as any form of high blood pressure that develops prior to pregnancy or before the twenty (20) week mark of a woman's pregnancy (Fonjo et al., 2020). Chronic hypertension could also be determined through medication, so a pregnant woman who is already taking medication could be at risk.

#### 2.3.1.5 Chronic hypertension with Superimposed Preeclampsia

Chronic hypertension predates pregnancy and mothers recorded to have been diagnosed with hypertension prior to pregnancy or before 20 weeks of gestation, and indications of preeclampsia after 20 weeks of gestation were present are classified under this condition (ACOG, 2013). Although superimposed Preeclampsia is not considered severe when the diagnosis is a pressure less than 160 mm Hg systolic and 110 mm Hg diastolic and proteinuria, organ failure can be recorded. Lindheimer (1993) revealed that preeclampsia, when covered in other forms of hypertension related to gestation, is the highest risk to both mother and foetus.

### 2.4 Diagnosis of HDP

The blood pressure prediction model and measurement have been in contention over the years (Lindheimer, 1993). Various recommendations have been developed and recommended by health organisations (both local and international) (National Institute for Health and Clinical Excellence, 2010). However, there are continuous variations in approaches used by countries. Antwi et al. (2016) explain that such differences in prediction models among countries, especially between

advanced and developing countries, are different in the availability and cost of diagnostic tools. The World Health Organisation has recommended the use of Korotkoff phase IV (muffling) as the determinant of diastolic levels yet, this may be difficult due to the likelihood of intra-arterial overestimation. The clinical prediction model is used in Ghana (Antwi et al., 2017). This model approximates the likelihood of a person developing certain health conditions (Altman et al. cited by Antwi et al., 2017).

Lindheimer (1993) describes blood pressure readings during pregnancy to decrease in the first trimester and stabilise by mid-trimester and increase after delivery. However, some pregnancies may experience excessive blood pressure beyond the normal readings. The stage in the pregnancy journey where such an alert is seen determines the type of HDP. This has been discussed in the previous section where the various types of HDP as recommended by the American College of Obstetrics and Gynecology. Diagnosis of Pregnancy-induced hypertension (gestation and preeclampsia) should be undertaken after five months (20 weeks) of pregnancy while chronic cases should be done before 20 weeks of gestation (Njukang et al., 2020). This is to give enough evidence to support the diagnosis for pregnancy-induced cases. Chronic diagnosis after pregnancy can be mistaken as gestation induced and affect appropriate treatment which can also affect foetal developments but gestational cases that fail to suppress after delivery may be classified as chronic diagnosis (ACOG, 2013). To be certain of hypertension diagnosis, ACOG recommends that diagnosis should be undertaken twice at least four hours (ACOG, 2013) to six hours (Njukang et al., 2020; Antwi et al., 2017; Kahsay et al., 2018) away from each other albeit, severe cases can be detected in minutes.

It is evident that blood pressure develops in two stages (Fonjo et al, 2019). During the first stage of blood pressure, the injury caused by The presence of foetal trophoblastic incursion of the

decidua, as well as localised placental hypoxia, is seen. The release of placental blood-related factors into the maternal circulation, as well as aberrant expression of pro-inflammatory, antiangiogenic, and angiogenic factors, are all associated with pregnancy complications, are the next stages of the condition. Medical prediction of blood pressure makes the assumption that people with certain underlying conditions or with specific health outcomes are more likely to have high blood pressure (Antwi et al., 2017). They combine patient data in order to estimate medical outcomes, which should be validated before being used in clinical practise. Mother's medical history, uterine artery Doppler, and biomarkers are the most important indicators used in the prediction.

There are also three different levels of blood pressure identified by the Guideline Development Group (GDG). Mild hypertension is diagonosed by systolic blood pressure between 90 and 99 millimetres of mercury (mmHg) and diastolic blood pressure between 140 and 149 millimetres of mercury (mmHg). Moderate hypertension is diagonosed by systolic blood pressure between 100 and 109 millimetres of mercury (mmHg) and severe hypertension as systolic blood pressure between 150 and 159 millimetres of mercury (mmHg (diastolic BP 110 mmHg or greater and systolic BP 160 mmHg or greater). In order to reduce the incidence of maternal mortality and morbidity, severe hypertension above the indicated thresholds must be treated as soon as possible (Martin et al., 2005)

The study by Antwi et al. (2017) measured the regional and district disparities in PIH in Ghana undertook samples in both using a mercury sphygmomanometer and Korotkoff phase V sound by trained midwives. Participants sat comfortably with their backs supported, legs uncrossed and mute. A suitable adult-sized cuff was placed on the bare left upper arm at the level of the heart. As recommended, two readings were taken at a 5-minute interval where average recordings were

calculated. The sphygmomanometers at the clinics are calibrated intermittently to guarantee accurate readings.

### 2.5 Causes of HDP

The main cause(s) of hypertension disorders in pregnancy is still being researched (Fonjo et al., 2019; Antwi et al., 2016). Hypertension primarily may have underlying causative factors however, the primary causes are not fully known (Owiredu et al., 2012; Roberts et al., 2015; Antwi et al., 2017; Kahsay et al., 2018; Laine et al., 2019; Njukang et al., 2020). Roberts et al. (2015) add that the cause of pregnancy-induced cases is elusive. However, some factors have been highlighted as risk factors linked to the disease in literature, although some of them have not been evidenced in Ghana. Albeit, genetic, nutrition and immunological factors and vascular changes have been cited as contributing agents to HDPs (Kashsay et al., 2018), other secondary causes are equally rare (Lindheimer, 1993).

This study's objective seeks to assess risk factors therefore, this section throws more light on some identified risk factors. Correct data that can help in the accurate diagnosis of pregnant women at risk of BP could enhance antenatal case and (ANC) as well as reducing complications developed due to the condition (Antwi et al., 2017). Several risk factors have been cited as contributive to HDP (Kahsay et al., 2018).

According to Roberts et al. (2011), risk factors for HDP have been well documented. General risk factors include socio-demographic, obstetric, family and medical-related factors. Other identified factors are geographical factors (Kahsay et al., 2018), poor placentation and feto-maternal interactions (Antwi et al., 2016), contraceptives, maternal age, partner change (Owiredu

et al., 2012). Ahenkorah (2009) did an enormous job in her doctoral thesis with scholarship study on the vast factors that have been noted as underlying causes of hypertension related to pregnancy.

Scientists and physicians have been trying to figure out the specific cause of pre-eclampsia since Hippocrates' time, and various theories have been advanced in the meantime. Although the symptoms of preeclampsia and eclampsia were previously described by the ancient Greeks, it was not until 1739 that eclampsia (preeclampsia with seizures) was distinguished from epilepsy and given the name eclampsia parturentium that it was officially recognised. Proteinuria was first observed in 1843, which led to the hypothesis that eclampsia was caused by uraemic poisoning, which was caused by impaired renal excretion, as previously stated. It was not until the end of the nineteenth century that eclamptic hypertension was discovered.

Initially, it was assumed to be a symptom of essential hypertension that had been brought to light and coloured in particular by pregnancy, but this was later proven to be incorrect (Chesley, 1984). Although formerly thought to be caused only by the presence of placental tissue, it has now been revealed that preeclampsia can develop in the presence of placental tissue in situations such as retained placental tissue and hydatidiform mole, even in circumstances in which the foetus is not present. Previous theories suggested that the placenta's disease was to blame for the birth defect. It was not until 1967 that Robertson and Brosens reported precise structural changes in the uteroplacental unit that led to the development of preeclampsia. Until recently, it was believed that a failed pregnancy was a precondition for the development of preeclampsia (Ahenkorah, 2009). Although the pathophysiology of hypertensive pregnancy is still a mystery, it has been described as complicated, involving components such as immune system activation, genetics, placental development, and environmental exposure, among others.

Women who present with prenatal hypertension and preeclampsia have been found to have reduced amounts of vasodilators such as nitric oxide and prostacyclin in their tissues, according to some research (Granger et al.; Mitchell et al. cited by Ahenkorah, 2009). Some researchers feel that preeclampsia is actually two diseases that exhibit themselves at the same time, rather than just one. In the first trimester, it is asymptomatic; nonetheless, the initial stage is characterised by aberrant placental development, which leads to placental insufficiency as well as the discharge of large amounts of placental components into the maternal blood. When a woman is in the second trimester of pregnancy, she experiences aberrant placental development, which leads in placental insufficiency as well as the expulsion of large amounts of placental components into the maternal circulation. In turn, this results in the development of characteristic hypertension and renal impairment, as well as an increased risk for the HELLP syndrome (haemolysis, elevated liver function enzymes, and low platelets), as well as for eclampsia and other endorgan damage in the second, symptomatic stage of the condition. All of these factors could play a role in the development of endothelial dysfunction, which is a feature of gestational hypertension and preeclampsia.

Following this endothelial dysfunction, several critical features of preeclampsia may manifest themselves, including vasoconstriction, hypertension, loss of the usual pregnancy-associated refractoriness to the pressor effects of angiotensin II, increased platelet aggregation, and proteinuria, among other things (National High Blood Pressure Education Group, 2000). Preeclampsia, in particular, is a multisystem disorder with varying progression that manifests as signs and symptoms that must be treated as soon as possible. It is associated with generalised vasospasm and progressive participation of essential organs such as the liver, kidney, brain, and circulatory systems, all of which require prompt treatment. Several studies have suggested that

abnormalities of the placenta are the primary cause of preeclampsia. This is supported by the fact that placental delivery can reverse the symptoms of preeclampsia, indicating that the placenta plays a critical role in the disease. The incidence of preeclampsia is also higher in women who have increased placental tissue relative to their gestational age, such as those who have hydatidiform moles or who are carrying twin children.

### 2.5.1 Placental Involvement

It is plausible to believe that the placenta plays an essential part in the aetiology of the condition because delivery of the placenta is the only definite treatment for the disease. On the pathologic examination of placentae from preeclamptic pregnancies, infarcts and sclerotic constriction of arteries and arterioles are prevalent. There is also a decrease in cytotrophoblast endovascular invasion and insufficient remodelling of the uterine spiral arterioles. When preeclampsia is present, there is a 30 – 80% chance of experiencing growth restriction during pregnancy. Normal pregnancies result in significant remodelling of the uteroplacental spiral arteries caused by invading cytotrophoblast. The muscular, intimal and endothelial layers of the spiral arteries are removed and replaced by trophoblast, which is a stem cell (Robertson et al., 1967).

According to the findings, there is a correlation between preeclampsia and the trophoblast's incapacity to transform spiral vessels; the number of transformed vessels is reduced, and transformation does not reach the myometrium of the arteries (Robertson et al., 1967). A failure in the penetration of the cytotrophoblast has been demonstrated in the histology of women who go on to develop preeclampsia, resulting in the retention of muscular elastic elements in the walls and carotid arteries of the maternally derived vessels. Unsuccessful placentation can result in decreased placental blood flow, and the consequent underperfusion of the placenta can result in

hypoxic damage to the mother as well as the formation of hazardous metabolites. Preeclampsia is a generalised disease that can be caused by toxic compounds from a hypoxic placenta that are discharged into the maternal circulation, according to the leading explanation in recent years. Numerous research have provided evidence in support of this idea.

### 2.5.2 Circulating Factors

Several lines of evidence point to the presence of a circulating factor derived from the placenta, which targets the endothelial cell and causes widespread activation, as the cause of preeclampsia. The hypothesis and nature of the circulating factor(s) as well as their relationship to preeclampsia have been thoroughly investigated in a number of in vivo and in vitro studies.

### 2.5.3 Placental Malaria and Hypertensive Pregnancy

In Africa's tropical regions, malaria and hypertension are two of the most common pregnancy disorders. The symptoms of these two diseases include placental ischemia, endothelial dysfunction, and the production of proinflammatory cytokines (Ahenkorah, 2009). This similarity has led to speculation that there may be a link between malaria and hypertension in pregnancy. It has been suggested that there may be a connection between malaria and hypertension in pregnancy.

Parasite sequestration in the placenta is defined as a condition characterised by There is a link between placental ischemia and increased production of proinflammatory cytokines as well as increased production of cytokines associated with endothelial dysfunction. According to the Centers for Disease Control and Prevention (CDC), placental malaria infection (PMI) results in

placental ischemia and loss of placental integrity, which leads to endothelial cell dysfunction and cytokine activation in the mother and child.

### 2.5.4 Maternal Factors

This disorder is thought to be caused by an aberrant placentation induced by failure of trophoblast remodelling in the uterine spiral arterioles, which causes secreted factors to enter the maternal circulation, resulting in the clinical signs and symptoms that are distinctive of the condition. Preeclampsia is characterised by the presence of end organ damage and/or hypoperfusion as a result of the illness. Glomerular endothelial dysfunction, increased vascular permeability, and a systemic inflammatory response are all factors contributing to the development of clinical symptoms. These clinical signs are most common after the 20th week of pregnancy, according to research (Hladunewich et al., 2007). There is evidence that tissue-specific immune system constituents, such as cells and molecular components, may play an important role in the regulation of normal trophoblast invasion, and an abnormal maternal immune response to the invading trophoblast has been proposed as a contributing factor to superficial trophoblast invasion.

