SCHOOL OF PUBLIC HEALTH

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FACTORS ASSOCIATED WITH MALARIA IN PREGNANCY AMONG WOMEN ATTENDING ANTENATAL CLINIC AT DODOWA DISTRICT HOSPITAL IN THE GREATER ACCRA REGION

BY

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DECLARATION

I, Benjamin Offei, do hereby declare that except for other people's work which have been duly acknowledged, this work is the result of my own original research work done under supervision, and this dissertation, either in whole or in part has not been submitted for any other degree apart from this.

…… ……..

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Supervisor

DEDICATION

This work is dedicated to my family especially my brother Benjamin Opoku and his family, my sisters Gifty Offei and Joyce Offei for their sacrifices and contributions in cash and in-kind throughout my studies.

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ABSTRACT

Background: Malaria in pregnancy is a serious public health issue which affects the mother, the fetus and the neonate. Adverse effects of malaria during pregnancy have been known over the years, but effective preventive coverage of pregnancies at risks during antenatal care and factors associated with malaria in pregnancy have been underreported in malaria-endemic countries. The objective of this study was to determine the factors associated with malaria during pregnancy among pregnant women attending antenatal clinic at Dodowa District Hospital in the Greater Accra Region.

Methods: A cross-sectional study was used among 270 pregnant women attending the antenatal clinic during the study period. Pregnant women of all gravidities and gestations were interviewed from 1st June to 24th June 2019 using simple random sampling method with structured questionnaires to obtain sociodemographic, obstetric and knowledge profiles. Peripheral blood samples were taken to determine the presence of malaria using Rapid Diagnostic Test (RDT). Chi-square test was used to assess the association between malaria and other explanatory variables. Logistic regression was used to determine the strength of association for variables which were statistically significant under the chi-square test statistical significance was set at $p< 0.05$.

Results: Out of the total of 270 study participants, (30/270)11.1% (95%CI= 0.08, 0.15) had malaria infection among participants attending the antenatal clinic. Maternal age, marital status, occupation, religion, number of pregnancies, ITN use, number of antenatal visits, and knowledge of malaria, IPT-sp, and IRS were not statistically significant in the multiple regression models.

Conclusion: Malaria prevalence was low among the pregnant women studied. Age, gravidity, education level, occupation, gestation, IPT-sp use and ITN use were not

significantly associated with malaria infection ($p \geq 0.05$). Continuous scale-up of malaria intervention as recommended by World Health Organization (WHO).

LIST OF ABBREVIATIONS /ACRONYMS

ANC	Antenatal Clinic
DOT	Direct Observed Therapy
GHS	Ghana Health Service
GSS	Ghana Statistical Service
IPT	Intermittent Preventive Treatment
IRS	Indoor Residual Spray
ITN	Insecticide Treated Net
IUGR	Intrauterine Growth Retardation
LBW	Low Birth Weight
LLINs	Long Lasting Insecticide Nets
MDG	Millennium Development Goals
MIP	Malaria in Pregnancy
NMCP	National Malaria Control Programme
OPD	Outpatient Department
PCR	Polymerase Chain Reaction
PMI	President Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SP	Sulphadoxine-Pyrimethame
WHO	World Health Organization

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CHAPTER ONE

INTRODUCTION

1.1 Background

Malaria in pregnancy is a serious public health issue which affects the mother, the fetus and the neonate. Malaria infection is caused by five different species of malaria parasite which include; *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale and Plasmodium knowles* (Quartey, 2016). These parasites are mainly transmitted through the bite of an infected female anopheles mosquito. Women are more susceptible to malaria infection with its deleterious effects during pregnancy, with *Plasmodium falciparum* been the most common species for malaria infection during pregnancy in sub-Sahara Africa accounting for 99% death globally (WHO, 2017). An estimate shows that 125 million pregnancies were at risk of malaria infection annually with 32 million pregnancies in malaria-endemic sub-Sahara Africa (Moya-Alvarez, Abellana, & Cot, 2014). In 2016, there was an estimated 216 million cases of malaria, a 5 million increase over the 2015 figures. Sub-Saharan Africa carries the heaviest burden of malaria with 91% recorded death (WHO, 2017).

Adverse effects of malaria infection include maternal anemia, low birth weight (LBW), stillbirth, especially in areas of high levels of immunity where pregnant women present asymptomatic infection (Moya-Alvarez et al., 2014). In Ghana, the major cause of malaria morbidity is *Plasmodium falciparum* where malaria transmissions are stable year-round with seasonal variations within the ecological zones in the country. In areas of low malaria transmission where acquired immunity is low, pregnant women are prone to episodes of severe malaria infection leading to negative health outcomes. It is estimated

that 5-12% of all low birth weight (LBW) are due to malaria in pregnancy (Menendez, 2006). Malaria continues to be one of the preventable causes of LBW in dense transmission areas of sub-Sahara Africa (Eijk et al., 2012). In Ghana, 10.1 million people were infected with malaria in 2015 and the country recorded 2,133 malaria-associated deaths in 2015 (NMCP, 2015). In 2017, Ghana recorded 33.4% of OPD confirmed malaria in pregnancy cases (Ghana Health Service, 2018). Malaria constitutes 31.1% of causes of outpatient morbidity in 2016 in Ghana. The case fatality rate of malaria in the Greater Accra Region stood at 0.26 for all ages in 2016 (NMCP, 2017).

In order to protect the pregnant woman and her fetus from the devastating consequences of malaria infection during pregnancy, a number of available preventive measures have been outlined by WHO. These intervention programs in Ghana include vector control, chemoprophylaxis and case management (WHO, 2017). Vector control will help reduce and prevent malaria infection. Additionally, chemoprophylaxis drugs can be used to prevent malaria infection among pregnant women living in dense transmission areas where malaria is endemic (WHO, 2017). WHO recommends intermittent preventive treatment in pregnancy using sulfadoxine-pyrimethamine (IPTp-sp) with each antenatal care (ANC) visit after the first trimester which can prevent maternal death and anemia and other negative effects of malaria (WHO, 2017). Pregnant women attending ANC clinics begins IPTp-sp at sixteen weeks through a monthly interval under Direct Observed Therapy (DOT) at a Focus ANC Clinic (Dapaa, 2017).

An indoor residual spray is another important preventive measure to rapidly reduce the incidence of malaria in endemic areas of Ghana. Indoor residual spray (IRS) involves the spraying of indoor walls and ceilings where malaria-carrying mosquitoes hide after biting individuals and households. Indoor residual spray (IRS) is effective for 3-6 months,

relying on the insecticide formulation (WHO, 2017). It is estimated that in 2015, 106 million people were protected by IRS (WHO, 2017).

Achievement for the malaria preventive measures affecting pregnant women since the introduction of the Roll Back Malaria Partnership (RBM) has remained elusive for most sub-Saharan Africa. A report in 2015 for 20 countries with information on IPTp-sp and ITN together with case management have the lowest coverage among ANC participants (Hill et al., 2013). Ghana has adopted a management plan to reduce the burden of malaria in 2020 by 75%. This goal calls for greater involvement of all stakeholders and requires multi-disciplinary research if the goal of total eradication of malaria is to be attained in 2030 (Awine, 2017).

1.2 Problem Statement

Malaria in pregnancy continues to remain a problem in Ghana. A study in Ghana in 2015 revealed that pregnant women accounted for 28.1 % of Outpatient department (OPD) attendance, 13.7% of admission, 9% of maternal death and 2-15% maternal anemia (Ghana Health Service, 2017). In 2017, 33.4% confirmed malaria in pregnancies cases were reported in Ghana of OPD attendance (Ghana Health Service, 2018). This increase in figures is as a result of low uptake of IPT-sp among pregnant women, low ITN ownership and usage, young maternal age and late enrollment at ANC. In the Shai Osudoku District, malaria in pregnancy was 19.7% in 2009 (Ofori, Ansah, Agyepong, Hviid, & Akanmori, 2009). Consequences of malaria in pregnancy include preterm delivery, maternal anemia, spontaneous abortion, and low birth weight (Ao et al., 2017). Although these adverse effects of malaria during pregnancy have been known over the years, effective preventive coverage of pregnancies at risks during ANC has remained low in malaria-endemic countries (WHO, 2017). Prevention of malaria continues to remain a major challenge in

Ghana and it is linked with achieving the 4th and 5th Millennium Development Goals (MDGs). The increase in malaria in pregnancy in this area results from seasonal variation, late enrollment at the antenatal clinic, and lack of information about malaria prevention and control. Given the seasonal fluctuations in malaria infection in this area, where long exposure to the rainy season leads to malaria infection, pregnant women whose first antenatal attendance largely occurs in the dry season also carries substantial exposure to malaria infection.

The objective of this study was to determine the factors associated with malaria in pregnancy in the Dodowa District of the Greater Accra Region. It is, therefore, anticipated that the findings of this study will help guide policy decisions at the district level to reduce maternal and infant mortality and morbidity in Ghana.