It is normal for women to experience changes in their blood pressure during pregnancy, including a decrease in both systolic and diastolic blood pressure as a result of decreased systemic vascular resistance as a result of vasodilation (Hladunewich et al., 2007). Relaxin, which is secreted from the ovaries under the supervision of Human Chorionic Gonadotropin, has the ability to upregulate nitric oxide synthase activity (NOS). Endothelin B receptors in the endothelium are receptors for the enzyme NOS, which creates nitric oxide (NO) from the amino acid arginine. Endothelin B receptors in the endothelium are receptors for the enzyme NOS. The disturbance of endothelial-

derived vasoactive factors in preeclampsia is thought to result in the predominance of substances that are vasoconstrictors (endothelin, thromboxane A2) in the bloodstream over molecules that are vasodilators (oxytocin, thromboxane A2) (NO, prostacyclin). This type of hypertension is described by recurring blood pressure measurements of 140/90 mmHg or greater. It is likely that improper vasoconstriction will result in hypertension. Thus, it is probable that the hypertension observed during a hypertensive pregnancy is caused by anomalies such as aberrant vasoconstriction during the pregnancy.

### 2.5.5 Genetic Factors

For several years, it has been established that a familial factor contributes to the development of preeclampsia and its complications. The existence of a genetic predisposition for preeclampsia has been demonstrated in several families, indicating that genetic factors may play a role in its progression. A 3 to 4 fold increase in the incidence of preeclampsia in first-degree relatives of affected women has also been demonstrated in epidemiological studies (Brown et al.,2011). When comparing daughters of women who have had preeclampsia to daughters of women who have not had preeclampsia, it is possible that the risk is two-fold higher. Prevalence of preeclampsia and eclampsia among women with severe preeclampsia and eclampsia among their daughters was found to be significantly higher than among their daughters-in-law in the same study. As a result, a genetic predisposition to preeclampsia is suggested to be passed down from mother to daughter, which proposes a model of mitochondrial inheritance of the disease (Ahenkorah, 2009).

According to the findings of Ahenkorah, (2009), the existence of homozygosity for the same recessive gene in both the mother and the foetus, on the other hand, is the single-gene model of

inheritance that best explains the general occurrence of preeclampsia in the general population. As a result, the recessive allele would be present in the genomes of these foetuses, which they would then pass on to their male and female progeny as a result of their conception. Consequently, if their mother has preeclampsia, both male and female children are at increased risk of experiencing a pregnancy that is affected by preeclampsia. It was discovered in a study conducted on the children of preeclampsia patients that both males and females were more likely than controls to have a child who was the product of a preeclamptic pregnancy (Alhusen, 2011). This study examined cases of the illness ranging in severity from mild to severe. According to the findings of a population-based study conducted in Norway among males who had children with more than one woman, it has been demonstrated that, in addition to the previously observed maternal contribution to the risk of preeclampsia, there is a paternal component to the risk (Roten et al.,2015). According to the findings of this study, men who had fathered a kid during the course of her pregnancy were more than twice as likely as men who had not fathered a child during the course of her pregnancy to develop preeclampsia while pregnant with another woman, according to the study's findings. Theoretically, the contributions made by mothers and fathers to the inheritance of preeclampsia may differ depending on the severity of the illness in question (Roten et al.,2015). All in all, preeclampsia is a syndrome that can be caused by a variety of conditions, with the majority of cases being caused by a combination of placental, immunologic (maternal, paternal, and modifier genes), and environmental (environmental factors) factors. Although little is known about the relationship between these various conditions and specific clinical manifestations of the syndrome, there is some evidence that they may be. The existence of specific patterns of associations between maternal risk factors and clinical subtypes of preeclampsia, on the other hand, may aid in elucidating the underlying heterogeneous pathogenesis of the condition.

### 2.5.6 Immunological Factors

A basic failure of trophoblast invasion is related with preeclampsia, the cause of which has not been discovered. According to some experts, disordered placentation may be a symptom of an aberrant maternal immune response to foetal antigens derived from the father, which could lead to preterm birth. Because of the increased prevalence of preeclampsia in multiple pregnancies, molar pregnancies, and pregnancies associated with increased placental mass, it has been hypothesised that the antigen load and trophoblast volume of the foetus may play a pathological role in the development of this condition. Immunological factors are linked to the development of preeclampsia, according to a large body of epidemiological evidence, and other studies have confirmed this finding while also demonstrating that the association does not hold true for factors such as nulliparity or gestational hypertension, among others (Ahenkorah, 2009). This could imply that preeclampsia and gestational hypertension are two distinct disorders with distinct etiologies, as previously suggested. According to research, the presence of preeclampsia in multigravid women increases when a woman's romantic partner changes.

### 2.5.7 Contraceptive Use

Pregnancy-Induced Due to the fact that it occurs more commonly in primigravidae and extremely rarely in multigravidae unless there is a change in paternity, it has long been assumed that hypertension has an immunological foundation (Robillard et al., 1993). It has been discovered in several studies that frequent exposure to a father's spermatozoa before conception may reduce the incidence of pregnancy-induced hypertension during the first trimester (Marti & Herrmann, 1977). Contrary to popular belief, the findings of studies on the use of contraceptives as a risk factor for hypertensive pregnancy are still subject to debate. According to certain research, barrier

techniques or oral contraceptives do not appear to lessen the risk of Pregnancy-Induced Cervical Cancer in women who are pregnant ( Roten et al.,2015).

### 2.5.8 Abortion/Miscarriage

Some research has looked into the impact of abortion on the occurrence of pregnancy-induced hypertension (PIH) in a subsequent pregnancy, with inconsistent results (Eras et al., 2000). The first study to address this subject was carried out by MacGillivray in 1958. It was determined whether having a full-term pregnancy and an abortion has any effect on the likelihood of having a perinatal haemorrhage in a subsequent pregnancy. A full-term pregnancy had a preventive impact and lowered the risk of disease in a subsequent pregnancy by as much as 90%, according to the researchers, whereas abortion provided a measure of protection that was close to but not equal to the protection conferred by a completed pregnancy, according to his findings (Eras et al., 2000). The protective effect of abortion has been affirmed by other studies. It has been suggested that the number of previous abortions that confer this protection varies for gestational hypertension and preeclampsia (Eras et al., 2000).

## 2.6 Biochemical Aspects of Hypertension in Pregnancy

Aside from the causes that have been identified in the previous section as the main factors accounting to hypertensive disorders among pregnant women, Ahenkorah (2009) revealed two biochemical aspects of the disease. These are explained in the two sections illustrated.

### 2.6.1 The HELLP Syndrome

It has just been two decades since the HELLP syndrome, which refers to a subset of women who have severe preeclampsia and also have hemolysis, increased liver function tests, and

thrombocytopenia (low platelets), first became widely known. The majority of these groups of women are symptomatic, with upper abdominal pain, nausea, and vomiting being often mentioned by the participants. A wide range of serum chemistry abnormalities can be found in patients with the HELLP syndrome, but typically only mild to moderate (>10 times normal) transaminase elevations are found, as well as signs and symptoms of haemolysis (in the form of elevated lactate dehydrogenase and bilirubin), and platelet counts are typically less than 100,000/mm2. If you get a liver biopsy, you will notice that there is fibrin deposition in the periportal areas and sinusoids as well as isolated parenchymal necrosis; nonetheless, there will be no signs of inflammatory infiltration. It is a dangerous pregnancy condition characterised by aberrant interactions between the microvasculature and the elements of blood that circulate during pregnancy. Thiocytopenia, microangiopathic hemolytic anaemia, and the release of cellular breakdown products, mainly from the liver, are all recognised as a result of this process. This group of breakdown products includes enzymes such as the transaminases and the lactate dehydrogenases.

Overall, there are three main diagnostic criteria for HELLP syndrome that can be employed in the laboratory setting to rule out other possible causes. The majority of patients first develop microangiopathic alterations that are visible on peripheral blood smears but do not appear to be connected with clinical indicators of disease severity, such as the presence or absence of hypertension and/or proteinuria in the blood, at least at the outset. The fragmented red blood cells that have been observed have been referred to as schistocytes, burr cells, and fragmentocytes, to name a few titles. There appears to be a link between the level of microangiopathic haemolytic anaemia and the extent of small vessel participation, as well as the extent of endothelial dysfunction in the bloodstream after the anaemia has been treated. As a result of the haemolysis,

these women's serum indirect bilirubin and total lactate dehydrogenase levels rise, but their serum haptoglobin levels fall.

The presence of increased liver enzymes, which are symptomatic of hepatic cell injury and dysfunction, which is the second requirement for HELLP syndrome, defines the condition as such. Elevated transaminases, particularly aspartate aminotransferase, are given a great deal of consideration when evaluating this criteria (AST). In the liver's hepatocytes, the enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are both found in high concentration, and they are both released into the circulation when the liver's hepatocytes or cell membranes are destroyed. Because it is located solely in the cytoplasm of hepatocytes, ALT is a more specific marker of hepatocellular damage than other markers, owing to its location in the cytoplasm. It is practically hard to have a healthy liver if your AST and ALT levels are raised in the bloodstream. Because of the high variability of enzyme concentrations in serum, it is important to understand how they are determined. The intracellular concentration and source of enzymes, the amount of enzymes that are released from the cell, and the rate at which enzymes are cleared from the circulation are all factors to consider. It follows as a result that the presence or absence of serum aminotransferase concentrations is not always an accurate predictor of the severity of hepatic injury, and that neither of the aminotransferases alone is an accurate predictor of hepatocyte injury. During an active illness state, the enzyme ratio AST to ALT is frequently 2:1 or higher; however, during a disease recovery state, this ratio commonly returns to 1:1 or even reverses itself.

Thrombocytopenia is the third and final criterion for HELLP syndrome, and it is present in all cases. In fact, it is the disease's most rapid laboratory alteration, and it can be detected by the vast majority of laboratory testing procedures already in use today. When thrombocytopenia is

identified, it is determined that a platelet count of fewer than 150,000/mL is found in the blood. Thrombocyte counts are split into three subgroups: 100,000 to 150,000/mL for mild thrombocytopenia, 50,000 to 100,000/mL for moderate thrombocytopenia, and 50,000 to 100,000/mL for severe thrombocytopenia, respectively. While less than 100,000/mL is regarded diagnostic of HELLP syndrome, any concentration less than 100,000/mL is also considered diagnostic. There are several reasons for this, including to identify HELLP syndrome from the more benign gestational thrombocytopenia, as well as because in most cases, a platelet count of 50,000 or fewer is the threshold for serious harm to the mother and foetus with HELLP syndrome.

### 2.6.2 Electrolytes and Hypertensive Pregnancy

The pathophysiology of preeclampsia has been hypothesised to be influenced by irregularities in intracellular cation metabolism, according to some research. Despite the fact that the majority of biochemical and haematological laboratory parameters change during pregnancy, data on cation patterns during pregnancy are inconsistent, primarily due to variations in methods, and the majority of reports have examined only a few cations in preeclampsia. The notion that disturbances in intracellular pH, calcium, and magnesium ([Ca2+]i and [Mg2+]i) homeostasis are involved in the pathogenesis of hypertensive pregnancy stems in part from the well-established roles of these cations in contractility of smooth muscles and in cellular energy metabolism, respectively. The precise nature of their involvement, on the other hand, is still up in the air.

## 2.7 Effects of HDP

A study conducted in the 1990s by Lindheimer (1993) identified some of the effects of HDP on pregnancy that had previously been seen. There are several maternal and neonatal problems, some of which are fatal (Meazaw et al., 2020). HDP has an adverse effect on the health of the mother as well as the development of the child. Cushing's syndrome is a condition that affects some women who have secondary forms of hypertension. In patients with scleroderma and periarteritis nodosa, severe hypertension has been related with deadly cerebral haemorrhage, which has been documented on occasion. Pheochromocytoma and transitory hypertension are among the other side effects.

If PE is left untreated, it can progress to eclampsia, which can result in adverse foetal outcomes such as preterm birth, small for gestational age babies, placental abruption, and perinatal death. Women who have PE are also at an increased risk of developing cardiovascular and cerebrovascular disease, as well as the development of venous thromboembolism in later life (Fonjo et al., 2019). Furthermore, women who have PE are more prone than women who do not have PE to suffer from mental health problems such as shame, remorse, feelings of failure, loss of control, personal inadequacy, and postpartum depression. According to another study, HDP increases the risk of heart attacks, cardiac failure, cerebrovascular accidents, and renal failure in pregnant women (Njukang et al., 2020). Increased hazards for foetuses of hypertensive moms include unwanted placental oxygen transfer, Intrauterine Growth Restriction (IUGR), preterm birth, placental abruption, stillbirth, and neonatal death, among other things. Aside from that, hypertensive diseases are responsible for more than 18% of all foetal deaths, which is a significant number (Cnossen et al. 2009).

The presence of hypertensive disorders during pregnancy is related with greater risks for both the mother and her unborn child. When it comes to maternal mortality in the United Kingdom, hypertensive disorders during pregnancy are one of the most common causes, accounting for approximately a quarter of all maternal fatalities (National Institute for Health and Clinical Excellence, 2010). Despite advances in treatment, preeclampsia, eclampsia, and prenatal hypertension remain to be among the most prevalent high-risk pregnancy problems that cause maternal and foetal morbidity and mortality in the United States of America (ACOG, 2013). Several studies, including a systematic review conducted by the World Health Organization (WHO), have found that hypertensive disorders are one of the leading causes of maternal mortality worldwide, accounting for 50,000 deaths per year, with the majority of these deaths occurring in Africa, Latin America, and the Caribbean, according to the WHO (Antwi et al., 2016).

The 30-34-year-old age group had the highest frequency of deaths in this category (30.1%), followed by the 30-34-year-old age group. This was followed by the age group of 35-39 years, which received 17.1% of the vote (Table 2). The most common complications of hypertensive disorders that resulted in death in this group were intracranial haemorrhage in 27 (21.9%), congestive cardiac failure in 24 (19.5%), and hypertensive encephalopathy with cerebral oedema in 19 (all of whom died) (15.5%). According to the Ghana Health Department, 14% of all female deaths are related to pregnancy, with high-dose pregnancy (HDP) being the third leading cause of maternal deaths (9%), following haemorrhage (22%) and induced abortion (11%) (Antwi et al., 2016; Antwi et al, 2017). Ghana Maternal Health Survey estimates that HDP is responsible for 9% of all maternal deaths in the country.

## 2.8 Prevalence of HDP

Hypertension complicates an average of 9% of pregnancies worldwide, according to the World Health Organization (Ahenkorah, 2009). It is believed that between 2% and 10% of pregnancies globally are affected with HDP each year, with the prevalence varying from nation to country (ACOG, 2013). Pregnancy complications are common in the United States, with 5-10% of pregnancies being complicated by this disease. It is also a primary cause of maternal, foetal, and neonatal morbidity and mortalities, as well as neonatal mortality (Seely & Solomon, 2003). Pregnancy problems due to gestational hypertension have been documented in between 4.4 and 17.5% of pregnancies, with a weighted mean of 14.6% in the general population (North et al., 1999). Depending on the study, the reported incidence of preeclampsia can range between 3 and 10% (World Health Organization, 1988), with some of the discrepancy presumably attributable to differences between study populations (World Health Organization, 1988). Iranian officials have reported a preeclampsia prevalence of 3.0% in the city, according to government figures (Pyri et al., 2001). According to studies on the illness, pregnancy-related hypertension disorders have been recorded in 4.9% of pregnant women giving birth in a tertiary care hospital in Sri Lanka (Jayawardana & Fernando, 1995).

Despite the fact that PE is found in fewer than 20% of the population worldwide, it has been linked to hundreds of cases of maternal morbidity and mortality (Agyare, 2018). In developing countries, the prevalence of HIV/AIDS varies between 4 and 15%, with certain African countries having a rate as high as 15%. In South Africa and Tanzania, the prevalence rates range from 1.8% to 7.1%, depending on the region. This disorder affects between 2.0% and 16.7% of the Nigerian population, depending on the source. Ethiopia has a prevalence rate of 5.5%, according to the latest available data (Berhe et al., 2018).

Eclampsia has been documented among pregnant women throughout the world, although the incidence is modest. Since not all preeclamptic instances proceed to eclampsia, the condition's prevalence can be justified (Ahenkorah, 2009). In the United Kingdom, eclampsia has been reported to occur in 0.049% of pregnancies (Douglas & Redman, 1994), 0.056% of pregnancies in the United States (Saftlas et al., 1990), 0.1% reported by (Zhang et al., 2003), and 0.024% in Finland (Ekholm et al., 1999). In Tehran, the incidence of eclamps (Pyri et al., 2001). According to Jayawardana and Fernando (1995), the incidence of pregnancies in Sri Lanka is lower than the national average, with 0.28% of pregnancies reported in the Central Sri Lankan town of Peradeniya, and 0.38% of pregnancies reported in Galle, in the Southern Sri Lankan town of Galle (Goonewardene & Sirisena, 2006).

Women with hypertensive disorders were admitted to intensive care units at a rate of about 6% in one study, with pre-eclampsia being more common than other hypertensive disorders, according to Adu-Bonsaffoh and colleagues (2014). They presented a number of studies that reported the HDP is found in abundance all over the world and that about 6% of women with hypertensive disorders were admitted to intensive care units. In comparison to other hypertension illnesses, pre-eclampsia was associated with a higher rate of admission to the intensive care unit (Adu-Bonsaffoh et al., 2014). When Wolde and colleagues (2011) conducted an Ethiopian study, they found an 8.6% rate for HIV infection, which is consistent with the total rate reported here. However, according to their findings, the risk of being admitted to the critical care unit was not connected with the types of hypertensive diseases that were present during the course of the research investigation. Hypertensive disorders are currently the major cause of institutional maternal death in Ghana, according to recent studies (Adu-Bonsaffoh et al., 2015; Lee et al., 2011).

At the same time, more proactive and targeted interventions to prevent and appropriately manage the adverse maternal consequences of hypertension disorders in pregnancy are urgently needed to reduce the number of maternal deaths that are associated with these conditions in the future, as well as the number of pregnancies that are terminated due to these conditions (Adu-Bonsaffoh et al., 2014). The researchers at the Korle-Bu Teaching Hospital in Ghana did a study and discovered that pre-eclampsia and severe postpartum haemorrhage were the most common problems among pregnant women who were either in imminent risk of dying or on the edge of dying (Tunçalp and colleagues, 2013). Women with severe morbidity were found to have a high intra-hospital maternal mortality index in this study, indicating that the quality of care provided to them has to be improved. In low-income countries, there are inherent delays in providing care; therefore, the high rate of severe maternal outcomes associated with hypertensive disorders in pregnancy and other obstetric emergencies may be explained in part by these delays, with significant contributions also coming from underlying poverty and specific sociocultural factors (Adu-Bonsaffoh et al., 2014).

Additionally, according to a study by Njukang et al. (2020), the prevalence of hypertensive disorders of pregnancy (HDP) was 14.5%, with 3.4% being chronic hypertension (CH), 31.8% being gestational hypertension (GH), 48.3% being preeclampsia (PE), 5.7% being PE superimposed on CH, and 10.8% being preeclampsia plus preeclampsia plus preeclamps It was determined that there are risk factors for hypertensive disorders of pregnancy among pregnant women in a study conducted in public hospitals in Tigray, Ethiopia, by Kahsay et al. (2018), which was conducted in public hospitals in Tigray, Ethiopia. Residents in rural areas were shown to be at higher risk of developing hypertensive disorders (odds ratio = 3.7, 95% confidence interval [CI]: 1.9 to 7.1), according to the study's findings.

Ghana has not yet recorded any incidents of widespread prevalence on a national scale. According to hospital records, the figures for prevalence shown here are accurate. Prevalence of PE has been reported to be 7.03% at the Korle-Bu Teaching Hospital in Accra (Obed & Aniteye, 2006b), whereas the prevalence of PE has been reported to be 6.5% at the Kofo Anokye Teaching Hospital in Kumasi (Obed & Aniteye, 2006; Owiredu et al., 2010). The Korle-Bu Teaching Hospital in Accra, Ghana, has previously reported HIV/AIDS prevalence rates of 29 percent (Coleman et al., 2014) and 38 percent (Adu-Bonsaffoh et al., 2017) in the hospital's patient population.

The fact of the matter is that when it comes to the management of hypertensive emergencies and other complications related with hypertension disorders in pregnancy in low-resource nations such as Ghana, there are considerable challenges to overcome (Adu-Bonsaffoh et al., 2015; Danso and Opare-Addo, 2010). In their research, they discovered that most tertiary hospitals in Ghana lack adequate laboratory support, which makes parenteral antihypertensive drugs, which are the most commonly used for managing hypertensive crises in the obstetric population, difficult to obtain. This is made worse by a lack of adequate laboratory support in most tertiary hospitals in Ghana. There is evidence that significant inadequate treatment is provided in the management of hypertensive diseases during pregnancy, which may result in bad maternal outcomes, as has been found in Sub-Saharan African nations in recent years.

Globally, the World Health Organization estimates that preeclampsia affects roughly 7.03% of pregnant women, with the highest prevalence observed in Ghana (Obed & Aniteye, 2006).

Pregnant women in the Kumasi metropolitan had a mortality rate of 5.87%, 6.55%, and 12.42%, respectively. HDP prevalence in Ghana is predicted to be between 6.55 and 7.03%, according to a study conducted by Fonjo et al. (2019). In addition, Antwi et al. (2016) investigated the quality

of health management information system (HMIS) data in order to assess geographical variations in pregnancy-induced hypertension, which they found. According to the findings of the retrospective investigation, the prevalence rate between the two study areas differed significantly. When comparing the Greater Accra region to the Upper West region, PIH incidence was 6.1%, whereas the Upper West region had 3.2%. Pregnancy visits, weight, and height data were used to make this determination.

## 2.9 Risk factors associated with HDP

Many risk factors for preeclampsia have been identified, including being a first-time mother, being older than 40 years old, having numerous pregnancies, having a high body mass index (BMI), and having a family history of chronic hypertension (Taebi et al, 2015). During the past decade, the prevalence of preeclampsia has risen, partly as a result of an increase in the number of women who are falling pregnant at older ages, as well as a rise in female obesity. Increases in the frequency of obesity during pregnancy have more than doubled over the past 20 years, and studies have indicated that obesity is substantially connected with unfavourable gestational and perinatal outcomes, including preeclampsia and eclampsia. The fact that maternal obesity is the most important modifiable risk factor for preeclampsia makes it a prospective candidate for prevention of the condition. A high body mass index (BMI) has been related to a higher risk of preeclampsia in some studies, whereas women with a low BMI have been found to be less likely to acquire the illness.

### 2.9..1 Maternal Age

Age has been a common risk factor in most studies over the years. Some studies have identified maternal age as a risk factor of PIH (Ahenkorah, 2009). However, maternal age still needs additional research to either affirm or refute the claim due to inconsistency in literature findings. Even though some studies have not found age to be a significant risk factor, others have found an increased risk of preeclampsia in younger women (those under the age of 21) and an increased risk of preeclampsia in women over the age of 35 (those over the age of 35). (Ahenkorah, 2009). Women over the age of 50, on the other hand, have a higher risk of developing HDP than younger women (Omenya et al., 2018; Ebeigbe and Aziken, 2007). The odds of HDP in pregnant women 35 years or older were found to be 5.3 times higher than those in younger women in one study conducted in Tanzania (AOR: 5.32; 95% confidence interval: 2.55, 11.10) (Mwanri et al., 2015).

According to the findings of a case-control study conducted in Ethiopia, pregnant women over the age of 30 were seven times more likely than younger women to develop HDP (adjusted odds ratio: 6.59; 95% confidence interval: 2.99, 14.50). (Ayele and Agedew, 2016). In Ethiopia, Nigeria, and Ghana, similar findings have been confirmed despite the fact that the age ranges used in the studies were different (Kahsay, et al. 2018; Njukang et al., 2020; Ahenkorah, 2009). A study conducted in Kenya, on the other hand, found that younger women were at greater risk of developing HDP than older women (Omenya et al., 2018)..

### 2.9.2 Parity

Parity has also been cited as a risk factor of HDP (Ahenkorah, 2009; Meazaw et al., 2020). Parity refers to the number of times a woman has given birth (Ahenkorah, 2009). Similarly, different studies have reported diverse findings on the link between parity and HDP (Meazaw et al.,

2020).The incidence of the risk of parity and the development of HDP has been confirmed by studies in Ghana. A study by Ahenkorah (2009) found that nulliparous women were protected from the risk of developing PE. Also, Antwi et al. (2017) found that parity is a significant predictor in women developing HDP during pregnancy in Ghana. In Ghana, one study that confirmed age as a risk factor of HDP was by Ahenkorah (2009). Her study found that age is a significant risk factor for the development of PIH (PE+ GH); both the young and older mothers were at increased risk of the condition. In medicine, the term "parity" refers to the number of births a woman has had in her lifetime, and it has long been connected with the likelihood of having a high-risk pregnancy (Ahenkorah, 2009). It was Mauriceau, over 300 years ago, who discovered the link between parity and clinical condition, stating that a woman with a single pregnancy is at significantly greater danger of convulsions than a woman with numerous pregnancies. Despite the overwhelming evidence, there are disagreements about the relationship between parity and HDP. A study conducted by Jasovic et al.,(2011) in Macedonia, parity was categorized based on pregnancies which was divided in groups of primmiparas, secundiparas, tertiparas and multiparas. Logistic regression analysis revealed: for primamiparas are 1.2 times more likely to have HIP [ AOR(1.28) ,CI ( 0.12-2.23) P=0.03)] compared to the multiparas . It is expected that such a relationship will be strong in the Northern region of Ghana because the parity rate is high in that region.