1.3 Conceptual framework

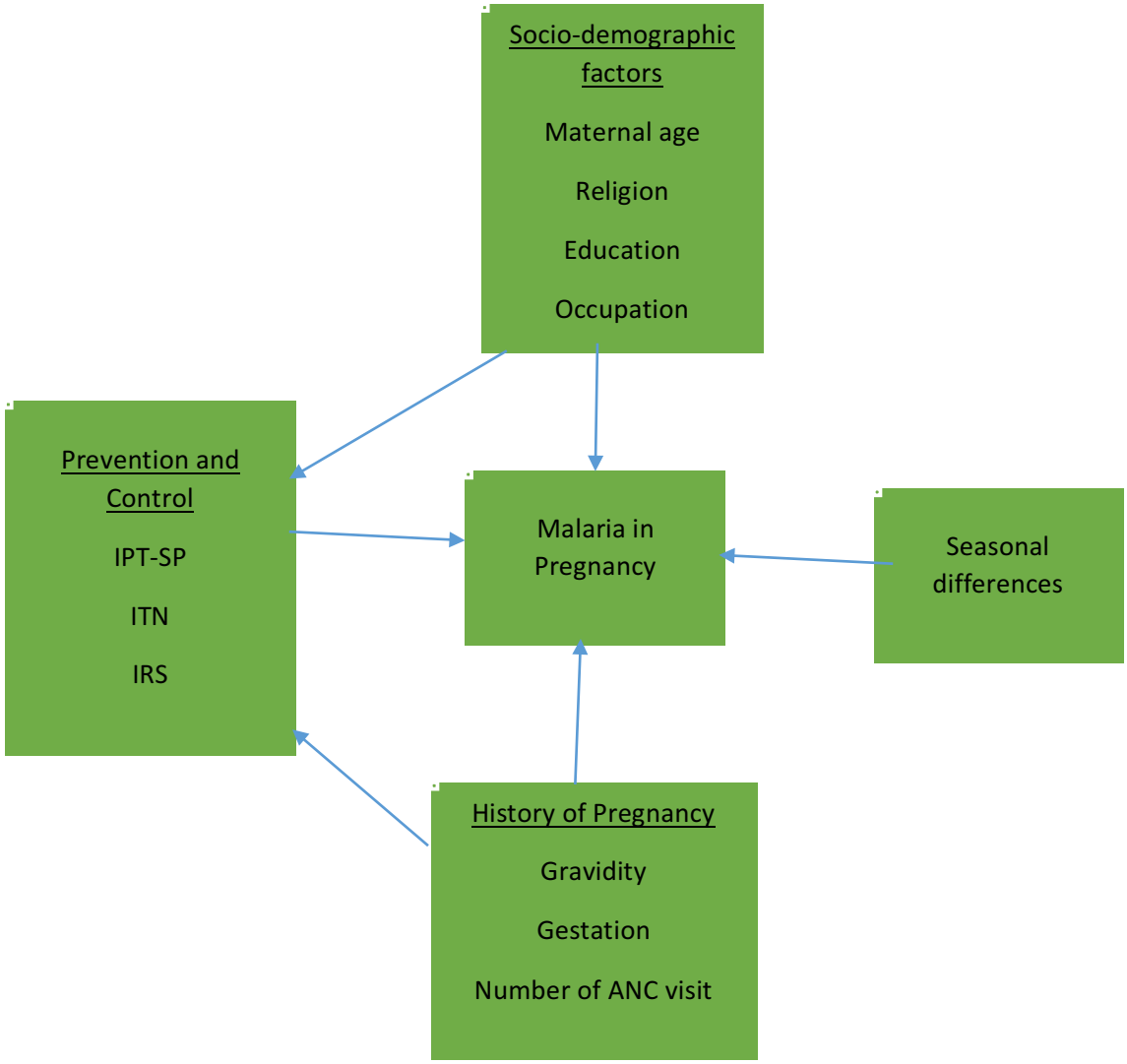


Figure 1.1: Conceptual Framework of the study

1.4 Narrative of the Conceptual Framework

Factors associated with malaria in pregnancy include gestational age, maternal age, level of education, gravidity and occupation and religion. The prevalence of malaria in pregnancy is higher during first pregnancies because of low immunity status. Multigravidity has a lower infection rate especially in stable transmission areas as acquired immunity increases with pregnancy (Berry et al., 2018). Pregnant women with higher educational level are more able to adhere to malaria interventions such as IPT-sp, ITN, and IRS (Takem & Alessandro, 2013). It has been demonstrated that pregnant

women who are employed are better able to access health services and also able to afford medications to control malaria infection during pregnancy.

Information about malaria in pregnancy and its adverse effects can lead to early utilization of ANC services and improve pregnancy outcomes (Goshu & Yitayew, 2019). Research has demonstrated that the utilization of ANC early in pregnancy has reduced malaria prevalence in sub-Saharan Africa (Boudová et al., 2015). Seasonal variation in an area has an influence on malaria infection. During the rainy season, the risk of malaria infections during pregnancy peaks and falls substantially during the dry season (Berry et al., 2018).

1.5 Justification of the Study

Studies have shown that an estimated 32 million pregnancies are recorded every year in malaria-prone sub-Sahara Africa (Moya-Alvarez et al., 2014). Malaria continues to be a health problem in Ghana, accounting for 40% of OPD visits with 28.1% pregnant women and 9% of maternal deaths recorded (Awine, 2017). Malaria in pregnancy poses a serious health outcome in infants and women which include LBW, stillbirth, intrauterine growth retardation (IUGR), and maternal anemia (Muhammad et al., 2016). However, malaria control in pregnancy has received low program support (Kiptoo, 2016). Most malaria infections in endemic areas such as the Shai Osudoku District remain asymptomatic and as a result interventions such as IPT-sp, ITN and IRS have low uptake. This study sought to assess factors associated with malaria in pregnancy among women attending ANC at Dodowa District Hospital Accra, Ghana. The findings of this study can be useful in providing information on preventive measures uptake and hence reduce the adverse effects on the mother, fetus and the neonate.

1.6 Research Question

The research questions that this study sought to answer include the following:

1. What is the level of knowledge of malaria in pregnancy among pregnant women attending antenatal clinic at Dodowa District Hospital?
2. What is the prevalence of malaria infection among pregnant women attending antenatal clinic at Dodowa District Hospital?
3. What are the factors associated with malaria infection during pregnancy for women attending the antenatal clinic at Dodowa District Hospital?

1.7 Objectives

1.7.1 General Objectives

The general objective of this study is to determine the prevalence and factors associated with malaria infection in pregnancy among women attending antenatal clinic at Dodowa District Hospital in the Greater Accra Region of Ghana

1.7.2 Specific Objectives

1. To determine the level of knowledge of malaria in pregnancy among pregnant women attending antenatal clinic at Dodowa District Hospital
2. To determine the prevalence of malaria infection among pregnant women attending antenatal clinic at Dodowa District Hospital.
3. To assess the factors associated with malaria in pregnancy in women attending ANC clinic.

CHAPTER TWO

LITERATURE REVIEW

2.1 Burden of Malaria in Pregnancy in Different Settings

The burden of malaria infection in pregnancy has been reported globally. Malaria infection is the second leading cause of mortality of infectious disease after tuberculosis (Eijk et al., 2012). According to the World malaria report 2018, there were 219 million cases of the disease in 2017, compared to 217 million the year before (WHO, 2018). Approximately 125 million pregnant women are exposed to the risk of malaria in pregnancy every year globally (Kweku, Ofori, Takramah, Axame, & Owusu, 2017). Malaria continues to be endemic especially in sub-Saharan Africa. Within the sub-Saharan Africa, about 9.5 million pregnant women were at risk of malaria infection in 2015 (Berry et al., 2018). Approximately 70% of the world's burden of malaria is found in sub-Saharan Africa (WHO, 2018). Among the adult population, pregnant women are reported to have the highest prevalence. In Angola for instance, 19.4% prevalence rate was seen among women attending the antenatal clinic in 2015. A prevalence of 18.1% has been reported in Burkina Faso in 2015 (Sohail et al., 2015). In Nigeria, a prevalence of 48% was reported in a health facility with malaria infection accounting for 60% ODP visits and 30% hospitalization (Onyeneho, Idemili-aronu, Igwe, & Iremeka, 2015). The study also revealed that mortality related to malaria in pregnancy varies 100- fold in respect to the weight of newborn and rises continuously with decreasing birth weight (Onyeneho et al., 2015).

Maternal deaths mostly occur from severe anemia accounting for hundred thousand deaths every year in Africa. In Burkina Faso for instance, 97 maternal deaths were recorded in 2011 (Cisse et al., 2014). In Ethiopia, deaths attributed to malaria has seen a gradual decrease from 1995 to 2015, however, malaria continues to be a major public concern

(Goshu & Yitayew, 2019). In Ghana, malaria in pregnancy is a public health problem, malaria accounts for 28.1% of OPD attendance among pregnant women and the prevalence of 10.6% was reported in 2017 (Ghana Health Service, 2017; Balami et al., 2017). In the Kassena-Nankana district of Ghana, the overall prevalence of malaria during pregnancy was 47%. Another study conducted in Kumasi, Ghana revealed the prevalence of malaria in pregnant women was 12.6% (Kweku et al., 2017).

2.2 Malaria Transmission and Maternal Immunity

The transmission of malaria infection varies depending upon whether the area is of low, stable, unstable, or seasonal transmission. In high-density malaria infection area such as sub-Saharan Africa, *Plasmodium falciparum* is the major species found. Evidence from high malaria transmission areas suggests a very high prevalence of malaria infection often seen at first ANC visits with asymptomatic infections (Berry et al., 2018). In stable malaria transmission areas, frequent exposure to malaria parasites leads to acquired immunity. Malaria infection is often unnoticed and untreated thereby putting the pregnant woman at greater risks (Berry et al., 2018). In these areas, placental malaria is associated with twofold more risk of stillbirth and about 35% preventable LBW (Coulibaly, Gies, & Alessandro, 2007). The prevalence of malaria is higher during pregnancy than the non-pregnancy state in a more endemic and stable area (Clerk, Bruce, Greenwood, & Chandramohan, 2009). The adverse outcomes are more pronounced in primigravidae (Desai et al., 2007) Adverse effects of malaria infection where mortality constitute 50% among pregnant women compared to non-pregnant women (Hile, Assam, Amali, & Amuta, 2013, Sohail et al., 2015).

Geographical settings with unstable malaria transmission acquired immunity is insignificant and women with pregnancy are more prone to severe malaria infection with

serious consequences such as stillbirth, maternal anemia, and death. In unstable areas, people of all ages exhibit symptomatic malaria infection (Berry et al., 2018).

In a study conducted in Garoua, Cameroun, estimates of the burden of malaria in low-density areas were low among pregnant women with infection of 1.03% compared with high-density area of 79.38% (Hile et al., 2013). In Ghana, malaria transmission is predominately stable, many pregnant women have developed immunity due to frequent exposure to *Plasmodium falciparum* and remained asymptomatic and cause complications (Bohulu, 2016).

2.3 Risk Factors of Malaria in Pregnancy

Various risk factors make pregnant women more vulnerable to malaria infection. Most studies use demographic factors such as the age of gestation, gravidity, and educational level. It is to be noted that there are variations in findings among the risk factors (Berry et al., 2018). In Burkina Faso, a study of pregnant women found greater risk among those with no formal education compared to those with formal education. There is a lower burden of malaria in pregnancy with increasing educational attainment (Hill et al., 2013). These results are consistent with other studies in sub-Saharan Africa (Cisse et al., 2014). The risk of malaria infection during pregnancy increases with no antenatal care (ANC) visit (Balami et al., 2018).

Gravidity is another factor reported among various studies (Kweku et al., 2017; Clerk et al., 2009) Primigravidae increases the risk of pregnancy-related malaria infection compared with secundigravidae and multigravidae. A study of seasonal dynamics of malaria in Ghana, Burkina Faso, and Mali, found that primigravidae has a higher risk of infection (Berry et al., 2018). In Nigeria, the burden of malaria in pregnancy was higher among first pregnancy compared with previous pregnancy (Balami et al., 2018). It is

generally believed that primigravidae are highly susceptible to malaria infection because they lack protection from infection during pregnancy which is available for previous pregnancies. These protective antibodies develop with subsequent pregnancies (Lufele et al., 2017).

Gestational age in pregnancy is another factor associated with malaria in pregnancy. Maternal age is inversely related to malaria infection. Younger age group have increased risk of malaria infection compared with older age (Balami et al., 2018).

2.4 Antenatal care and malaria in pregnancy

To curb the harmful effects of malaria in pregnancy, antenatal care must be provided early during the first trimester especially in high transmission areas. However, pregnant women in sub-Saharan Africa seek ANC care late because they exhibit asymptomatic malaria infections for months before receiving vector control measures (Anto, Agongo, Asoala, Awini, & Oduro, 2019). Bed nets are usually distributed through antenatal clinics to reach high transmission areas, most importantly pregnant women (Boudová et al., 2015). Effective distribution and administration of LLIN and IPTp-sp are carried out at antenatal clinics in the Hohoe Municipality (Kweku et al., 2017). Barriers that affect women have to be overcome in seeking ANC services such as household and societal barriers. Commitment to employers, farming and household responsibilities often affects pregnant women ability to seek treatment services early in pregnancy. Educating women about the advantages of seeking antenatal services early would lead to better pregnancy outcomes (Hill et al., 2013).

Studies conducted in three West African countries including, Ghana, Burkina Faso, and Mali, with strong metrological differences in malaria transmission, indicate that the overall burden of malaria infections at first ANC visit was 59.7% in Ghana, 56.7% in Burkina

Faso, and 42.2% in Mali. Additionally, ITN use at first ANC was lowest in Ghana with 37.4% whiles Gambia has the highest with 81.7% (Berry et al., 2018).

2.5 Malaria prevention and treatment in pregnancy

Effective tools for malaria prevention and treatment are available through World Health Organization (WHO) recommendations. These preventive and control measures include vector control, case management, and chemoprophylaxis (WHO, 2015). In Ghana, the previous anti-malaria drug policy focused primarily on chloroquine chemoprophylaxis for malaria treatment during pregnancy (Ministry of Health, 2009). The use of chloroquine recorded low compliance rate with 11.6% outside the clinical setting and made malaria prevention ineffective (Wilson et al., 2011). In Nigeria, the use of chloroquine led to minimal reductions of malaria infection among women, failure and noncompliance rate ranged from 37.9% to 59.1%. A similar situation was also recorded in Burkina Faso with a high rate of failure at 46.7% among pregnant women using chloroquine chemoprophylaxis. High cost, dosing regimen are some of the problems for low compliance rates (Agomo & Oyibo, 2013).

Intermittent preventive treatment (IPTp-sp) with sulfadoxine-pyrimethamine replaced chloroquine has reduced maternal anemia, the episodic incidence of malaria and the incidence of LBW. The IPTp-sp has been identified as cost-effective to control and prevent malaria infection in endemic sub-Saharan Africa. Additionally, single-dose usage of IPTp-sp has shown to be attractive, which lends itself to ensure compliance (Wilson et al., 2011). A study conducted in Ghana at Korle Bu Teaching Hospital to assess the effectiveness of IPTp-sp found that pregnant women who use IPTp-sp had a lower burden of malaria and severe anemia, compared with pregnant women who did not use the medication (Wilson et al., 2011). This finding is in agreement with similar studies in

Malawi, where the use of IPTp-sp was associated with lower anemia among gravid women (Wilson et al., 2011). In Benin, a similar finding was also reported which showed that IPT-sp has been efficacious despite marked resistance (Takem & Alessandro, 2013).

Many barriers affect the smooth administration of IPTp-sp during ANC visits. General knowledge of IPTp-sp among health care providers remained poor (Akaba, Otubu, Agida, & Onafowokan, 2013). Research conducted in Ghana and Nigeria showed that nurses, allied health workers were unable to name the major side effect of SP and its contraindications (Hill et al., 2013). In Tororo, a highly endemic malaria infection area in Uganda showed that the efficacy of SP is waning given drug resistance parasite where 70% of pregnant women who were compliant with more than two doses of IPTp-sp reported 62% of placental malaria (Muhindo et al., 2016). Resistance to SP has been increasing in recent times in West Africa (Ruizendaal et al., 2017). Treatment failure among pregnant women is about 30% in Central Ghana (Wilson et al., 2011).

Vector control is another important tool recommended by the WHO (WHO, 2017) Insecticide-treated net (ITN) has been effective to reduce malaria infection during pregnancy. In Ghana, the National Malaria Control Program (NMCP) has a management plan to reduce the prevalence of malaria infection by 75% across Ghana by 2020 (Ghana Health Service, 2018) To achieve this goal, the scale-up of the distribution and use of ITN has been proposed (Awine, 2017). The use of ITN is an effective and cost-saving approach to reduce mosquito bites thereby reducing the risks of infection in endemic regions in the sub- Saharan Africa. A total of 289 million ITN were delivered between 2008 and 2010 to endemic sub-Saharan Africa by WHO to cover 76% of 765 million persons at risk (Onyeneho et al., 2015).

A moderate reduction of malaria infection after the universal bed net campaign has been documented in Malawi where prevalence of malaria declined from 28.4% to 18.5% in 2012 to 15.0 % in subsequent years (Boudová et al., 2015). Insecticide-treated net (ITN) should be implemented during the early stages in pregnancy to reduce infection. Pregnant women who visit the antenatal clinic for their first registration are given ITN. A major coverage gap remains ineffective implementation of ITN (WHO, 2017). In 2015, 47% of the population at risk which includes pregnant women did not sleep under ITN (WHO, 2017). In Enugu State Nigeria, most pregnant women do not own ITN, only about 9.7% of households owned at least one ITN, possible reasons for this lack of ITN ownership include poverty, low attendance of ANC and cultural beliefs (Onyeneho et al., 2015).