### 2.9.3 Family History of HDP

Meazaw et al. (2020) revealed that 14 studies have been assessed across West Africa that has examined the link between family history of hypertension in pregnancy and developing HDP. The risk of women with a family history developing HDP was six times higher than those without a family history of HDP (Mekonen, Wubshet and Haile, 2015). (AOR: 6.2; 95% CI: 2.9, 12.8).

The risk of family history and HDP has been equally reported by a study in Ghana by Owiredu et al. (2012). Their study found that women with a family history of HDP are seven times at risk of developing HDP than those without (AOR: 6.8; 95% CI: 2.3, 19.6). Antwi et al. (2017) found that a history of GH in a previous pregnancy increases the likelihood of women developing HDP in subsequent births in Ghana.

### 2.9.4 Maternal Body Mass Index (BMI)

Anthropometric indices including weight (W), height (H) body mass index (BMI) etc. have been cited as risk factors of HDP (Ahenkorah, 2009). Meazaw et al. (2020) found that more than seven studies have looked into the link between maternal body mass index and HDP across sub-Saharan Africa. Obese women are three times more at risk of developing HDP than women with normal BMI (RR: 2.7; 95% CI: 1.37, 5.51) (Singh et al., 2014) and overweight (BMI > 25 Kg/m2) mothers are higher at risk of developing HDP as compared with the normal and underweight mothers (AOR = 5.5 95% CI; 1.12, 27.6) (Kahsay, et al., 2018). Also, a study conducted in Ethiopia reported that overweight women (BMI >25 kg/ m2) and obese women (BMI>30 kg/m2) are more than four times at risk of developing HDP than those with normal BMI (Owiredu et al., 2012).

In Ghana**,** Kahsay et al. (2018) found that women who are overweight (AOR: 5.5; 95% CI: 1.12, 27.6) and obese (AOR: 4.7; 95% CI: 1.7, 12.5) have a greater likelihood of developing HDP compared to women with a normal BMI. Also, high BMI was single-handedly a risk factor for HDP among women in both urban and rural areas (Meazaw et al., 20202). Height and weight are risk factors for developing HDP in Ghana by Antwi et al. (2017).

### 2.9.5 Socio-demographic factors

Some demographic factors have been linked to HDP among pregnant women. Several studies have included demography of pregnant women that were sampled for their data collection as the variable used in determining risk factors of HDP. Amongst this are age, educational background, marital status etc.

Some studies have confirmed the link between the educational background of pregnant women and HDP. The risk of women with no education developing HDP was 2.5 times higher than women with secondary and above education level (AOR: 2.5; 95% CI: 1.2, 5.3) (Mekonen, Wubshet and Haile, 2015). Also, another research reported 2.6 times the riskiness of developing HDP for women with low-level education than those with higher educational backgrounds. Both studies were undertaken in Ethiopia (AOR: 2.64; 95% CI: 1.10, 6.32) (Temesgen, 2017).

Furthermore, the marital status of pregnant women has also been found as a risk factor of HDP, but the findings were not statistically significant (Meazaw et al., 2020).

### 2.9.6 Other factors

One factor that has been sighted in literature as having the odds of increasing the likelihood of HDP among pregnant women is multiple Pregnancy (Meazaw et al., 2020). There is a statistically significant relationship between multiple births and HDP (Kahsay, et al. 2018; Singh et al., 2014). Also, the abortion history of women has been sighted as a risk factor. One study that reported this association was Hinkosa, Tamene and Gebeyehu (2020) that reported that women with induced abortion history were 4.4 times at the risk of developing HDP compared with those with no abortion history. Women with a history of preterm delivery (Hinkosa et al., 2020) and stillbirth

(Mwanri et al., 2018) were at a higher risk of developing HDP than women with no such histories. However, a study by Ahenkorah (2009) revealed that women with abortion history were less likely at the risk of developing preeclampsia and gestational hypertension, both pregnancies induced. Most studies have used BMI as a risk factor for the development of preeclampsia in the antenatal period (Taebi et al., 2015).

The nutrition of pregnant women plays a role in their health. Some studies have reported a link between vegetable and fruit intake and the possibility of developing HDP. Kahsay, et al. (2018) found that high consumption of fruits during pregnancy can reduce the possibility of pregnant women developing HDP. The study found that women who take a low number of fruits in their diet have five times the risk of developing HDP. Similarly, Longo-Mbenza et al. (2008) found that high consumption of vegetables is a protective practice against HDP during pregnancy. The study found that women who eat more than thrice portions of vegetables were at less risk of developing HDP as compared to those who consume less than three servings of vegetables daily. One study also confirmed higher salt intake and the risk of HDP in Ethiopia. Ayele and Agedew (2016) found that women who consume excessive salt during pregnancy were 4.4 times at risk of HDP than women who consume a normal level of salt in their diet. One study that established a link between the nutrition of pregnant women and the prevalence of HDT is (Jones et al., 2017). Jones et al. (2017) found that frequent consumption of junk foods (industrial trans fatty foods such as cakes, pies, doughnuts, etc.) by pregnant women has a higher risk of developing HDP than those who do not consume such foods while pregnant.

Females who used a contraceptive were shown to be at higher risk of HDP in Ghana (adjusted odds ratio: 1.7; 95% confidence interval: 1.2, 3.0) and Nigeria (P0.005) than females who did not use contraception (adjusted odds ratio: 1.7; 95% confidence interval: 1.2, 3.0). (Azubuike, 2018).

Women who had a partner who used a condom during sex had a six-fold increased chance of getting HDP when compared to women who did not have a partner who used a condom during sex, according to Owiredu et al. (2012). (AOR: 5.8; 95% CI: 1.2, 23.0). According to the findings of another study, women in Ghana who changed their partners during their second or subsequent pregnancies were more than twice as likely as women who stayed with the same spouse to develop HDP (adjusted odds ratio: 2.3; 95% confidence interval: 1.1 to 5.8). (Owiredu et al., 2012). The use of contraceptives in either the male [OR 5.6; 95% confidence interval [CI] 1.2-25.2] or female [OR 1.7; 95% confidence interval [CI] 0.8-3.5] spouse was found to raise the incidence of PIH by the same amount, according to Ahenkorah (2009). It has also been shown that partner change and placental hormonal imbalance are connected with an increased chance of developing the clinical disorders. Both of these events are regular occurrences.

Alcohol use has also been identified as a risk factor for the development of HDP in women (Omenya et al., 2018; Ahenkorah, 2009). An investigation by Omenya et al. (2018) indicated that there is a statistically significant association between alcohol consumption and smoking during pregnancy and the likelihood of having HDP compared to those who do not smoke or drink alcohol in Kenya, according to the findings of the study. According to Ahenkorah (2009), drinking alcohol increases the likelihood of having PIH in women.

It has also been hypothesised that regional variations in HDP development in pregnant women may be a risk factor for the development of HDP. Anthropometric evidence suggests that urbanisation is connected with changes in lifestyle, which are associated with overweight and obesity, according to Antwi et al. (2017). An investigation carried out in Tanzania found that urban-dwelling women are twice as likely as rural-dwelling women to acquire HDP as compared to those who reside in rural settings (adjusted odds ratio: 1.90; 95% confidence interval: 1.1, 3.6).

Mwanri and colleagues (2018) developed a formalised formalised formalised formalised formalised (Mwanri et al., 2018). Within the country of Ghana, there are considerable variances in the prevalence of PIH between different administrative districts (Antwi et al., 2017). They discovered that the mean adipose tissue concentration (ATC) of women in the Greater Accra region and the rural Upper West region differed significantly between the two regions, according to their findings. A few studies, on the other hand, have discovered that HDP is more common among women who reside in rural areas, according to the findings of their research (Meazaw et al., 2020). According to Kahsay et al. (2018), rural inhabitants in Tigray, Ethiopia had a higher chance of suffering from hypertensive disorders (odds ratio = 3.7, 95% confidence interval [CI]: 1.9 to 7) than urban residents (odds ratio = 3.7, 95% confidence interval [CI]: 1.9 to 7).

According to the findings, spontaneous abortion doubled the likelihood of getting preeclampsia. However, there have been indications that having a history of abortion lowers the risk of developing both gestational hypertension and preeclampsia during the course of pregnancy (Ahenkorah, 2009). Abortion did reduce the incidence of PIH and GH in this study, however the reduction did not reach statistically significant levels in this particular study. It was shown that having an abortion performed between 13 and 27 weeks of pregnancy can provide protection against preeclampsia in the future pregnancy, according to one of the few published studies that looked at when the abortion should be performed. Early spontaneous abortions, on the other hand, did not offer the same level of protection as later ones. This could explain in part why spontaneous abortion (i.e., miscarriage), which generally occurs in the first few weeks of pregnancy, was found to have no influence on the risk of preeclampsia in the current investigation, despite the fact that it typically occurs in the first few weeks of pregnancy. A higher risk of PIH is connected

with the use of contraceptives by either the male or female partner, as does the change of partners by the female spouse, according to the findings of a recent study (Ahenkorah, 2009).

It was once believed that pregnancy-induced hypertension was caused by an immunological response, however that belief was disproved. As revealed by the outcomes of multiple research, regular exposure to the spermatozoa of the man who will father the child before conception lowers the risk of developing Pregnancy-Induced Hypertension during the first pregnancy. Therefore, if long-term cohabitation with a partner is associated with a lower risk of pregnancy-induced hypertension, it is possible that the protective mechanism is related to the contact of spermatozoa with the female genital system. Given that using a condom as an effective form of contraception minimises or limits exposure to male partner's spermatozoa, this could explain the increased risk reported in women whose husband used a condom as an effective method of contraception, according to the study's findings.

As was found in this study, women who had used oral contraceptives previous to the study were not protected from pregnancy-induced hypertension, despite the fact that they did so. According to the results of the face-to-face interviews that were performed, oral contraceptives were used by the vast majority of the women who took part in this study. Women who do not use contraceptives are more likely than those who do to be exposed to spermatozoa, with the key distinction being that the features of cervical mucus may confine the semen to the vaginal area. One of the reasons oral contraceptives have a nonprotective effect is because they have no influence on tubal motility. Oral contraceptives have no preventive effect because they have no influence on ovulation, which is why they are not recommended.

According to a number of research investigations, preeclampsia is related with a shift in the paternity of the child (Ahenkora, 2009). According to the findings of this present study, changing partners is not only a significant risk factor for preeclampsia, but it is also a big risk factor for gestational hypertension as well. Although some researchers have observed that having had a previous normal pregnancy is related with a lower risk of Pregnancy-Induced Hypertension, other studies have discovered that this protective impact is lost when a couple switches partners. As previously mentioned, it has been observed by Lie et al. (1998) that there is an occurrence known as the "hazardous father." Regardless of whether or not the first woman had previously suffered from a preeclamptic pregnancy, they discovered that males who fathered preeclamptic pregnancies in one woman were roughly twice as likely to father another preeclamptic pregnancy in a different woman. Further research has discovered that women who have experienced a partner change before the index pregnancy are at an elevated risk of having preeclampsia. Contrary to what most research show, preeclampsia may be more common among women who are primipaternal than among women who are primigravidal.

### 2.10 Psychosocial status of Pregnant women

The health of pregnant women contributes immensely to their general well-being. Some state that pregnant women can contribute to adverse habits which negatively affect the pregnancy journey. This results in complications such as miscarriage, inappropriate nutritional behaviours, weight increase in pregnant women. Depression and stress are major contributors to the healthy behaviours of pregnant women, especially in terms of physical activity, nutrition, and weight gain during pregnancy (Omidvar et al., 2018).

Having social support throughout pregnancy is beneficial because it helps individuals cope with the stress of pregnancy and maintain their mental health (Gennaro, 2003; Degirmenci & Vefikulucay, 2019). Some believe that social structures play an essential influence in either simplifying or complicating the resolution of psychological disorders, and that this is true. Recent research revealed that pregnant women who received emotional support from their partners, relatives, and even social networks throughout their pregnancy were less likely to have postnatal difficulties than other pregnant women. According to reports, the absence of social support during pregnancy has a bad impact on the health of the mother, her foetus, and the newborn child, among other things (Yalnz Dilcen et al., 2020). Women who do not receive adequate psychological and emotional support throughout pregnancy are more likely to suffer from depression during pregnancy and in the postpartum period, according to the American Psychological Association (Vrt et al., 2008). Poor social support and the presence of mouth clefts in neonates have been demonstrated to have a statistically significant association.