A study conducted in 2007 in Cameroun showed that pregnant women that used ITN during the period were less infected with 30% compared with non-users of ITN with 47%. The research further found that ITN is among the most effective methods in malaria prevention and control (Hile et al., 2013). ITN does not only reduce maternal morbidity and mortality, but has been linked with a reduction of maternal parasitemia of 38%, and LBW 28% (Takem et al., 2013). Further evidence from Kenya in the highly malaria-affected area revealed that, during the first trimester, pregnant women who used ITN at night gave birth to 25% fewer LBW and premature babies compared to pregnant women who did use ITN (Hile et al., 2013).

Despite the enormous contributions of ITN in reducing malaria infection during pregnancy, a common barrier to the effective utilization of ITN was associated with discomfort and the feeling that the net was bad to the pregnant woman and the unborn child was revealed in the research conducted in Uganda (Hill et al., 2013). In the Greater Accra Region, for instance, 36.6 % of pregnant women who used ITN night before the

survey in 2016 compared to 56.3% in the Volta Region and 42.6 % in the Ashanti Region (Ghana Statistical Service, 2017).

Indoor residual spraying (IRS) is also the recommended tool by the WHO as a means to prevent malaria infection. Indoor residual spraying (IRS) has been reported to be efficacious in reducing malaria burden and mortality in unstable transmission areas. In Uganda, the use of IRS in endemic areas of the country recorded significant reductions in malaria morbidity in 2006. Additionally, in 2014, results of research conducted in endemic areas assessing the efficacy of IRS was related to lower malaria infections and improved birth outcomes (Muhindo et al., 2016). Indoor residual spraying (IRS) is important in preventing malaria during pregnancy. In Ghana, IRS forms a key component of the national malaria control strategic plan to reduce the malaria burden in the country (Coleman et al., 2017).

2.6 Knowledge of malaria in pregnancy

Knowledge about malaria among pregnant women has been shown to be positively associated with the reduction of the prevalence of infection. This is particularly true with ANC visits, compliance with IPT-sp two or more doses. Results from a study conducted to determine the uptake of IPT-sp found that women with adequate knowledge of malaria had a higher percentage of completing the maximum dose of IPT-sp (Hajira, 2015). Similarly, pregnant women with information about the negative implications of malaria in pregnancy were more likely to complete the maximum dose of IPT-sp (Azizi et al., 2018). Educational attainment of pregnant women is directly correlated to the knowledge of malaria (Hill et al., 2013). Women with higher education showed a better understanding of malaria than women with little or no education. Government efforts to reduce the burden of malaria in Ghana could be achieved if policies are tailored towards improving

the educational level of its people (Oladimeji, Mahlako, Gwegweni, Ojewole, & Yunga, 2019). Women who are better knowledgeable about malaria control and prevention can serve as role models in heightening awareness in the home environment which would lead to a low incidence and prevalence of malaria infection.

Malaria prevention is an important key element in roll back malaria partnership. Research conducted in Uyo, Nigeria to assess the knowledge of malaria among women, 71% had knowledge about malaria and its effects. Additionally, respondents indicated that knowledge of the factors responsible for malaria in pregnancy is directly proportional to educational status (Ojong, Iheanacho, Akpan, & Nlumanze, 2013). It must be mentioned that reports from malaria knowledge, attitude and practices indicate misconceptions about malaria. This has adverse effects on malaria prevention and control. Results from studies conducted in Nigeria revealed that even though the knowledge was high among pregnant women about 90%, it did not translate into their practice (Oladimeji et al., 2019). A study conducted in a teaching hospital in Abuja Nigeria revealed that knowledge and preventive measures of malaria among pregnant women was 71.5% (Akaba et al., 2013). Level of Education is associated with knowledge of malaria infection. In the same study, it was noted that women who reside in the cities areas are more knowledgeable than those who live in a rural area (Akaba et al., 2013). This could be due to the fact that women in the cities have more information and have higher education than women in rural areas (Goshu & Yitayew, 2019). Other studies have revealed that knowledge about IPT-sp could increase the uptake of medication among pregnant women. The study noted that about 70% of participants who had a good knowledge of IPT-sp benefits led to reductions in malaria infection. Furthermore, knowledge about the cause of malaria infection is another important factor (Ibrahim et al., 2017). In Nigeria, a high literacy rate among pregnant women was positively associated with the understanding of malaria infection (Oladimeji et

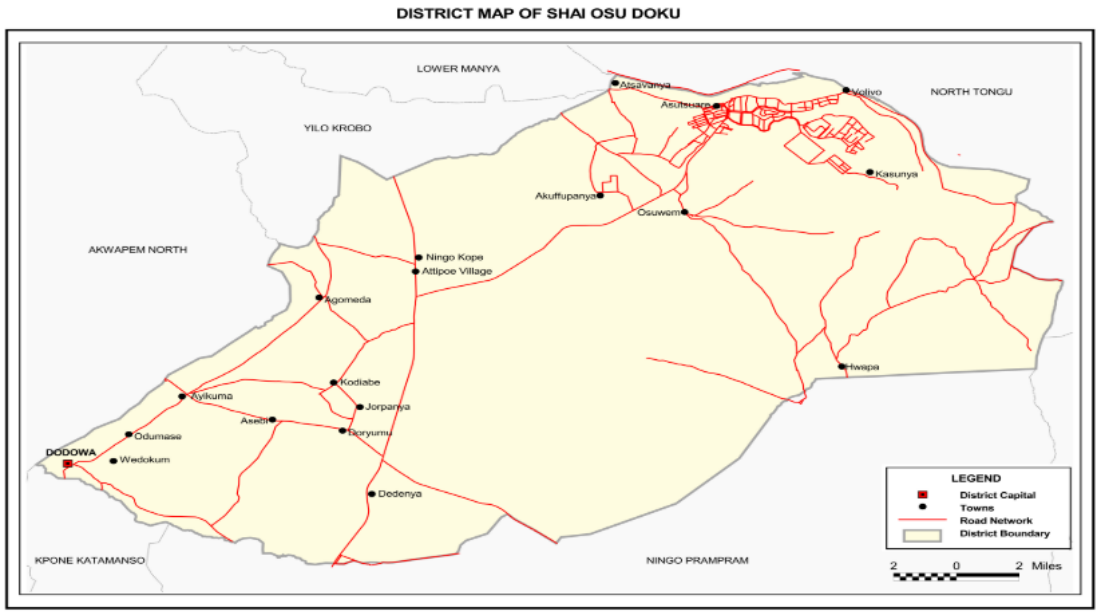
al., 2019). Of the pregnant women surveyed almost 93% correctly stated malaria result from a mosquito bite. This high level of knowledge is in agreement with other studies in Ethiopia and other sub-Sahara Africa. (Akaba et al., 2013). In a study conducted in Amasaman, Ghana, it was revealed that pregnant women had knowledge about the causes of malaria (Bohulu, 2016).

CHAPTER THREE

METHODOLOGY

3.1 Study Location

The study was carried out at Dodowa the district capital of Shai Osudoku located in the South-Eastern part of Ghana in the Greater Accra Region. It has a total land area of 986.361 square km. Dodowa District Hospital serves as the biggest hospital in the district serving a population of 51,913, with 51.3% female (Ghana Statistical Service, 2014). The district population constitutes 1.3% of Greater Accra Region overall population. Majority of the population resides in the rural community constituting 76.7%. The population of Shai Osudoku is mostly agrarian with 85.6% in crop farming. The district has two rainy seasons coming in April and June, and from September to November. Rain pattern in the district is generally erratic making Shai- Osudoku one of the driest parts of the country. The absolute maximum temperature in the South-Eastern part is 40°C (Ghana Statistical Service, 2014). Malaria transmission varies from low, moderate and heavy with seasonal differences.



Source: Ghana Statistical Service, GIS

Figure 3.1: District map of Shai Osudoku

3.2 Study Design

This was a cross-sectional aimed at examining prevalence and factors associated with malaria in pregnancy among women attending antenatal clinic at the Dodowa District Hospital in the Greater Accra Region.

3.3. Study Variables

Table 3.1: Variables of the Study

Variable Name	Variable identification	Measurement
Dependent Variable	Presence of malaria using	Categorical
Malaria infection	RDT	
Independent Variables		
Age	Age in completed years	Discrete
Marital Status	Current marital status	Nominal
Occupation	Professional activity	Nominal
Education	Educational level achieved	Ordinal
Religion	Religious status	Nominal
Gravidity	Number of Pregnancies	Discrete
Gestational Age	Current gestational age in weeks	Discrete
Knowledge of Malaria Prevention	Measures of malaria prevention	Nominal
ITN	Used last night before the survey	Binary: Yes, No
ITN	Used during pregnancy	Binary: Yes, No
IRS	Ownership and use	Binary: Yes, No
IPT-sp	Use of IPT-sp	Binary: Yes, No
ANC	No of ANC visit	Discrete

3.4 Sampling

The simple random method was used for all pregnant women who attended the antenatal clinic at the Dodowa District Hospital during the study period.

3.4.1 Study Population

This study population included pregnant women from the first trimester and above who attended antenatal clinic at the Dodowa District Hospital in Accra, Ghana. All pregnant women attending the antenatal clinic at the Dodowa District Hospital within the study period and consented were enrolled in the study. Pregnant women who did not consent to the study were excluded from the study.

3.4.2 Sample Size Calculation

The sample size was calculated using the formula; n= **$(Z^2$ pq)\d^2**. A prevalence of 20% (Stephens, Ofori, Quakyi, Wilson, & Akanmori, 2014) was used in this study to assess the prevalence of malaria in pregnancy. The research was carried out at Dodowa District in the Greater Accra Region with a confidence interval of 95%.

P= estimated proportion with the condition of interest.

n = sample size= $(Z^2$ pq)\d^2

Z=1.96 at a 95% confidence interval (CI)

d= Desired difference between observed proportion and true proportion= 5%

n = sample size = 245

n=**270** after considering 10% to non-response rate

3.4.3 Sampling Technique and Procedure

To select a representative sample, a simple random method was used to select respondents. Participants who attended the antenatal clinic from 1st June to 24 June 2019 were enrolled. Participants were selected during ANC visit and a one-on-interviews were held with pregnant women who had come at the ANC on a daily basis. A structured questionnaire was used to obtain information. Informed consent was obtained from pregnant women who attended antenatal clinic at Dodowa District Hospital. After providing information about the purpose of the study, willing and consenting pregnant women were enrolled in the study. Pre-testing data collection occurred at St John of God Clinic at Shai Osudoku District. Information obtained included socio-demographic such as age, educational level, marital status, occupation, and religion. Additionally, obstetric information was also obtained including gestation, gravidity, ITN and IPT use. This pre-testing was conducted to detect the weakness and validity of the research. Rapid diagnostic test (RDT) was used to determine the presence of malaria infection among participants. Results of the test were recorded as either negative or positive.

3.5 Data Collection Techniques and Tools

Primary data was collected using structured questionnaires from pregnant women who attended antenatal clinic. The questionnaire had both open and close-ended questions. The questionnaire contained socio-demographic, malaria and obstetrics information. The questionnaire was structured to provide respondents easy to fill-in data. Each participant was evaluated once either in English, Twi, or Ga by the trained field assistants. In the event that there was no reliable interpreter of the above-named languages for a respondent, that respondent was excluded from the study.

The rapid diagnostic test (RDT) used for this study was *Plasmodium falciparum* specific. Blood samples were obtained from pregnant women by a trained phlebotomist from a peripheral vein into RDT cassette to determine the presence of malaria parasites.

3.5.1 Quality Control

Questionnaires were checked for completeness and consistency. Double data entry was done to reduce data entry errors. Eligibility criteria were confirmed by the interviewer before a participant was enrolled. The data was handled very well and protected with a password on the computer where the data was entered as soft copy and the hardcopy was protected under lock and key.

3.5.2 Data Analysis and Processing

Questionnaires were coded and cleaned before entry into Stata version 15 (STATA, College Station, Texas, USA). All information was first coded in Microsoft Office Excel and imported into Stata version 15 for analysis. Descriptive studies were performed to determine the frequency distribution of various factors. Bivariate analysis was done using Pearson chi-square tests to assess significant association between malaria infection and each independent categorical variable. Factors with p value < 0.05 at 95% CI were considered statistically significant. Multivariate logistic regression analysis was performed at $p< 0.05$ significance.

3.5.3 Ethical Considerations

Ethical approval was obtained from the Ghana Health Service Ethics Review Committee before the start of the study on 25th April 2019 (protocol number GHS-ERC 017/03/19). Additional permission was obtained from the Regional Health Directorate, Greater Accra

Region as well as the District Health Directorate, Dodowa. Final authorization was received from the Hospital Management Team at Dodowa District Hospital. The in-charge nursing officer of the hospital introduced the field assistants to the staff of the clinic. Informed consent was obtained from the respondents before the start of each interview.

3.5.4 Voluntary Consent

All information pertaining to the study was clearly explained to participants while getting informed consent. Hospital management and participants were assured of confidentiality and security at all times, data safety and usage.

CHAPTER FOUR

RESULTS

4.1 Sociodemographic and Obstetric characteristics of Pregnant Women

A total of 270 pregnant women were interviewed and blood samples obtained for the random diagnostic test during the study period from 12th June to 2nd July 2019 at Dodowa District Hospital. The sociodemographic and obstetric factors of the study participants are summarized in table two. Majority of the respondents were in the age group of 25-29 years representing 29.6% (80/270), followed by age group 30-34 years representing 27.4% (74/270). Age 15-19 years had the lowest number of participants with 7.0% (19/270). Of the pregnant women who were interviewed more than three fourth were married 77.8% (210/270) compared to single women 22.2% (60/270). Most women had primary school education level representing 45.93% (124/270), while women with no education were the least among the participants with 7.0% (19/270). Petty traders had 66.3% (179/270) whiles occupation in farming was at 2.6% (7/270). Majority of the participants were Christians, 90% (240/270). Among the women who consented to the study, the majority were multigravidae constituting 44.1% (119/270) whiles secundigravidae was the lowest representing 27.4% (74/270). Most of the participants were in their third trimester representing 39.3% (106/270) while those in their first trimester was the lowest 23.7% (64/270). The overall prevalence of malaria infection was 11.1% (30/270).

Table 4.1: Sociodemographic factors, Obstetric and malaria infection of the study participants

Variables	Frequency(n=270)	Percentage (%)
Age(completed Years)		
15-19	19	7.0
20-24	46	17.0
25-29	80	29.6
30-34	74	27.4
≥35	51	18.9
Marital Status		
Single	60	22.2
Married	210	77.78
Education Level		
No education	19	7.0
Primary/JHS	124	45.9
SHS/Vocational	89	33.0
Tertiary	38	14.1
Occupation		
Farming	7	2.6
Petty trading	179	66.3
Civil Servant	33	12.2
Unemployed	51	18.9
Religion		
Christian	240	88.9
Muslim	30	11.1
Gravidity		
Primigravidae	77	28.3
Secundigravidae	74	27.4
Multigravidae	119	44.1
Gestation		
First trimester	64	23.7
Second trimester	100	37.0

Third trimester	106	39.3
Presence of Malaria		
Yes	30	11.1
No	240	89.9

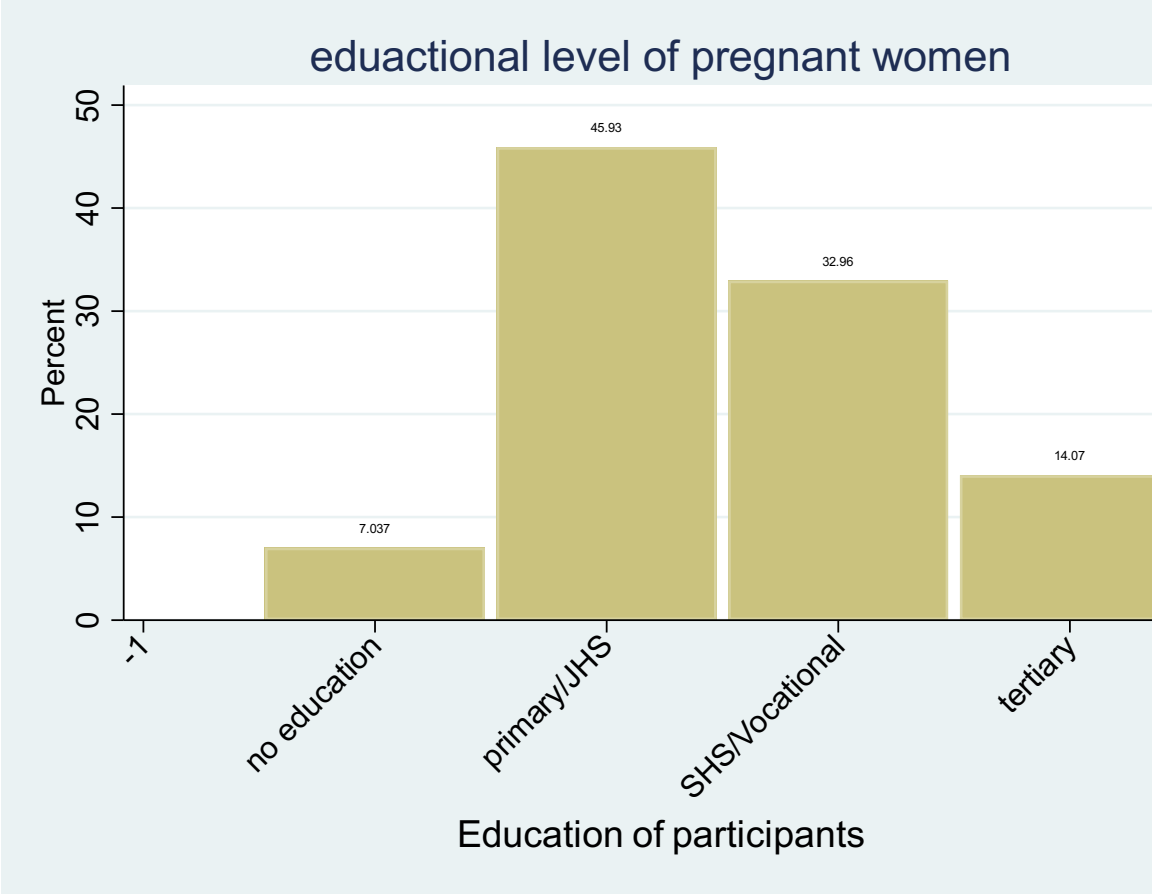


Figure 4.1: Percentage of participant's educational level

4.2 Knowledge of malaria and prevention methods among the study participants

Among the pregnant women who visited the antenatal clinic, first-time visitors constitute the highest percentage of 42.6% (115/270) compared to the second time visit of 16.3% (44/270). Knowledge about malaria prevention was higher representing 78.2% (211/270), whiles pregnant women with no knowledge were low at 21.8% (59/270). Usage of ITN during pregnancy was higher at 57.4% (155/270), compared to no- usage of ITN during pregnancy at 42.6% (115/270). The number of women who used IPT-sp was 50.7% (137/270), while those who did not use IPT-sp at 49.3% (133/270) almost the same percentage. Majority of the pregnant women used IRS representing 51.9% (140/270), while those who did not use IRS were 48.1% (130/270).

Table 4.2: Status of knowledge and preventive methods of the study participants

Variables	Frequency(n=270)	Percentage (%)
ANC visits		
First visit	115	42.6
Second visit	44	16.3
Three or more visits	111	41.1
Knowledge of malaria		
Yes	211	78.2
No	59	21.8
Used ITN during pregnancy		
Yes	155	57.4
No	115	42.6
Used IPT-sp		
Yes	133	50.7
No	137	49.3
Used IRS		
Yes	140	51.9
No	130	48.1

4.3 Results of Sociodemographic, Obstetrics and knowledge factors associated with malaria infection using Pearson's chi-square test.

Test of association was performed based on the last two objectives of this study: To determine the factors associated with malaria in pregnancy in women attending ANC clinic and to assess the prevalence of malaria infection among pregnant women. A significant association was found between the age of participants and the prevalence of malaria infection (χ^2= 18.02, $p<0.05$). Age group 15-19 years had the highest prevalence of infection 36.84% (7/19) compared to age groups 30-34 with 5.41% (4/74) with the lowest prevalence of infection. Marital status was statistically associated with the presence of malaria infection (χ^2= 6.17, $p<0.05$). Married women had the lowest prevalence of infection 8.57% (18/210) compared to single women with 20.0% (12/60). The gravidity of the pregnant women was also found to be associated with malaria infection (χ^2=7.77, $p<0.05$). Primigravidae represent the highest number of infections at 19.48% (15/77) while secundigravidae had the least infection of 6.76% (5/74). Other factors such as educational level, occupation, religion, number of antenatal visit, gestation were not associated with malaria infection ($p>0.05$). Additionally, no association was found between knowledge of malaria infection, insecticide-treated net use during pregnancy (ITN), sulfadoxine-pyrimethamine (IPT-sp) and indoor residual spray (IRS).

Table 4.3: Relationship between Malaria infection, sociodemographic characteristics, Obstetric and knowledge of pregnant women

Variables	Infection (n, %)	No infection (n, %)	Chi-square	p-value
			18.02	0.001
Age(completed Years)				
15-19	7(36.84%)	12(63.16%)		
20-24	8(17.39%)	38(82.6%1)		
25-29	7(8.75%)	73(91.25%)		
30-34	4(5.41%)	70(94.59%)		
≥35	4(9.30%)	39(90.70%)		
Marital Status			6.17	0.013
Single	12(20.00%)	48(80.00%)		
Married	18(8.57%)	192(91.43%)		
Education Level			5.77	0.124
No education	3(15.79%)	16(84.21%)		
Primary/JHS	19(15.32%)	105(84.68%)		
SHS/Vocational	5(5.62%)	84(94.38%)		
Tertiary	3(7.89%)	35(92.11%)		
Occupation			4.17	0.243
Farming	1(14.29%)	6(85.71%)		
Petty trading	15(8.38%)	164(91.62%)		
Civil Servant	5(15.15%)	28(84.85%)		
Unemployed	9(17.65%)	42(82.35%)		
Religion			0.04	0.837
Christian	27(11.25%)	213(88.75%)		
Muslim	3(10.00%)	27(90.00)		

Gravidity			7.77	0.021
Primigravidae	15(19.48%)	62(80.52%)		
Secundigravidae	5(6.76%)	69(93.24%)		
Multigravidae	10(8.40%)	109(91.60%)		
Number of ANC visit			0.49	0.783
First visit	12(10.43%)	103(89.57%)		
Second visit	4(9.09%)	40(90.91%)		
Three or more visit	14(12.61%)	97(87.39%)		
Gestation			2.86	0.239
First trimester	5(7.81%)	59(92.19%)		
Second trimester	9(9.00%)	91(91.00%)		
Third trimester	16(15.09%)	90(84.91%)		
Knowledge of malaria			0.04	0.835
Yes	7(11.86%)	52(88.14%)		
No	23(10.90%)	188(89.10%)		
Used ITN during Pregnancy			0.76	0.384
Yes	15(13.04%)	100(86.96%)		
No	15(9.68%)	140(90.32%)		
Used IPT-sp			0.01	0.931
Yes	15(11.28%)	118(88.72%)		
No	15(10.95%)	122(89.05%)		
Used IRS			0.90	0.343
Yes	12(9.23%)	118(90.77%)		
No	18(12.86%)	122(87.14%)		

4.4 Sociodemographic, Obstetric and knowledge factors associated with malaria prevalence using logistic regression analysis

The logistic regression figures shown in table 4.4 were used to assess the strength of association between malaria infection and independent variables. In the unadjusted model, participants in the age group (25-29) years have 84% reduced odds of getting malaria infection compared to those in age (15-19) years [OR=0.16 (95% CI=0.05, 0.55), p<0.05]. Participants in the age group (30-34) years have 90% reduced odds of having malaria infection compared to age (15-19) years [OR=0.10 (95% CI=0.02, 0.39), p<0.05]. Further pregnant women age greater or equal to 35 years have 85% reduced odds of developing malaria infection compared to those in the age group (15-19) years [OR=0.15 (95% CI=0.04, 0.58), p<0.05]. There was statistical significance between age and malaria infection under the crude regression method. This means that for any unit increase in age among participants in the age group aforementioned, result in reduced odds of malaria infection. Married women have lower odds of malaria infection during pregnancy compared to single women [OR=0.38 (95% CI=0.17, 0.83), p<0.05]. There was 62% reduced odds for married women to get malaria infection compared to single pregnant women. This was statistically significant with malaria infection. There was a statistical association between gravidity and malaria infection under the unadjusted model. Participants who had two pregnancies have 70% reduced odds to get malaria infection compared to primigravidae [OR=0.30(95%CI=0.10, 0.87), p<0.05]. Pregnant women who had more than two pregnancies have 62% reduced chance to develop malaria infection than women who were primigravidae [OR=0.38(95%CI=0.16, 0.89), p<0.05]. There was no statistical significance with the following independent variables in the unadjusted model. This includes educational level, occupation, religion, number of antenatal care

visit, gestation, and knowledge of malaria infection. Additionally, use of ITN, IPT-sp and IRS had no statistical association with malaria infection.

On the other hand, in this current study, there was no significant association between maternal age, marital status, occupation, education, and religion with malaria infection after controlling for confounding variables using the multivariate logistic regression model ($p \geq 0.05$). Other independent variables such as gravidity, number of ANC visit, gestation, knowledge, use of ITN, us of IPT-sp, and use of IRS were not significantly associated with malaria infection ($p > 0.05$).

Table 4.4: Sociodemographic factors associated with malaria in pregnancy using logistic regression models

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age				
15-19	reference			
20-24	0.36(0.11,1.20)	0.097	0.58(0.11,2.92)	0.505
25-29	0.16(0.05,0.55)	0.004	0.25(0.04,1.61)	0.144
30-34	0.10(0.02,0.39)	0.001	0.16(0.02,1.42)	0.100
≥35	0.15(0.04,0.58)	0.006	0.22(0.02,2.01)	0.179
Marital Status				
Single	reference			
Married	0.38(0.17,0.83)	0.016	0.87(0.26,2.90)	0.825
Educational level				
No education	reference			
Primary/JHS	0.97(0.26,3.64)	0.958	0.62(0.12,3.21)	0.572
SHS/Vocational	0.32(0.07,1.46)	0.141	0.12(0.02,0.90)	0.039
Tertiary	0.46(0.08,2.52)	0.369	0.08(0.01,1.25)	0.072
Occupation				
Farming	reference			
Petty trading	0.55(0.06,4.86)	0.590	0.43(0.04,4.59)	0.482
Civil/Public Servant	1.07(0.11,10.91)	0.954	2.78(0.17,45.99)	0.475
Unemployed	1.29(0.14,12.03)	0.826	0.64(0.05,7.94)	0.727
Religion				
Christian	reference			
Muslim	0.88(0.25,3.08)	0.837	0.86(0.18,4.04)	0.845
Gravidity				
Primigravide	reference			
Secundigravidae	0.30(0.10,0.87)	0.027	0.63(0.15,2.54)	0.511
Multigravidae	0.38(0.16,0.89)	0.027	0.82(0.18,3.69)	0.792
No of ANC visit				
First visit	reference			
Second visit	0.86(0.26,2.82)	0.801	0.40(0.09,1.77)	0.225
≥3 visit	1.24(0.55,2.81)	0.608	0.63(0.18,2.16)	0.461
Gestation				
First trimester	reference			
Second trimester	1.17(0.37,3.65)	0.791	1.41(0.40,5.11)	0.595
Third trimester	2.10(0.73,6.03)	0.169	3.99(0.93,17.13)	0.062
Knowledge of malaria prevention				
No	reference			
Yes	0.91(0.37,2.24)	0.835	1.54(0.51,4.70)	0.445

Used ITN during pregnancy				
No	reference			
Yes	0.71(0.33,1.53)		1.17(0.16,8.43)	0.877
Used IPT-sp				
No	reference			
Yes	0.97(0.45,2.07)	0.931	1.09(0.33,3.66)	0.883
Used IRS				
No	reference			
Yes	1.45(0.67,3.14)	0.345	2.45(0.88,6.83)	0.087

CHAPTER FIVE

DISCUSSION

5.1 Prevalence of Malaria

The study interviewed 270 pregnant women who attended the antenatal clinic during the study period. The overall prevalence was 11.1% among the respondents. This prevalence of malaria infection was lower and consistent with other studies found in sub-Saharan Africa where malaria is endemic and having high intense malaria infections and transmissions (Balami et al., 2018). A lower prevalence of malaria of 5% was reported in similar research conducted in Madina, Accra Ghana (Stephens et al., 2014). Another study found 10.9% in Luanda, Angola,(Cisse et al., 2014). However, other studies have shown the higher burden of malaria infection. In Nigeria, a higher prevalence of malaria was found among pregnant women 48.1%. In Gabon, the burden of malaria was 34.4% (Balami et al., 2018). In the Kasena Nankana district of Ghana, the overall prevalence of malaria parasitaemia among pregnant women was reported to be 47% (Clerk et al., 2009).

A similar study conducted at Dodowa District Ghana revealed a higher prevalence of malaria infection of 19.7% under microscopy, while in Kumasi Ghana, a lower prevalence of 12.6% was found (Kweku et al., 2017). These differences in malaria prevalence could be due to geographical locations and intensity of malaria transmission. The prevalence of malaria infection in this study could be attributed to the use of RDT which has low sensitivity compared to a polymerase chain reaction (PCR). One of the most widely used methods of malaria diagnosis is microscopy, which has the advantage of determining parasite density and species. Another factor that led to the low prevalence was the fact that 78.2% of the respondents have enough information about malaria infection and its prevention. A review of the prevalence of malaria infection during pregnancy in West Africa was 35.1% (95% CI: 28.2-41.9) done with microscopy which may be lower when

PCR was used (Takem & Alessandro, 2013). However, recent trends have shown that pregnant women who suffer malaria infection are decreasing in sub-Sahara Africa. Another plausible factor for the lower prevalence in this study could be explained by an association between education at the SHS/Vocational level and malaria infection. The odds of malaria infection was lower with higher education and this was statistically significant.

5.2 Sociodemographic factors

Educational level with respect to SHS/ Vocational had a statistical association with malaria infection in this study. Overall, participants who attained a higher level of education had lower odds of malaria infection compared to those with no education. This may be as a result that pregnant women who were educated may easily comprehend malaria information and thereby able to adopt and implement preventive methods of malaria control. This finding is also consistent with other studies in Uganda, Cameroun, and Nigeria, where it was found that knowledge and educational level were significantly associated with malaria infection. Participants who had a college education were 2.3 times more likely to be knowledgeable than those who had no education (Goshu & Yitayew, 2019). Another study found an association between educational level and IPT-sp utilization. Educated pregnant women were more likely to understand the effects of malaria in pregnancy and were more likely to receive the maximum doses of IPT-sp (Ibrahim1 et al., 2017). However, another study conducted in Lagos Nigeria revealed that educational level did not have a significant association with infection. This may be due to massive health campaigns on a regular basis on both print, TV and radio (Chimere et al.,2013). A similar study found no association between educational level and malaria infection at Ridge Hospital, Accra Ghana, where pregnant women received health

information on malaria during the antenatal visit. This has bridged the gap between educated pregnant women and women with no education as regards malaria prevention (Kiptoo, 2016).

In our current study, there was no significant association between gravidity and malaria infection under the adjusted model. However, women with multigravidae have lower chance of having malaria of 8.40% compared to primigravidae 19.48%. This is as a result of acquisition of immunity to malaria infection. In Burkina Faso, a study conducted revealed that primigravidae have increased risk of malaria infection compared to multigravidae. Similar findings were found in India which revealed a four times more increased risk of infection among pregnant women with their first and second pregnancies compared to those with their third pregnancies or more (OR=4.23; 95% CI: 2.15-8.42), (Balami et al., 2018). Other studies have confirmed this trend, where multigravidae women were less likely to have malaria infection compared to primigravidae (Clerk et al., 2009). Most studies have not adjusted parity for other covariates such as age for the simple fact that pregnancy is related to a reduction in immunity. In Mali, the number of pregnancies was statistically significant with the prevalence of malaria only in the unadjusted model. This finding is consistent with this study (Cisse et al., 2014).

A study done to determine ITN used during pregnancy and birth prematurity in Kenya, pregnant women who used ITN delivered 25% fewer premature babies than those who did not use ITN (Hile et al., 2013). Similarly, a study done at Korle-Bu Teaching hospital revealed low usage of ITN among pregnant women as low as 6.3% (Wilson et al., 2011) This may be partly due to the cost of ITN and lack of access (Wilson et al., 2011). Other barriers may include poor ventilation, size of ITN and husbands lack of encouragement and acceptability.

To reduce and prevent a malaria infection, the World health organization (WHO) recommends the use of three doses of IPT-sp. Findings in this study showed low coverage of IPT-sp among study participants. The study recorded 50.74% IPT-sp coverage which is even higher compared to the national average of 39% as reported by the Ghana Demographic and Health Survey in 2014 (Ibrahim1 et al., 2017). The utilization of IPT-sp in this study was lower than the 80% recommended by WHO and this is consistent with other studies in sub-Saharan Africa (Ao et al., 2017). There was no statistical association between IPT-sp and infection in this study. The finding in this study is analogous with other studies in sub-Saharan Africa. The study showed that 89.1% of participants who received IPT-sp were negative for malaria infection. Another study in Ghana has shown that IPT-sp had a statistically significant association with malaria infection where 15% of IPT-sp users were positive for malaria infection. This figure is much higher than the current study of 10.95%. The low coverage of IPT-sp is consistent with other studies in Ghana, and the reason may be related to late enrollment at ANC, and inadequate prenatal services in the communities. Since IPT-sp could reduce malaria infection, focused antenatal care services must be scaled up.

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5.3 Limitation

The use of RDT to detect positive malaria have low sensitivity and specificity compared to PCR. This may have resulted in a lower prevalence of malaria in this study. Another study in Burkina Faso showed that the burden of malaria infection using RDT was much lower than microscopy or PCR (Quartey, 2016). The comparison of malaria infection with different studies may not reflect the true picture. The nature of the study allowed for a single encounter with respondents and therefore could lead to respondent bias. Therefore

findings in this study cannot be generalized in the Ghanaian population. Since this is a cross-sectional study and causality cannot be assessed.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

Overall, the study found that the prevalence of malaria infection was low with 11.1%. This low prevalence could be attributed to the lack of association. It could also be due to the scaling-up of malaria interventions that has seen the level of knowledge, the use of ITN and IPT-sp increase tremendously in Ghana. These effective interventions have had a positive impact on malaria infection among pregnant women given that women had repeated contact with ANC until delivery.

6.2 Recommendation

This study underscored the need to scale up health promotion among pregnant women. It is therefore recommended that healthcare providers especially midwives should encourage women in their fertility age to seek early ANC service when they are pregnant. The district health directorate should continue to implement the World Health Organization (WHO) recommendations for malaria control.

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APPENDICES

Appendix I: Questionnaires

Factors associated with malaria in pregnancy among women attending antenatal clinic at Dodowa District Hospital

You have been selected to participate in this study by responding to this questionnaire. The information you provide for the purpose of this research will be treated with strict confidentiality. Kindly check he appropriate box that correspond to your response and write appropriately where a spaces have been provided.

Code number……. Date of interview……

Section A: Demographic characteristics of respondents

1. **Sampling location……..**
2. **Age of participant……. (completed years)**
3. **Marital status :**
   - 0) Single [ ]
   - 1) Married [ ]
   - 2) Divorced [ ]
   - 3) Separated [ ]
   - 4) Widowed [ ]
4. **Educational level:**
   - 0) No education [ ]
   - 1) Primary/JHS [ ]
   - 2) SHS/Vocational [ ]
   - 3) Tertiary [ ]

5. **Occupation:**

   0) Farming [ ]

   1) Petty trader [ ]

   2) Civil/Public Servant [ ]

   3) Unemployed [ ]

6. **Ethnicity:**

   0) Christianity [ ]

   1) Islam [ ]

   2) Traditional Religion [ ]

   Others (specify)……..

7. **Do you have Health Insurance?**

   0) No [ ]

   1) Yes [ ]

Section B: Risk factors for malaria in pregnancy

8. **Number of pregnancies ……**

9. **Have you attended ANC with this pregnancy?**

   0) No [ ]

   1) Yes [ ] Go to Q11, 12

10. **How many ANC visit during current pregnancy……**

11. **Which trimester did you attend first ANC visit:**

    0) Ist trimester (1-3 months) [ ]

    1) 2nd trimester (4-6 months) [ ]

    2) 3rd trimester (7-9 months) [ ]

12. **Haemoglobin level at 1st ANC visit**…… (g/dl)

13. **Haemoglobin level at 36 gestational weeks**…….(g/dl)

Section C: Knowledge of malaria among pregnant women

14. Have you heard about malaria in pregnancy?

0) No [ ]

1) Yes [ ]

15. How did you hear about malaria in pregnancy?

0) TV [ ]

1) Radio [ ]

2) Newspapers [ ]

3) Other (specify)……..

16. Do you own insecticide treated bed net

0) No [ ]

1) Yes [ ]

17. Did you sleep under insecticide treaded bed net last night?

0) No [ ]

1) Yes [ ]

18. Did you sleep under insecticide treated bed net during pregnancy?

0) No [ ]

1) Yes [ ]

19. Did you take IPT-SP during pregnancy?

0) No [ ]

1) Yes [ ]

20. Did you use indoor residual spray during pregnancy?

0) No [ ]

1) Yes [ ]

Section D: Prevalence of malaria in pregnancy

21. Have you been screened for malaria during ANC?

0) No [ ]

1) Yes [ ]

22. Were you positive for malaria after the screening/test?

0) No [ ]

1) Yes [ ]

2) Don't know/can't remember [ ]

23. Have you ever suffered from malaria during pregnancy?

0) No [ ] If No, Skip Q18 and Q19

1) Yes [ ]

24. **What did you do when you had malaria?**

……

……

25. When (trimester) did you suffer/get malaria?

0) 1st trimester [ ]

1) 2nd trimester [ ]

2) 3rd trimester [ ]

26. Which season did you get the malaria?

0) Dry season [ ]

1) Wet/rainy season [ ]

27. Malaria RDT result

0) Negative [ ]

1) Positive [ ]

Appendix II: Consent Form

STUDY TITLE: FACTORS ASSOCIATED WITH MALARIA IN PREGNANCY AMONG ATTENDING ANTENATAL CLINIC AT DODOWA DISTRICT HOSPITAL IN THE GREATER ACCRA REGION OF GHANA

Participants' statement

I acknowledge that I have read or have had the purpose and contents of the Participants' information sheet and satisfactorily explained to me in a language I understand English ☐ Twi ☐ Ga ☐. I fully understand the contents and any potential implications as well as my right to change my mind (ie withdraw from the research) even after I have signed this form. I voluntarily agree to be part of this research.

Name or Initials of Participant ……ID Code

Participants' Signature ……OR Thumb Print……..

Date…….

Interpreters' Statement

I interpreted the purpose and contents of the Participants' Information Sheet to the afore named participant to the best of my ability in the Twi ☐ Ga ☐ language to her proper understanding. All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to her satisfaction

Name of Interpreter……Signature…… Date…….

Contact Details

Witness statement

I was present when the purpose and contents of the Participants' Information Sheet was read and explained satisfactorily to the participant in the language she understood

English ☐

Twi ☐

Ga ☐

I confirm that she was given the opportunity to ask questions/seek clarifications and same were duly answered to her satisfaction before voluntarily agreeing to be part of the research.

Name.....

Signature……..OR Thumb Print……. Date……

Investigator Statement and Signature

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed

Researcher's Name……..

Signature……..Date

Appendix iii: Introuctory Letters

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

My Ref. No. **GHS/GARHD/007/19**

Your Ref. No.

GHANA HEALTH SERVICE
REGIONAL HEALTH DIRECTORATE
GREATER ACCRA
P. O. BOX 184
ACCRA

Tel: +233-0302-234225/226263

E-mail:c_braks@yahoo.com

4th June, 2019

THE DISTRICT DIRECTOR OF HEALTH SERVICES
SHAI OSUDOKU DISTRICT HEALTH DIRECTORATE
DODOWA

RE: PERMISSION TO CONDUCT RESEARCH AT DODOWA DISTRICT HOSPITAL
OFFEI BENJAMIN

This is to introduce to you **Offei Benjamin** a student from the School of Public Health, University of Ghana, Legon who has approval from the Regional Health Directorate to conduct a research for his academic work on the topic: ***"Factors Associated with Malaria in Pregnancy among Women Attending Antenatal Clinic at Dodowa District Hospital"*** in your District/Facility as per attached.

You are kindly entreated to provide the needed assistance.

Thank you.

DR. (MRS.) CHARITY SARPONG
REGIONAL DIRECTOR OF HEALTH SERVICES
GREATER ACCRA

C/o University of Ghana
School of Public Health
P.O. Box LG13
Legon –Accra

31st May, 2019

ACCRA REGION
RECEIVED
04 JUN 2019
Reg. Dir

The Regional Director
Ghana Health Service
Greater Accra.

Dear Sir,

PERMISSION TO CONDUCT RESEARCH AT DODOWA DISTRICT HOSPITAL

I, **Offei Benjamin** a student of the University of Ghana, School of Public Health with ID (**10702617**) wishes to carry out a research at your facility with the title **Factors associated with malaria in pregnancy among women attending antenatal clinic at Dodowa District Hospital**

The research will be conducted from June-July 2019 and the target group will be pregnant women attending the antenatal clinic. I would adhere strictly to your protocols in conducting research and the ethics review policies.

I have secured approval from the Ghana Health Service Ethics Review Committee with approval number **GHS-ERC 017/03/19 which expires on 24th April, 2020**

I would be happy if my letter is given the necessary consideration in this regard.

Yours faithfully

OFFEI BENJAMIN

Appendix iv: Ethical Clearance

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

My Ref. SODIAU/033
Your Ref. No.

GHANA HEALTH SERVICE
Your Health - Our Concern

Shai-Osudoku District Health Dir.
Ghana Health Service
P. O. Box DDI
Dodowa.
Ghana.

Tel: 0244668487
E-mail:easiamah@yahoo.com

7th June, 2019

THE MEDICAL SUPERINTENDENT
SHAI-OSUDOKU DISTRICT HOSPITAL
DODOWA

Dear Sir/Madam,

RE: PERMISSION TO CONDUCT RESEARCH AT DODOWA DISTRICT HOSPITAL

This is to introduce to you the under-mentioned student from the School of Public Health, University of Ghana - Legon.

He has been granted approval to undertake his research work in your facility. The research topic is: **"Factors Associated with Malaria in Pregnancy among Women Attending Antenatal Clinic at Dodowa District Hospital".**

- Mr. Offei Benjamin

I would be grateful if you would give him the necessary support and assistance. Attached are letters from the School and Regional Health Directorate.

Thank you.

Yours faithfully,

REV. EBENEZER ASIAMAH
DISTRICT DIRECTOR OF HEALTH SERVICES
SHAI-OSUDOKU

SHAI-OSUDOKU DIST. HOSPITAL
RECEIVED
Date: 10/06/19
P.O. BOX DD 1, DODOWA

Attention: ICU / Research

DR. KENNEDY BRIGHTSON
MEDICAL SUPERINTENDENT
10 JUN 2019
SHAI - OSUDOKU DIST. HOSP.
DODOWA

Our Core Values: Professionalism, Teamwork, Innovation and Excellence, Discipline, Integrity and People Centeredness