Lack of social support during pregnancy is connected with higher cortisol output as well as increased physiologic susceptibility to psychological stress. As a result, during the course of its development, the foetus is exposed to the potentially damaging effects of cortisol, which can be fatal. According to Yalnz Dilcen et al. (2020), it has been discovered that women who have social support networks had less stressful birth experiences.

According to some accounts, women are still experiencing postpartum trauma symptoms four to six weeks after giving birth (Maxson et al., 2016). Atop that, between 9 and 44% of women around the world report having experienced an emotionally unpleasant birthing experience. Social support appears to be of crucial relevance in view of the potential negative repercussions

of mother mental health, maternal bond, and newborn and child development (Yalnz Dilcen, et al., 2020), as well as the potential benefits of social support.

Certain elements, including as a woman's psychological health history and social support throughout pregnancy, have been claimed to have an impact on her perception of childbirth (Yalnz Dilcen et al., 2020). When it comes to how individuals interpret events that occur throughout the process of childbirth, women's impressions of their childbirth experiences may differ from one another, according to research (Ayers et al., 2007). In a recent study, researchers discovered that women who had low social support perceptions during pregnancy were more likely to develop trauma symptoms in the postpartum period, according to the researchers (Soet et al., 2003). During the course of the study, it was discovered that a lack of adequate social support was connected with post-traumatic stress symptoms in the first month following birth. Several studies have discovered that women who believe their husbands or partners provide them with great emotional support report fewer postpartum symptoms of post-traumatic stress disorder than women who do not believe this.

Psychosocial well-being and perceptions of social support should all be taken into consideration when examining traumatic birth perceptions, as should physiological reactions throughout pregnancy and psychosocial well-being. Obtaining this recognition is essential in order to mitigate the detrimental effects of a traumatic delivery on the health of the mother and child, and in order to establish preventive mental health interventions for mothers and their children. It is vital to undertake an effective examination of pregnant women in order to examine their psychosocial health and social support conditions, as well as to question risk factors, diagnose problems, and give care and support according to their needs in a holistic manner. Midwives are the ones who spend the most time with the expectant mother during the course of her pregnancy,

labour, and the postpartum period, according to the American College of Midwives. Consequently, midwives should consider the physiological and mental health needs of pregnant women during these periods. (Maxson et al.,, 2016). According to some study, the psychosocial health and social support status of pregnant women are assumed to be associated to their painful impressions of childbirth. When pregnant women are given the opportunity to make efficient use of mental health and social support resources, healthcare practitioners may be more effective in reducing their perception of a traumatic birth experience. As a result, the purpose of this study was to evaluate the relationship between mental health and social support, as well as the perceptions of pregnant women concerning painful birth.

According to the findings of a study conducted by Boakye Yiadom et al. (2015) to assess the prevalence of stress and anxiety among pregnant women in the Tamale metropolis, as well as the relationship between stress/anxiety and socio-demographic characteristics, the prevalence of anxiety and stress was 9.7% and 28.6%, respectively. The study also discovered that the prevalence of stress and anxiety was 9.7% and 28.6%, respectively. Additionally, 26.6% of educated women were found to have anxiety disorders, with a shorter mean gestation duration being connected with anxiety disorders as a result of the study findings. In comparison to women who were not feeling stress during pregnancy, those who were experiencing stress had a younger age. Moreover, women who were married had a larger proportion of normal women when compared to women who had experienced pregnancy stress (90.9%).

A comprehensive review of the literature on research conducted on the psychosocial well-being of pregnant women was published (2019). Many factors, including age, income, educational level, substance misuse, and previous miscarriage history, have an impact on the psychological health of women who are expecting a child. According to the authors, their research discovered

that anxiety experienced during pregnancy is connected with attention deficit and hyperactivity in children aged 8–9 years after birth. According to Agostini et al. (2015), depression is claimed to be prevalent among pregnant women at a rate of 14.9%, and depression during pregnancy has been proven to be associated with an increased risk of depression in offspring. In addition, it was observed that low levels of social support from family, friends, and others were associated with a higher risk of depression during pregnancy. Reduced levels of social support have been demonstrated to have a major negative influence on psychosocial health (Maharlouei, 2016).

Researchers from nine different universities in Ghana undertook a study to learn more about the relationship between the psychosocial health of pregnant women in Ghana and the psychosocial health of Ghanaian migrants in Europe, and they came up with some fascinating findings. It was discovered by Awuah et al., (2019) that there was a statistically significant link between stress at home and work and hypertension among solely female migrants, according to their data. The existence of depression symptoms was shown to be significantly connected with an elevated risk of developing hypertension only among non-migrant females, according to the findings. A further conclusion of the study was that having had a negative life event was related to an increased likelihood of acquiring hypertension among non-migrant Ghanaian women.

In a recent study, Karakoça and Ozkanb found that pregnant women's anxiety and stress subscales, as well as their need for psychological assistance, were both at a moderate level. In his research, Uçar (2014) discovered that the anxiety and stress subscales of pregnant women were at a medium level in his participants. The findings of both researches were nearly identical. A study conducted by Yldz (2011) discovered that pregnant women have specific challenges, particularly in terms of anxiety and stress subscales, and that their overall psychosocial health is on a moderate level. Because of the disparities in geographical regions where the studies were

conducted, as well as variances in participant characteristics, this disagreement may be caused by these factors. Therefore, in contrast to the research conducted by Yldz (2011), which was conducted in health centres and in which the educational levels of pregnant women were primarily primary school, this study was conducted in a maternity hospital with pregnant women with educational levels that were primarily high school and university graduates, which may have contributed to the discrepancy. Despite the fact that the mean prenatal attachment score dropped with increasing gestational age, no statistically significant difference was identified between the two groups in this study. For example, there have been research conducted that demonstrate that there is no substantial association between prenatal attachment during pregnancy and the mother's age during pregnancy (Abasi et al., 2012; Metin, 2014).

Women over the age of 25 had a low level of connection with their infants, according to Rubertsson et al. (2014), in contrast to Lindgren (2001), who discovered that pregnant women in the younger age group had higher prenatal attachment levels than pregnant women in the older age group. In their study, the researchers identified a statistically significant association between pregnant women's educational levels and the mean scores on the prenatal attachment scale. According to Ustunsoz et al. (2010), prenatal attachment has been shown to be positively correlated with educational attainment, and Kwon and Bang (2011) discovered that women with lower educational attainment had lower prenatal attachment levels than women with higher educational attainment. We believe that this finding supports the notion that people with higher educational levels are more likely to be employed, set their priorities when it comes to life planning, and be better prepared when it decides to become parents. Hediye Karakoça and Hava Ozkanb are two of Turkey's most promising young women, and they are also friends. 43 It was

discovered that there was a statistically significant relationship between the length of time a pregnant woman had been married and the mean score on prenatal attachment.

Metin (2014) discovered a statistically significant association between the length of a marriage and the amount of prenatal attachment a couple of experiences. According to the findings of this study, prenatal attachment reduced as a person's age and the length of his or her marriage increased. Although there was no statistically significant difference between employed and unemployed pregnant women, the mean prenatal attachment scores of employed pregnant women were higher than those of unemployed pregnant women. Furthermore, women whose husbands were out of work had lower prenatal attachment mean scores than those whose husbands were employed. This research implies that an individual's employment status can have an impact on the care offered to pregnant women as well as the reinforcement of prenatal attachment during the course of the pregnancy. The difference in mean prenatal attachment scores between husbands who had and did not have schooling was also statistically significant between the two groups. When it came to pregnant women and their husbands who had advanced degrees, the levels of prenatal connection were high. Higher educational levels mean that both the pregnant woman and her spouse have a better awareness of what to expect during the pregnancy and its aftermath.

This may result in the husband being more capable of providing emotional support to the expectant mother and receiving better care, contributing to the formation of prenatal attachment. In this study, it was discovered that the income status of pregnant women had no effect on prenatal attachment and was statistically insignificant. It was discovered by Karakoça and Ozkanb (2017) that there was no association between mother-infant bonding and the family's financial situation during pregnancy. The connection between family structure and mean prenatal attachment ratings in pregnant women was found to be non-significant at the statistical level. In

addition, Ylmaz and Beji (2010) and Metin (2014) discovered that family structure was not a major predictor of mother-infant attachment in their investigations, according to their findings. We conclude from these findings that the number of people who dwell in a house does not have a major impact on the development of mother-infant attachment. In response to the question "Are socio-demographic factors of pregnant women related to their prenatal attachment levels?" it was discovered that prenatal attachment levels were influenced by educational status, length of the marriage, and the educational position of the spouse. However, prenatal attachment levels were not changed by characteristics such as age, domicile, work position of the pregnant woman and her husband, opinion of the family's financial situation, or family type.

Researchers Rubertsson and colleagues (2014) discovered that low attachment levels are observed in multipara pregnant women, Ustunsoz and colleagues (2010) discovered that there was a negative correlation between the number of births and prenatal attachment, and Abasi and colleagues (2012) discovered that multipara women who gave birth more than three times had low prenatal attachment levels. Prenatal attachment is thought to be directly related to the fact that a pregnant woman is ready for parenting and desires to have children, as seen by this finding. Researchers discovered a statistically significant relationship between pregnant women's prenatal attachment mean scores and the number of stillbirths and abortus, and that pregnant women with a history of stillbirths and abortus had lower prenatal attachment mean scores than those without a history.

It has been stated by Alhusen (2008) that while the loss of a foetus during prior pregnancies is a sad event, it may result in dread of losing in following pregnancies, as well as a decrease in the amount of attachment during pregnancy. Between the mean prenatal attachment scores of the pregnant mothers and the gender of their infants, there was a statistically significant difference.

In this study, the researchers discovered that knowing the gender of the newborn had an increasing impact on the pregnant woman's prenatal connection as time progressed. Additionally, it has been found that the ability of pregnant women to attend their regular medical appointments has an impact on the mean prenatal attachment score during the pregnancy.

According to Alhusen (2008), several health practices, such as obtaining prenatal care, eating a nutritious diet, and exercising regularly, were associated with high levels of prenatal attachment. The outcomes were comparable in both cases. In this study, researchers discovered that mean prenatal attachment scores differed statistically significantly between the states of a pregnant woman and her husband's willingness to have a child. According to a study published by Karakoça & Ozkanb,(2017), prenatal attachment levels were greater in pregnant women who had planned pregnancies than in pregnant women who had unplanned pregnancies. Increased levels of prenatal attachment were observed in pregnant women who had planned and desired their pregnancy before conception. When asked whether there was a relationship between obstetric characteristics and prenatal attachment levels, researchers found a correlation between many pregnancies, the number of living children born to those women, the number of stillbirths, the number of abortuses, the gender of the infant, attendance at regular medical checkups, and the state of the pregnant woman and her husband when they decided to have the baby.

In this study, it was discovered that the mean psychosocial health scores of pregnant women and the mean prenatal attachment scores were strongly connected in a positive and significant way. A high degree of psychological health during pregnancy may lead to an increase in the level of prenatal attachment. Prenatal depression, according to Flykt et al. (2010), hurts the bonding between a mother and her child throughout the first trimester. Psychological well-being, according to Walsh et al. (2014), is the most important predictor of prenatal attachment. The

attachment was shown to be diminished during the prenatal period, when depression levels were increased, according to Lindgren (2001) findings. According to Berlin et al., (2013) pregnant women's hostile behaviour toward their infants, as well as their mental health problems and social isolation, are all associated with pregnancy. A study conducted by Abasi et al., (2012) found that women who experienced high levels of anxiety and depression during their pregnancies had lower levels of mother-infant attachment; a similar study found that clinical diagnosis of major depressive disorder during the second and third trimesters was significantly associated with low levels of mother-infant attachment.

According to the findings, pregnancy and the relationship with the husband subscale, as well as prenatal attachment, are positively related to one another. A positive association exists, according to Abasi and colleagues (2012), between marital attachment and prenatal attachment. In one study, it was discovered that marital adjustment had a favourable effect on prenatal attachment. There is a statistically significant relationship between the anxiety and stress subscale scores and the mean scores on the prenatal attachment scale that was discovered in this study. Having a baby stillborn during a previous pregnancy is a heartbreaking experience for the mother, and it may cause her to be scared of having another child during a subsequent pregnancy (Alhusen, 2008). According to Abasi et al. (2013), greater levels of prenatal attachment were connected with lower levels of anxiety, stress, and depression, resulting in better mental health for women in their reproductive years. Prenatal attachment levels for subsequent pregnancies may be lowered as a result of the dread of loss associated with abortus and abortion occurrences, in particular, during the first trimester of pregnancy. There was a statistically significant link identified between the domestic violence subscale and the mean prenatal attachment scores on the prenatal attachment questionnaire. A growing body of research has revealed that pregnant women are frequently

subjected to physical and emotional abuse during their pregnancies, with the majority of cases involving emotional or verbal abuse (Göüş & Yldz, 2013; Bolu et al., 2015).

Bothe Karakoça and Ozkanb (2017), as well as Hergüner et al. (2014), argue that violence hurts the psychosocial well-being of pregnant women. It has been suggested that being exposed to violence while pregnant can have a deleterious impact on prenatal attachment levels (Karakoça and Ozkanb, 2017). An inverse association between the psychosocial support need subscale, the familial traits subscale, and the mean score of prenatal attachment was observed, and this relationship was shown to be positive and statistically significant. Prenatal attachment and perceived social support are positively related, according to Hergüner and colleagues (2014).

## 2.11 Conclusion

This chapter has done a review of the literature with rich African references. The chapter conceived the study themes under prenatal disorders theorised as affecting pregnancies. The chapter continued to theorise about hypertensive disorders affecting pregnancies and their types. The chapter equally presented the diagnosis of HDP, its risk factors and the psycho-social status of pregnant women. The empirical review presented study findings across the sub-Saharan African region with rich content from Ghana as the case-study country. Albeit, only two studies were cited to have been undertaken in locations similar to this study's geographical setting, the available evidence offers rich literature to embark on the next stage of this study.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter presents the methodological approaches that have been adopted for the study. The chapter includes the study setting, design, population, sampling size, techniques and data collection and analysis strategy.

## 3.2 Study Setting

In this cross-sectional study, women in the perinatal period in the Tamale metropolis, in Ghana's Northern Region, were asked to report any hypertensive illnesses they were experiencing during pregnancy. A special emphasis is placed on pregnant women who are either in the latter stages of their second trimester or near the end of their third, and who are attending the antenatal clinic at each of the study sites. The investigation was carried out at three hospitals in the capital, namely the Tamale Teaching Hospital, the Tamale Central Hospital, and the Tamale West Hospital. It is estimated that Tamale has a population of 671,812 people, making it the capital city of the Northern Region (World Population Review, 2021). Tamale is the third-largest city in Ghana and one of the fastest-growing cities in West Africa, thanks to its position as the country's third-largest metropolis.

### 3.3 Study Design

An analytical cross-sectional survey design was used for this study. Cross-sectional research designs, according to Udimal et al. (2019), provide the researcher with enough opportunity to interact with the study population. An observational study, according to Connelly (2016), occurs at a single point in time and can be considered a snapshot that provides an image of what the researcher is trying to learn about or understand. Surveys are adaptable, can be conducted in a variety of settings and situations, and can be used with a wide range of populations. (Polit & Beck, 2014).

### 3.4 Study Population

Pregnant women attending the Tamale Teaching Hospital, Tamale Central Hospital, and Tamale West Hospital for ANC service form the study population, which was conducted over three months from February to May 2021 on pregnant women who were at least 20 weeks pregnant.

#### 3.4.1 Selection Criteria

The main category for recruiting participants was the number of weeks of pregnancy. According to the National High Blood Pressure Education Group (2005) pregnancy–Induced Hypertension (PIH) occurs after 20 weeks of pregnancy therefore samples were taken from women who were more than 20 weeks pregnant. All women who are in the reproductive age group between 15 and 49 years and are between 20 and 42 weeks of pregnancy were eligible for recruitment at the onset of the study.

1. Pregnant women who were willing to give consent.
2. Pregnant women who were mentally and physically fit to partake in the study.

3. Pregnant women who were willing to complete the study protocol.

### 3.4.2 Exclusion criteria

Participants with any one of the following characteristics were excluded from the study.

1. Participants who declined consent.
2. Pregnant women who were less than 15 years and above 49 years.
3. Pregnant women who had pregnancies less than 20 weeks at the time of onset of the study.
4. Critically ill antenatal clients.

Pregnant women who cannot complete the two mandatory assessments for any reason.

## 3.5 Variables Investigated

The factors investigated included the dependent variable HDP and risk factors including age, marital status, level of education, religion, occupation, family monthly income, family history, contraceptive use (hormonal and condom), miscarriage and abortion (which includes preterm and stillbirth) and lifestyle of pregnant women as independent variables.

## 3.6 Sample Size Determination

The sample size is calculated using the Snedecor and Cochran (1989) formula for a point estimate sample; $n_0 = \frac{Z^2 \quad Pq}{d^2}$;

$n_0$= sample size, z = z- score of a 95% confidence level (5% significance level) of the study equivalent to 1.96, p = no similar study exists on the same topic in the region

A standard prevalence of 50% was assumed for this study. Hence p = 50% (0.50) in this study, q = estimated proportion of pregnant women who do not experience hypertension during pregnancy (1-p= 0.5), and d = margin of error of the study thus 100%- 95%= 5% = 0.05 in this study.

$n_0 = \frac{(1.96)2x0.50x0.50}{0.05^2}$, $n_0$ = 0.9604/0.025

$n_0$ = 384.16, Thus, the calculated sample size is approximately 385.

Using 10% as a non-response rate, the sample size for this study was therefore 424.

### 3.7 Sampling Techniques

This study adopted purposive and stratified random cluster-sampling techniques. In the first, the study adopted a purposive sampling technique in selecting the facilities i.e., Tamale Teaching Hospital, Tamale Central Hospital and Tamale West Hospital to draw the respondents. This is because they are three main public hospitals within the Tamale Metropolis where most pregnant women visit for antenatal services. In recruiting the participants, a combination of techniques was adopted.

Participants were then selected through a simple random sampling. In selecting study participants across the three hospitals, the number of respondents from each hospital was recruited based on daily visit proportional to size technique to ensure representativeness. These proportions were determined by dividing the average number of daily attendances of pregnant women for the antenatal care of each hospital by the combined number of daily attendances of pregnant women for the antenatal care of all three hospitals and multiplying the results by the sample size.

Represented mathematically as sample size of Facility (n) = (A/A+B+C) X sample size. The sample size, n, calculated above is 424. The combined number of daily ANC attendance of pregnant women in all three hospitals is 225

Sample size is = 424

A = Daily attendance of ANC by pregnant women at TTH - 100

B = Daily attendance of ANC by pregnant women at TCH - 70

C =Daily attendance of ANC by pregnant women at TWH - 55

The combined daily ANC attendance strength of the three hospitals is 225.

Inserting these values into the above equation generated the following quotas:

TTH- 188 pregnant women, TCH-132 pregnant women and TWH-104 pregnant women. Importantly, in recruiting respondents based on the quota of each study site, the consecutive sampling method approach was adopted. This is because it allows every subject meeting the criteria of inclusion to be selected until the required sample size is achieved.Chrononic hypertension in pregnancy, that is high blood pressure that precceds pregnancy is diagnosed within the first 20 weeks of pregnancy were not included in the study since it was not directly link with the pregnany whiles Gestatational pregnancy or pregnancy-induced hypertension after 20 weeks of gestation who still have high pressure were recruited. Participants were asked of their hyptension history and also a check was made from their maternal record books to confirm their pregnancy history.

### 3.8 Research Instrument

A structured questionnaire was used for data collection to assess the presence or otherwise risk factors including but not limited to demographic and psychosocial status. A pre-test of the questionnaire was administered at the Tamale Municipal Hospital. The pre-test was undertaken to correct errors and ambiguity in questions and also to train nurses who were in charge of samples and data collection at the study facilities.

By using a questionnaire, participants were asked whether they have been diagnosed with hypertension during their current pregnancy. Potential risk factors and psychosocial health status of pregnant women were recorded from their antenatal cards. Background and socioeconomic data included age, marital status, level of education, religion, occupation and hours of work.

Risk factors included medical characteristics; body mass index, height and weight, gestational age, personal and family history of hypertension during pregnancy, lifestyle; smoking, alcohol use, nutritional practices data; vegetable intake and contraceptive use and history of abortion.

### 3.9 Data Collection

The basic socio-demographic features of the participants were determined with the use of a well-structured questionnaire. Additionally, their medical records were checked to determine the results of their pregnancies, including the birth weight of their children.

For this study, the date of the subject's last menstrual cycle was utilised to calculate her approximate gestational age. It was determined that the mother's waist and hip circumferences were too small at her first prenatal checkup.

### 3.9.1 Height and Weight

Women who were pregnant were requested to stand up straight with their buttocks, shoulder blades, and heels touching the back of a stadiometer while the device was running for the duration of the study. At a 60-degree angle to the ground, their feet are pointed outward and outward from the body. In a relaxed position, her arms were loosely hung at her sides, with her palms resting against her thighs. This caused the horizontal bar of the stadiometer to be lowered until the hair was crushed up to the top of the skull, which was then raised. Everything on the head, including hair and objects, that could interfere with the bar's ability to compress the hair to the crown of the head was taken off before the procedure began. To achieve the highest degree of accuracy, the measurement was taken to the nearest 0.1 cm or 1/8 inch. Another measurement should be done to acquire two readings that are within 0.2 cm or 0.25 inches of one another, and the average of the two closest measurements should be recorded.

The weight of pregnant women was taken using a weighing scale.

## 3.10 Data Analysis Procedure

### 3.10.1 Blood Pressure

In this study, hypertension was determined by certified health professionals to be present in line with the criteria of the National High Blood Pressure Education Program Working Group for Primary Infectious Hypertension (PIH). Preeclampsia was diagnosed after 20 weeks of pregnancy if a woman's blood pressure was raised by further than 140 millimetres of mercury systolic or 90 millimetres of mercury diastolic on two separate evaluations at least 6 hours apart, and if she had proteinuria, which was defined as a qualitative 1+ dipstick reading on two samples after 20 weeks

of pregnancy, or if she had both of these conditions. In compliance with established operating practices, the patient's blood pressure was monitored with a mercury sphygmomanometer.

### 3.10.2 Body Mass Index (BMI)

The body mass index (BMI) was computed by taking the individual's height and weight into consideration. In adults, the BMI (body mass index) is used to diagnose obesity since it has a positive relationship with body fat (Taebi et al., 2015). It has some drawbacks when used as a stand-alone measurement instrument, although it does not directly measure body fat. It is important to note that the proportion of body fat varies based on the age, gender, and ethnicity of an individual. Even if one's weight remains constant, the proportion of body fat increases with age, making the percentage of body fat a less accurate indicator of obesity in adults than other measurements.

The following are the formulas for calculating body mass index (BMI):

BMI = weight in pounds divided by [height in inches divided by height in inches] multiplied by 703

BMI is calculated as follows: weight in kilogrammes / [height in metres x height in metres]

Data collected was entered, cleansed and cross-checked for accuracy and validity using Statistical Package for Social Sciences (SPSS, version 21).

When expressing continuous variables, the means and standard deviation were used, while categorical variables were written as a percentage of the entire population. The Spearman rank test was used to investigate the connection between hypertension and each of the anthropometric measurements (BMI, Hg and Wt). The area under the receiver-operating characteristic curve

(AROC) and 95% confidence intervals (CIs) were determined for each anthropometric measure to estimate the discriminatory power against the risk for hypertension. Univariate, bivariate and multivariate statistical analysis methods were employed. The prevalence of outcome variables was determined using univariate analysis and presented in figures and tables. Univariate analysis was also used to describe the respondents' socio-demographic and other aspects. The association between independent and dependent variables was determined using bivariate (Chi square test) analysis. Adjusted odd ratios were reported and p-values less than 0.05 were regarded statistically significant at 95% confidence level after a multivariate analysis

### 3.11 Ethical consideration

The Department of Social and Behavioural Change at the University for Development Studies gave an introductory letter which was taken to Ghana health service for approval for this research project. The data collection exercise was conducted upon receipt of ethical clearance from the Ghana Health Service's Ethics Review (GHS ERF Number- GH-ERC 024/01/21). Before the day of the test and interview, the participants were given a thorough explanation of the study's objectives and nature. They also received written permission to participate. Informed consent was obtained and supported by signatories from all respondents who agreed to partake in the data collection exercise. Women who could not read and write were given the option to thumbprint while literates were allowed to sign

# CHAPTER FOUR

# RESULTS

## 4.1 Introduction

This chapter present the findings of this study. It is presented in different sections but in two parts. Part one presents findings from the data collected from the three Hospitals in the Tamale metropolis and part two makes inferences from the data presented. Part one is divided into four sections. Ordered based on the study's objectives, the section gives a snapshot of the study's participants giving details about their demography and socio-economic characteristics which includes age, gender, marital status, educational background, sector of employment, income etc. Section two addresses the first research objective; the prevalence of elevated blood pressure among pregnant women in the Tamale metropolis. Section two addresses the main objective of this study by presenting the various factors associated with PIH and HDP among pregnant women in the metropolis.

## 4.2 Demographics Characteristics of Participants

The demography of study participants is presented in table 4.1. About 17.0% of the study participants were between the ages of 15-20, 53.3% and 23.3% were between 21 and 30 years and 31 and 40 years respectively. Additionally, 6.4% of participants were over 40 years.

About 59% of the respondents were Dagombas, 11.5% Akans, 10.5 Daagare, 10.3% Frafra and 8.6% from other ethnic groups. Also, 77.2% of the study participants were married while 77.2%, 10.9%, 7.1% and 4.8% were single, divorced and separated respectively. It was also observed that 65.1% of the respondents were Muslims, 30.9% were Christians, 3.5% were followers of

traditional religion and the remaining 0.5% belonged to other regions either than the three main ones indicated. Approximately 25% of the respondents have never received any formal education, 13.2% completed only primary education, 19.9% completed junior high school level, 18.6% have completed senior high school and 23.1% have completed tertiary level education.

**Table 4.1 Demography of Respondents**

| Parameters | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age** | | |
| 15-20 | 72 | 17.0 |
| 21-30 | 226 | 53.3 |
| 31-40 | 99 | 23.3 |
| 41+ | 27 | 6.4 |
| **Ethnic group** | | |
| Dagomba | 247 | 59.1 |
| Akan | 48 | 11.5 |
| Daagare | 44 | 10.5 |
| Frafra | 43 | 10.3 |
| Other | 36 | 8.6 |
| **Religion** | | |
| Islam | 276 | 65.1 |
| Christianity | 131 | 30.9 |
| Traditional | 15 | 3.5 |
| Other | 2 | 0.5 |
| **Marital Status** | | |
| Married | 309 | 72.9 |
| Single | 52 | 12.2 |
| Divorced | 38 | 9.0 |
| Separated | 25 | 5.9 |
| **Educational Background** | | |
| None | 107 | 25.2 |
| Primary | 56 | 13.2 |
| JSS | 84 | 19.9 |
| SSS/SHS | 79 | 18.6 |
| Tertiary | 98 | 23.1 |
| **Employed Sector** | | |
| Commercial/Trading | 227 | 53.5 |
| Service | 64 | 15.1 |
| Manufacturing | 9 | 2.1 |
| Crop farming | 29 | 6.8 |
| Animal farming | 9 | 2.1 |
| Other sectors | 86 | 20.3 |

**Source: Field Survey, 2021.**

### 4.3 Prevalence of hypertension among pregnant women in the tamale metropolis

The prevalence rate of hypertension among pregnant women in the Tamale metropolis was equally investigated as part of this study's objective. Out of the total number of pregnant women admitted at the OPD of the three understudied hospitals, 67 (15.7%) had been diagnosed with hypertension while the remaining 360 (84.3%) were not hypertensive. This is illustrated by figure 4.1.

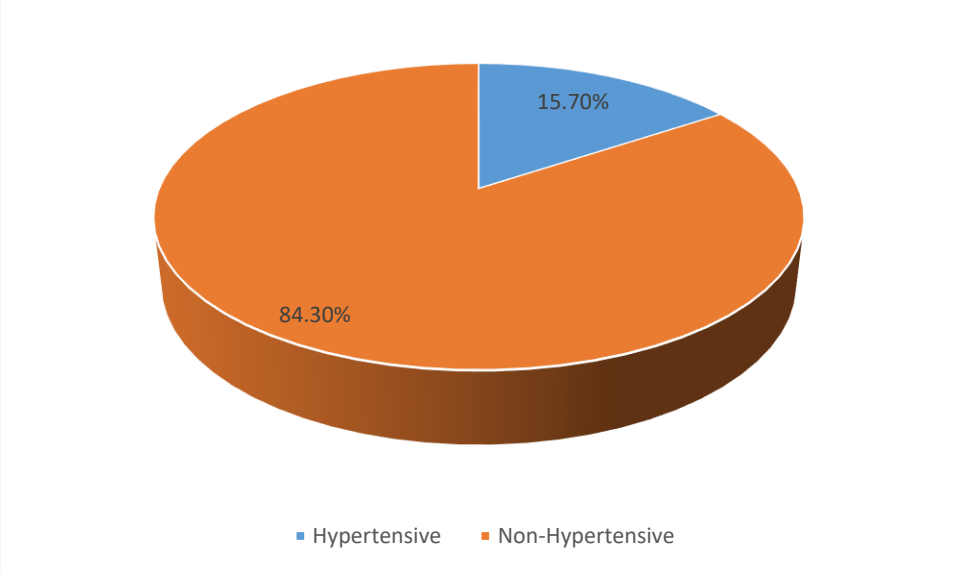


**Figure 4.1 Prevalence of Blood Pressure among Pregnant women**

**Source:** Fields data, 2021

### 4.4 Bivariate analysis of factors associated with hypertension during pregnancy

From the table 4.3, there was a significant association between demographic and socio-economic characteristics and life style factors including family history of hyperension. These include marital status, age, educational background, occupation, family history of hypertension, history of smoking, history of alcohol, oral contraceptive use, history of abortion, stress and daily fruit intake. With the demography of participants, the findings reveals that age ($x^2 = 11.62$, $p = 0.009$) and occupation ($x^2 = 12.61$, $p = 0.027$) of pregnant women are associated with HDP. Also the study revealed that a family history of hypertension ($x^2 = 42.85$, $p < 0.001$) compared with no family history of hypertension, and a history of smoking ($x^2 = 10.31$, $p = 0.006$) with those without a history of smoking. Also, pregnant women with a history of abortion ($x^2 = 27.44$, $p < 0.001$) was also associated with HDP. Mreover, oral contraceptive use ($x^2 = 3.72$, $p = 0.005$) was also significantly associated with HDP (Table 4.3).

**Table 4.2 Bivariate analysis of factors associated with hypertension during pregnancy**

| Variables | Hypertensive (15.7%) | Non-Hypertensive (84.3%) | $X^2$ | P-value |
|---|---|---|---|---|
| **Age** | | | | |
| 15-20 | 8.7% | 91.3% | | |
| 21-30 | 15.9% | 84.1% | 11.62 | 0.009* |
| 31-40 | 15.6% | 84.4% | | |
| 41+ | 37.0% | 63.0% | | |
| **Marital status** | | | | |
| Married | 14.4% | 85.6% | | |
| Single | 16.3% | 83.7% | 2.70 | 0.441 |
| Divorced | 21.4% | 78.6% | | |
| Separated | 26.3% | 73.7% | | |
| **Educational background** | | | | |
| None | 13.1% | 86.9% | | |
| Primary | 23.2% | 76.8% | 4.01 | |
| JSS | 17.3% | 82.7% | | 0.404 |
| SSS/SHS | 16.5% | 83.5% | | |
| Tertiary | 12.2% | 87.8% | | |
| **Occupation** | | | | |
| Commercial | 18.9% | 81.1% | | |
| Service | 6.6% | 93.4% | | |
| Manufacturing | 11.1% | 88.9% | | 0.027* |
| Crop farming | 10.3% | 89.7% | 12.61 | |
| Animal farming | 44.4% | 55.6% | | |
| Other | 12.8% | 87.2% | | |
| **Family History of Hypertension** | | | | |
| Yes | 34.2% | 65.8% | | 0.000* |
| No | 8.5% | 91.5% | 42.85 | |
| **History of Smoking** | | | | |
| Yes | 32.6% | 67.4% | | 0.006* |
| No | 13.9% | 86.1% | 10.31 | |
| **History of Alcohol** | | | | |
| Yes | 20.7% | 79.3% | | 0.260 |
| No | 14.9% | 85.1% | 1.27 | |
| **Oral Contraceptive use** | | | | |
| Yes | 22.0% | 78.0% | 3.72 | 0.005* |
| No | 11.8% | 88.2% | | |
| **History of Abortion** | | | | |
| Yes | 31.8% | 68.2% | | 0.000* |
| No | 11.3% | 88.7% | 27.44 | |
| **BMI** | | | | |

| | | | | |
|---|---|---|---|---|
| Underweight | 13.3% | 84.7% | | |
| Normal | 10.9% | 89.1% | 6.88 | 0.032* |
| Overweight | 0% | 100% | | |

### 4.6 Multiple logistic regression analysis of factors associated with Hypertension during pregnancy

The findings from multiple logistic regression analysis have been presented in table 4.5. This estimates the statistical relationahip between the predictors that were identified through the Pearson's chi-square results and HDP. In the multiple logistic regression, only history of smoking ( aOR = 3.97, 95%CI = 1.4-11.1, p = 0.009) was statistically significantly associated with hypertension. Pregnant women with history of smoking were 3.97 times more likely to be diagnosed as hypertensive than those without history of smoking.

**Table 4.3 Multiple logistic regression analysis of factors associated with Hypertension during pregnancy**

| Characteristics | OR | 95% CI | P-value | aOR | 95% CI | P-value |
|---|---|---|---|---|---|---|
| **Age** | | | | | | |
| 15-20 | 1 | | | 1 | | |
| 21-30 | 3.63 | 1.009-13.1 | 0.048* | 2.11 | 0.6-7.4 | 0.244 |
| 31-40 | 3.03 | 1.126-8.1 | 0.028* | 1.76 | 0.4-7.3 | 0.438 |
| 41+ | 3.44 | 1.109-10.6 | 0.032* | 3.17 | 0.6-17.2 | 0.181 |
| **Occupation** | | | | | | |
| Commercial/Trading | 1 | | | 1 | | |
| Service | 0.91 | 0.4-2.1 | 0.823 | 0.26 | 0.1-1.3 | 0.231 |
| Manufacturing | 5.65 | 1.3-24.6 | 0.021* | 0.67 | 0.1-10.2 | 0.096 |
| Crop farming | 1.04 | 0.1-12.0 | 0.974 | 0.85 | 0.2-4.2 | 0.773 |
| Animal farming | 1.09 | 0.2-5.2 | 0.913 | 4.75 | 0.9-25.9 | 0.840 |
| Other | 0.24 | 0.0-1.2 | 0.090 | 0.67 | 0.2-1.8 | 0.072 |
| **Family History of Hypertension** | | | | | | |
| Yes | 5.22 | 2.8-9.8 | <0.001* | 6.27 | 3.0-13.1 | 0.422 |
| No | 1 | | | 1 | | |
| **History of Smoking** | | | | | | |
| Yes | 2.74 | 1.2-6.3 | 0.018* | 3.97 | 1.4-11.1 | 0.009* |
| No | 1 | | | 1 | | |
| **Oral Contraceptive use** | | | | | | |
| Yes | 1.70 | 0.9-3.2 | 0.102 | 1.34 | 0.6-2.8 | 0.446 |
| No | 1 | | | 1 | | |
| **History of Abortion** | | | | | | |
| Yes | 0.87 | 0.7-1.0 | 0.143 | 1.96 | 0.8-4.8 | 0.135 |
| No | 1 | | | 1 | | |
| **BMI** | | | | | | |
| Normal | 1 | | | 1 | | |
| Overweight | 1.74 | 0.9-3.5 | 0.116 | 1.74 | 0.9-3.4 | 0.116 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Underweigth | 283.86 | 0.0-0.1 | 0.999 | 509.2 | 509.2-509.2 | 0.555 |

**Source:** Field Survey, 2021

# CHAPTER FIVE

# DISCUSSION

## 5.0 Introduction

In this study, 424 pregnant women within the Tamale metropolis participated in the study to determine the prevalence of hypertensive disorders during pregnancy and associated risk factors.

## 5.1 Demography of Respondents

Participants of this study were between the ages of 15-20 (17%), 21-30 (53.3%), 31-40 (23.3%) and the remaining 6.4% were more than 40 years. A similar study by De-Girmenci and. Yilmaz (2010) in Turkey reported similar findings where the majority of pregnant women were between the ages of 18 and 24 (38%) and 25 and 31 (43%). Also, Hinkosa et al. (2020) reported that 27% of their study respondents were between 25 and 29 years, 53.2% were less than 25 years old while 15.6% and 14.1% were between 30–and 34 and older than 34 years respectively. Another study in Ghana by Owiredu et al. (2012) reported that the majority of their study's participants were between 19-24.9 (28.0%) and 25-29.9 (54.0%) years. Thus most women's fertility years fall between 20 and 30 years.

Approximately 25% of the respondents have never received any formal education, 13.2% completed only primary education, 19.9% completed junior high school level, 18.6% have completed senior high school and 23.1% have completed tertiary level education. Jones et al., (2017) reported similar findings in their study in the Hohoe Municipality of Ghana where 14.4% of their study participants had no formal education, however, 46.3% attained Junior High School

(JHS) level of education as compared to our study but with 19% completion rate. Also, Ayele et al. (2016) found that (44%) has of their participants had no formal education.

### 5.2 Prevalence of Hypertension among Pregnant women

Hypertension-related to pregnancy within the Tamale metropolis was estimated at 15.7%. Generally, the prevalence rate of hypertension varies with the type of population with percentages ranging from 2% to 17.5% (ACOG, 2013; Seely & Solomon, 2003; North et al., 1999; WHO, 1988) or 1.5% to 22% (Awuah et al., 2020) but less than 20% globally (ACOG, 2013; Seely & Solomon, 2003; North et al., 1999; WHO, 1988). At Korle-bu Teaching Hospital in Ghana, a tertiary referral health facility in Nigeria, and North West Ethiopia, prevalence rates of 21.4 percent, 17 percent, and 16.8 percent, respectively, have been recorded during pregnancy. (Awuah et al., 2020). A similar study was undertaken by Njukang et al. (2020) discovered that the prevalence of HDP was 14.5% among their study participants. Additionally, this study's finding is higher than the predicted rate by Fonjo et al. (2019) to be between 6.55% and 7.03% among pregnant women. Ayele et al. (2016) confirmed that 11.8% of their study participants were diagnosed with hypertension.

### 5.3 Risk factors of Hypertension associated with Pregnancy.

Several risk factors of HDP have been reported by various studies across Africa and Ghana. Similarly, this study has identified some risk factors associated with HDP in the Tamale Metropolis. This study result revealed that only history of smoking [aOR = 3.97,95% CI = 1.4-11.1, (p = 0.009)] was statistically associated with hypertension. Pregnant women with history of smoking were 3.97 times more likely to be diagnosed of hypertension than those without

history of smoking. Only a few studies have reported a history of smoking as a risk factor for hypertension. Although, women who smoke during pregnancy have an increased risk for a variety of adverse pregnancy outcomes, according to Lucinda et al. (2002), previous reports show that maternal smoking reduces the risk of hypertensive disorders during pregnancy. In support of our finding, Lucinda et al. (2002) reported that women who smoke but quit before becoming pregnant have a high risk for gestational hypertension or preeclampsia. Additionally, Engel et al. (2013) also reported a strong association between continued smoking after pregnancy and increased risk of hypertension as well as women who quit smoking in their third trimester in Norway. Also, Bakker et al. (2010) found that smoking increases the risk of hypertension among pregnant women but Engel (2013) refutes that it was possible because their study was conducted with a smaller sample size. Hwang et al. (2015) reported that smoking progresses to chronic hypertension postpartum. A meta-analysis by Wang et al. (2021) found that a subgroup analysis showed smoking during pregnancy was a risk factor for HDP in Asia. This could be credited to the fact that tobacco smoking increases blood pressure acutely and increases the risk of renovascular thereby causing hypertension.

# CHAPTER SIX

# CONCLUSION AND RECOMMENDATIONS

## 6.1 Introduction

This chapter seeks to conclude the study report and make the necessary recommendations thereafter. The chapter contains a summary of the main findings of this study, the concluding remarks and recommendations for policy and future research

## 6.2 Summary of Findings

### 6.2.1 Prevalence of HDP

According to the findings of the study, 15.7% of study participants were diagnosed with hypertension, while the remaining 84.3% had not developed hypertension during pregnancy. The results of the detailed analysis of the prevalence rate revealed that the rate was highest among married (11.1%) pregnant women, followed by singles (1.8%) and divorcees (0.8%) (1.5% ). Furthermore, hypertension related to pregnancy was found to be more common in women between the ages of 21 and 30 (8.6%), followed by women between the ages of 31 and 40 (8.6%).

### 6.2.2 Risk Factors of HDP

The findings reveals that age ($x^2 = 11.62$, $p = 0.009$) and occupation ($x^2 = 12.61$, $p = 0.027$) of pregnant women are the pontential significant risk factors of HDP.

The study also revealed that a family history of hypertension ($x^2 = 42.85$, $p < 0.001$) compared with no family history of hypertension, and a history of smoking ($x^2 = 10.31$, $p = 0.006$) with those without a history of smoking were significantly associated with HDP. Also, pregnant women with a history of abortion ($x^2 = 27.44$, $p < 0.001$) were more at risk of having HDP than those without any history. Lastly, oral contraceptive use ($x^2 = 3.72$, $p = 0.005$) was also statistically significantly associated with HDP among pregnant women.

Out of the three clinical characteristics of pregnant women, only body mass index (BMI) was significantly associated with HDP ($x^2 = 6.88$, $p = 0.032$).

A multiple logistic regression revealed that Pregnant women with history of smoking were 3.97 times more likely to have HDP than those without history of smoking [aOR = 3.97, 95%CI = 1.4-11.1, ($p = 0.009$)].

Globally, hypertension complicates an average of 9 per cent of pregnancies (Ahenkorah, 2009). Pregnancy-related hypertension affects pregnant women all over the world, especially in sub-Saharan Africa and other developing countries. Its prevalence, risk factors, preventive measures and diagnosis are not readily available due to early draught in research into the development. One key approach for primary prevention largely depends on the identification of its risk factors. This study, therefore, assessed prevalence and risk factors of HDP among pregnant women in the Tamale metropolies.

Pregnancy-Induced Hypertension is becoming increasingly recognised as a highly complex multisystem disorder with numerous contributing factors**.** Pregnancy-Induced Hypertension

(PIH), Gestation Hypertension (GH), and Preeclampsia (PE) are all predisposed to women who have a history of hypertension in their families.

## 6.3 Conclusion

The findings of this study revealed that, 15.7% of study participants were hypertensive, while the remaining 84.3% had not developed hypertension during pregnancy at the time of the study.

This study has shown that history of smoking was the only predictor statistically significant in predicting HDP among pregnant women, in the Tamale Metropolis. Additionally, age, marital status, occupation of pregnant women, family history of hypertension, use of oral contraceptives and history of abortion were found to predict the likelihood of HDP although not statistically significant.

## 6.3 Recommendations

While hypertensive disorders of pregnancy (PIH, PE and GH) continue to take their toll on Ghanaian women, efforts are being made to understand its aetiology and possible prevention through research. This study has equally added to the existing literature on the subject. The identified risk factors serve as a directive for practitioners to help arrest the growing prevalence rate in Ghana and other West African countries. This study, therefore, proposes these recommendations;

1. Women with a family history of smoking should be given the necessary attention and early diagnosis to reduce the chances of developing acute levels that may affect their health and life by health worker.

2. Public education on the risk factors of HDP should be heightened to women before pregnancy to reduce the rate of HDP.
3. The ministry of health in collaboration with Ghana health service should formulate and implement healthy lifestyles policies that will target to reduce the rate of HDP
4. Based on the findings above, routine screening before pregnancy should be encouraged for early dectection of the risk factors.

### 6.3 Future Research

Future studies can be directed into these areas;

1. There is a need to conduct this study with a larger sample size to solidify the findings of this study.
2. Investigate the role of smoking in hypertension disorders of pregnancy since various studies have reported different findings on the subject.

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**APPENDIX 1: RESEARCH INSTRUMENT**

**SCHOOL OF ALLIED HEALTH SCIENCES**

**DEPARTMENT OF PUBLIC HEALTH**

**MPHIL COMMUNITY HEALTH AND DEVELOPMENT**


**RESEARCH TOPIC:**

RISK FACTORS OF HYPERTENSION DURING PREGNANCY IN TAMALE METROPOLIS

**STUDENT:**

MOHAMMED ABDUL-SABUR SUGLO

# INFORMED CONSENT FORM

**Introduction**

Hello. My name is Mohamed Abdul-Sabur Suglo, a Post Graduate student at the University of Development Studies conducting a study on the **risk factors of hypertension during pregnancy in tamale metropolis**. This study is in partial fulfilment of my academic requirements. By participating in the study, you will provide vital information that might be helpful to the Metropolis. Policy makers can use the study as source of information for improving maternal health.

It is for this purpose that I am kindly requesting for your participation by answering a few questions related to the study which may take about **20 minutes** of your time. In case you choose to participate, your name or identity will not be revealed to anyone. In addition, your participation in this study will not attract any financial rewards but will be on **voluntary** basis, you can choose not to answer any of the question(s). Just like those who may choose not to participate in answering any of these questions, their decision will be respected. Be assured that the information you give will only be used for purposes of this academic study.

***Signature:***

I have read/been read to the above consent statement and understood that my decision to participate or not to participate in the study is voluntary and that I will not get financial benefits by participating in this study.

Please, fill the following sub-section **(If YES, proceed to Q1, if No, terminate session by thanking the person):**

YES, I have agreed to participate: _____ _____

***Signature/Right thumb Print*** ***Date***

NO, I have refused to participate: _____

***Signature/Right thumb Print*** ***Date***

**Person Administering Consent:**

I, _____, confirms that the above consent was read an signed in my presence:

_____ _____

Signature/Thumb print Date

**UNIVERSITY OF DEVELOPMENT STUDIES**

**DEPARTMENT OF PUBLIC HEALTH**

**RESEARCH QUESTIONNAIRE**

**BACKGROUND INFORMATION**

1. Name:
2. District/Area of Residence:
3. Marital Status:

   a) Married/cohabiting [ ] d) Separated/Single [ ]
4. Age

   a) Less than 20 [ ] b) 20-24 [ ] c) 25-29 [ ] d) 30-34

   e) 35+ [ ]
5. Religion

   a) Catholic/Protestants [ ] b) Pentecostal [ ] c) Muslims [ ]

   d) Traditional [ ] e) None/Aithest [ ]
6. Educational background

   a) Never [ ] b) Primary [ ] c) JSS [ ] d) SSS/SHS [ ] e) Tertiary [ ]
7. Occupation?

   a) Peasant/Housewife [ ] b) Student [ ] c) Small trader [ ]

   d) Large scale trader [ ] e) Large Scale Farming [ ]
8. How many hours do you work? …….

**PREVALENCE OF ELEVATED BLOOD PRESSURE AMONG PREGNANT WOMEN**

9. Have you been diagnosed of HBP?

   a) Yes [ ] b) No [ ]

10. Suffered HBP by

    a) Elevated Systolic BP [ ]

    b) Elevated Diastolic BP and [ ]

    c) Both Elevated Systolic and Diastolic blood pressure [ ]

11. Type of Hypertension?

    a) Chronic Hypertension (CH) [ ]

    b) Preeclampsia Superimposed on Chronic Hypertension (PSCH) [ ]

    c) Gestational Hypertension (GH) [ ]

    d) Preeclampsia (PE) and [ ]

**FACTORS ASSOCIATED WITH ELEVATED BLOOD PRESSURE AMONG PREGNANT WOMEN**

**Risk factors**

12. Weight ……

13. Height ……

14. Blood pressure

    a) Yes

    b) No

15. BMI (before pregnancy) ……

16. Gestational age

17. First pregnancy

    a) Yes

    b) No

18. How old is this pregnancy? .....weeks

19. What trimester were you during your first visit?

    a) 1

b) 2

c) 3

d) 4

20. Have you visited the hospital for other issues other than for antenatal?

a) Yes [ ]

b) No [ ]

21. Family History of HDP

a) Yes

b) No

22. History of Smoking

a) Yes

b) No

23. History of Alcohol

a) Yes

b) No

24. Daily fruits and vegetable intake

a) More than 5 times

b) Less than or equal 5 times

25. Stress

a) Yes

b) No

26. Oral contraceptive use

a) Yes

b) No

27. History of abortion

a) Yes

b) No

**PSYCHO-SOCIAL STATUS OF PREGNANT WOMEN**

**Perceived Stress** (Woods et al. 2010; Maxson et al., 2016)

28. Do you worry about financial problem?

a) Yes [ ] b) No [ ]

29. Do you have any problems that prevent you from keeping your health care appointments?

a) Yes [ ] b) No [ ]

30. Do you feel unsafe where you live?

a) Yes [ ] b) No [ ]

31. Do you or any members of your household go to bed hungry?

a) Yes [ ] b) No [ ]

32. Have you experienced death of a spouse or family member?

a) Yes [ ] b) No [ ]

33. Have you gone through a divorce or marital separation?

a) Yes [ ] b) No [ ]

34. Have you been a victim of rape or sexual assault?

a) Yes [ ] b) No [ ]

35. Have you ever experienced any pregnancy loss?

a) Yes [ ] b) No [ ]

**Paternal Support** (Cohen & Williamson (1988 cite by Maxson et al., 2016)

In the past eight (8) weeks;

36. Have your partner hit you or tried to hurt you?

a) Yes [ ] b) No [ ]

37. Have you had increasing number of disputes with your partner?

a) Yes [ ] b) No [ ]

38. Have you had physical violence in a past relationship?

a) Yes [ ] b) No [ ]

39. Do you live with your spouse?

a) Yes [ ] b) No [ ]

40. Do you or your partner have concerns about having this baby?

a) Yes [ ] b) No [ ]

41. If you could change the timing of this pregnancy, would you want it to happen

( ) Earlier ( ) later ( ) Not at all

## APPENDIX 2: ETHICAL CLEARANCE

**GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE**

*In case of reply the number and date of this Letter should be quoted.*

*My Ref. GHS/RDD/ERC/Admin/App* 21051
*Your Ref. No.*

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Fax + 233-302-685424
Email: ethics.research@ghsmail.org
15th February, 2021

Abdul-Sabur Suglo Mohammed
P. O. Box 738
Tamale.

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

| | |
|---|---|
| GHS-ERC Number | **GHS-ERC 024/01/21** |
| Study Title | Risk Factors of Hypertension During Pregnancy |
| Approval Date | 15th February, 2021 |
| Expiry Date | 14th February, 2022 |
| GHS-ERC Decision | **Approved** |

**This approval requires the following from the Principal Investigator**

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

**You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19**

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. James Akazili
(Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra