Addis Ababa University

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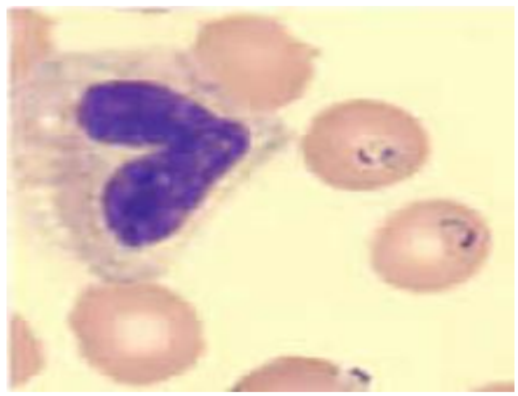
Five Years Prevalance of Malaria in Jardga Jarte Woreda ,Horoguduru Wollega Zone North West Ethiopia.



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LIST OFACRONYMSAND ABBREVATION

MOP:	Malaria Operation Plan.
AGP:	Agricultural Growth Program
DDT:	Dichloride Diphenyl Trichloro Ethane
NSP:	National Strategic Plans
PCR:	Polymerase Chain Reaction
PGLUDH:	Plasmodium Glutamate Dehydrogenises
PLD:	Plasmodium *L*actate Dehydrogenize
RBC:	Red Blood Cell
RBM:	Roll Back Malaria.
RDT:	Rapid Diagnostic Tests
SPSS:	Statically Package for Social Science
J\J:	JardegaJarte
CSA:	Central Statistical Agency
SSA:	Sub-Saharan Africa
CDC:	Centers of Disease Control and Prevention
IFA:	Immune Fluorescence Artemether
IRS:	Indoor Residual Spraying
LLINS :	Long Lasting Insecticidal Nets
MIS:	Malaria Indicator Survey
IPT:	Intermittent Preventive Treatment in Pregnancy
WHO:	World Health Organization
ACTs:	Artemisinin Based Combination Therapy
MOH:	Ministry of Health

PMI:	President Malaria Initiative
ELISA:	Enzyme Linked Immunosorbent
FMOH:	Federal Ministry of Health
USA:	Unit State of America

ABSTRACT

Malaria is one of the most devastating diseases in the world. However, malaria incidence is reduced by 37% globally and by 42% in Africa between 2000 and 2015. Malaria is one of the most important diseases in the world and caused by a protozoan parasite of genus Plasmodium. It mostly affects sub-saharan African countries (90%) including Ethiopia. It was estimated that about 75% of the land and 68% of the population is exposed to malaria in Ethiopia. Although the severity of the problem at the regional and national level in the country is well know, there is limited information about the disease in Jardega Jarete. To that end a retrospective study was undertaken in the area based on five years secondary data collected from Jardega Jarete Health Centers and Shambu Metrological Station from 2015-2019 year. The objective of this study was to assess the prevalence of malaria from secondary data in Jardga Jarete woreda, Horo Gudrun Wollega Zone, North West Ethiopia. A health centered based retrospective study design was used. According to the information obtained from health professional, fingerpick blood samples were collected from malaria suspected patients visited in Jardega Jarete health center woreda from 2015 up to 2019 year used to determine the prevalence of malaria. In this study a total of 25,868 blood samples were submitted for malaria diagnosis for the five last years (2015 -2019) in three health centers Jardega-Jarte District. From these 15,361 (60 %) were males and 10,507 (40%) were females. From the blood film samples 4,336 (16.7%) were microscopically confirmed as malaria cases. The data was analyzed and presented using Tables and figures. The chi-squared test was used to determine difference between years, season (months), age and sexes as well malaria parasite distribution. The pattern of infection indicated that the disease affected largely productive age groups of 16-45 years (d f =5, X^2*=33.25, P<0.001) with age group. The data shows Plasmodium falciparum was being the predominant parasite 2,561 (59.2%), followed by Plasmodium vivax 1,434 (33%) whereas the mixed infection was 341 (7.8%) in study area. The high peak of malaria infection was observed during spring (September– November) with prevalence of 25.8% followed by summer season (June – August) and autumn (March – May) with prevalence of 25.3% and 24.6% respectively.*

Key words: Jardga jarete, Plasmodium, data, malaria prevalence.

1. INTRODUCTION

1.1. Background

Malaria is one of the most devastating diseases worldwide and caused by infections of the *plasmodium* parasite. Malaria is an infectious disease caused by the protozoan parasite known as *plasmodium* and transmitted by anopheles mosquitoes, mainly by *Aides aegypti. The* distribution is mostly in tropics and sub tropics such as Africa (South east Africa), Latin America (WHO, 2012). Human malaria is caused by the genus *plasmodium* namely *P. falciparum, P. vivax, and P.ovalae* and *P. malaria*. In addition some reports showed as humans naturally infected with the simian parasites *P. simiovale* and *P. Knowles* (WHO, 2013).

Malaria is a huge public health problem in terms of morbidity and burden on health worldwide with 300 up to500 million cases and about one million deaths to 90% of which were reported from sub Sahara African countries. It is the fourth leading, cause of death of children under the age of five years in developing countries (Legesse *et al.,* 2007). However, malaria incidence is reduced by 37% globally and by 42% in Africa between 2000 and 2015. It is estimated that there were 214 million clinical cases and 438,000 deaths in 2015 due to malaria 90% of which were reported from sub Saharan African countries (WHO, 2015). A recent estimate in 2010 showed that 4 billion people were at risk to malaria infection in the different parts of the world by the two main causative agents namely: *P. falciparum* and *P. vivax* (Gething *et al.*, 2011).The highest level of *P. falciparum* transmission occurred in Africa which contribute to 99% globally and 95% in African. . According to 2018 World Health Organization (WHO) report about 3. 2 billion people remains at risk of malaria and approximately there were 216 million new cases of malaria and 445, 000 malaria death worldwide, African regions accounting for 91% of the death, 6% of death was South East Asia region and 1. 8% of death occurred in the Eastern Mediterranean Region (range 236,000–635,000). I t is still one of the major public health and medical concerns in many parts of the world. The most of malaria cases and deaths caused by *P. falciparum* and *P. vivax* while *P.falciparum* mostly predominates in Africa, *P. vivax* causes are distributed more frequently in Asia Latin American and some areas of Africa (Darymple *et al.,* 2015). Malaria is one of the major obstacles to socio economic development in Ethiopia as the main transmission periods coincide with peak agricultural harvesting periods. Globally several strategic plan initiated to eradicate, control and it had been to low level malaria (WHO, 2011), by focusing on 1st.The elimination of mosquito vectors, 2nd.A development of drug to poison the parasites once they have entered the human body, 3rd.Development of vaccine. The wide scale applications of DDT from 1940s to the 1960s lead to the elimination of the mosquito vectors, but rendered impossible by the development of DDT-resistant strains of malaria carrying mosquitoes in many regions. The burden of malaria also declined significantly in Ethiopia in the last decade, which could be the result of improved coverage of high impact control interventions such as use of vector control methods including indoor Long lasting insecticidal nets (LLINs) and indoor residual spraying of insecticide (IRS),prevention and control of malaria among pregnant using intermittent preventive treatment(IPTP),prompt treatment of cases using artemisinin based combination therapy (ACT), environmental management and health education new opportunity for large scale malaria control(Abeku *et al*., 2015).

Malaria is an entirely preventable and treatable disease, if the currently recommended interventions are properly implemented. According to the Roll Back Malaria (RBM) partnership was launched in 1998,if declared for the developing countries, by the UN with the goal to reduce the burden of malaria by half up to 2010 and halving again by 2015 (Sean, 2015). Combating malaria was among the eight millennium development goals. Early diagnosis and effective treatment, vector control, easy and universal accessibility to bed nets, residual periodic spray of dwelling, environmental management and continued efforts in epidemic prevention control strategies that are currently being implemented in most malaria endemic areas (sheleme. 2007) .

According to the world health Assembly (2011),Roll Back malaria partnership, set an objectives:- to reduce malaria case(75%) and malaria deaths to near zero from 200 levels by 2015.This objectives were linked to targets of achieving universal access to case management and utilization of malaria prevention measure(WHO,2012). Progress reports there after showed globally, malaria case decreased from 227 million in 2000 to198 million in 2013 (WHO, 2014) .The incidence was projected to fall by 35% globally and by 40% in African region by 2015 .The proportion of population, vector control in Sub Saharan Africa has increased in recent years, and reached 48% in 2013, and the number scaled up in 2014.Malaria incidence fell by 21% and mortality by 31% in Africa region between 2010-2015 (WHO, 2016).

The epidemiology Malaria in Ethiopia is generally lower than in other sub-Sahara Africa countries. It is estimated that about 75% of the population lives in malarias areas and population (>54million) were exposed to malarial approximately 68% of the country's land mass is suitable to malaria transmission of the infection (MOH, 2007). However, in Ethiopia malaria remains a major health problem .*P. Falciparum* and *p. vivax* are distributed throughout the endemic regions of the country that account for 60% and 40% of malaria cases respectively (WHO. 2017).

Meteorological factors have been considered as importance driver of malaria transmission by changes in temperature, rain fall, and relative humidity due to climate change are expected to influence malaria directly by modifying the behavior and geographical distribution of malaria vectors and by changing the length of the life cycle of the parasite (Alelign and Dejene, 2016).

Malaria infection incriminated with climate and low altitude that determine the survival of the mosquito vector, based on (WHO, 2008) report. The combination of tools and methods to combat malaria now that low level of education and poverty, lack of effective ant malarial drugs and long lasting insecticide treated bed nets aggravate the chance of the spread of the disease (Tilahun *et al*., 2009). Accordingly, malaria becomes the number one health problem in the country with average of 5 million cases per year and contributing to 70,000 deaths each year and 17% of the outpatient visits (WHO, 2010). Therefore, prevention and malaria treatment seeking behavior and their participation to practical activities to mosquito vector control have been unsatisfactory (Tilaye, 2005 and Henok *et al*., 2015).

Malaria is seasonal in most parts of Ethiopia and its transmission picks biannually from September to December and June to august(major) from April to May (minor) coinciding with the major harvesting seasons. Due to the difference in altitude and rainfall, the country has a varied pattern of malaria transmission with transmission season ranging from less than 3 months to more than 6 months (MOH, 2010).The prevalence of the disease is variable influenced by the large diversity in altitude and rainfall with a long time varying from a few weeks before the beginning of the rain season to more than a month after the end of the rainy seasons (Aynalem, 2008).

The Global malaria action plan aim to cut deaths and illness by 2010 to half their 2000 levels by scaling up access to INTs ,IRS and treatment achieve the near zero goals through sustained universal coverage (WHO,2008). The main components of malaria control strategic plan has projected goals to achieve malaria elimination in areas with historically low malaria transmission and near zero malaria deaths in all the remaining parts of the country by2015. To improving diagnosis of malaria cases using microscopy or using multi species rapid diagnostic test (RDT) and providing prompt and effect malaria case management at all health facilities (MOH, 2010). The national strategic plan for malaria control and prevention in Ethiopia (2011- 2015), aimed at strengthening and scale up of malaria control interventions though prompt and effective diagnosis and treatment, case management though rolls out of the highly efficacious anti-malarial drugs (MOH, 2010).

Based on World Health Organization report 2017, Ethiopia accounts 6% of malaria cases globally. In 2014 a total of 2, 118, 815 malaria confirmed cases and 213 malaria deaths, in 2016 a total of 1, 962, 996 malaria confirmed cases and 510 malaria deaths were documented in the country (WHO, 2017). Ministry of Health annual performance report indicated that from September 2014 to August 2015 a total of 2, 174, 707 malaria confirmed cases and 662 malaria deaths were reported in the country (www.moh,gov.et). Malaria remains a major public health problem in Oromia regional State. Several researches indicated that it was one of the malaria prone regions in the country where 75% of the administrated woreda and 64% of the kebeles are malaria’s (MOH, 2010). Accordingly, 17 million people were at risk with annual clinical cases of 1.5-2 million people in the Region. This accounts for 20-35% of outpatient visits, 16% of hospital admissions, and 18-30% of annual death.

Jardega jarete is one the largest woreda in Horo Gudrun Wollega Zone in the oromia regional state with conditions such as low altitude, hot weather, and high humidity that are conducive for both vector and parasite development (Jardega Jarete Woreda Health center Alibo, 2015).This study was intended to estimate the prevalence of malaria over five years period (2015-2019) from Jardega Jarete Woreda Health Center.

1.2. Statement of problem

In Ethiopia malaria remains one of the major public health problems despite considerable effort made to control it. Currently, it is one of the major tropical diseases adversely affecting the health of the people and particularly in sub-Saharan Africa (Deresse *et al*., 2004). In Ethiopia malaria remains the leading communicable disease seen at health facilities and Jardga jarete was one woreda in which population where vulnerable to malaria disease. The stakeholders including international bodies, private sector, religious and community based organization have supported a number of malaria programs towards fighting the spread of the disease leading public health problem in the country (Deresse *et al*., 2007).

National strategic plan for malaria control and prevention that done in line with the recommendation of WHO, they were frequently attached by such communicable disease. The country economy was based on agriculture and peak malaria transmission coincides with the major planting and harvesting season this has placed a heavy socio economic burden on the society.

Those targets to minimize and interrupt the burden of the disease long lasting insecticidal nets (LLINs),indoor residual spraying(IRS),prompt treatment of case using artemisinin based combination therapy (ACT),environmental control through community participation and health education are the malaria control measures that have been implemented in Jardga jarete district. However there is no published information concerning the trend of malaria in the study area. Thus a retrospective study design was employed to collect malaria epidemiological data from district health services by reviewing blood film malaria reports at health center (Dandy, Harolago and Akeyu)..

1.3. Objectives of the study

1.3.1. General objective

The main objective of this study was to assess the prevalence of malaria infection among patients attending three health centers (Dandy, Hero lago andAkeyu) in Jardga jarete woreda from secondary data 2015-2019 years.

1.3.2. Specific objectives

- ✓ To assess five years of malaria prevalence in Dandy, Haro lago and Akeyu health center of Jardega jarete district.
- ✓ To determine if infection to dependent in gender and age of people from 2015-2019 in study area.
- ✓ To identify the predominant species of *plasmodium* from 2015-2019 in the study area.
- ✓ To determine monthly, yearly and seasonal change of malaria in the past five years in the study area.

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2. LITERATURE REVIEW

2.1. Malaria

2.1.*1 Plasmodium* parasite

Malaria is a vector borne disease most widely spread in the tropical and sub tropical areas of the world, on the globe it extends up to 60^o north and 40^o south of latitudes. Its distribution in the world is not uniform (Taylor *et al*., 1997). Malaria is a preventable and curable disease caused by protozoan parasite and transmitted through the bites of female anopheles mosquitoes (Silver, 2008, Scathe and Tingare, 2010, Choumet, 2012). The malaria vector to produce eggs the female mosquitoes are need of blood meals and it is therefore only the female mosquito that bites (Igweh, 2012). Life cycle of malaria parasite include both the Anopheles mosquito and human host (Overdue and Nriagu, 2011).

There are five different plasmodium species are known to cause infection in humans. These are *P. falciparum, P. vivax, P. oval* and *P. malaria*, and occasionally humans can be affected by *P. Knowles*: which commonly affect the wild animals such as monkey, *P. Knowles* is zootomic being transmitted from macaque monkey to humans by the vector belongs to leucosphyrus group of Anopheles mosquitoes (Vythilingam *et al*., 2018). Not only does each type of parasite affect its human differently, but each malaria parasite resides in a different geo- geographic region and is found in different countries

P. vivax is widely distributed in Asia and South America because it can develop in most mosquitoes at lower temperature, and is the cause of the most prevalent form of malaria. Sometime referred to as benign malaria, the cycle of paroxysm occur every 3days, and the patients generally survive even without treatment. About 43% of malaria in the world is caused by *P vivax* and the merozoite invades only young erythrocytes, the reticulocytes are unable to mature in red blood cells. Merozoites can only penetrate erythrocyte with mediated receptors known as Duffy blood groups, two co dominant alleles $^{\text{FY a and FY b}}$ (Tortora, 2010).

P. falciparum is the most deadly species found throughout Africa with unique crescent shaped gametocyte and commonly found in Asia and South America. The most dangerous malaria is the one caused by *P. falciparum* and is referred as malignant or sub tertian malaria it accounts for about 50% of all malaria cases and true relapses do not occur. It is recrudescence of the disease may follow remissions of up to a year. The Merozoite of *P. falciparum* can invade erythrocytes of any age more red blood cell are infected than other forms of malaria, and accounts to highest mortality rates in young children (Tortora, 2010).

P. malariae generally develops into mild clinical cases with lower prevalence than *P. falciparum,* and *P. vivax* found in South America, Asia and Africa. Also relatively causes quart and malariae with paroxysms every 72hrs .The ring forms are less amoeboid than those of *P. vivax*, and the cytoplasm is somewhat thicker. *P. malaria* is only species of human malaria that is regularly found in wild animals and can only invade aging erythrocytes.

P.ovale is the second most common species in Africa (after *P. falciparum*). It is biologically and morphologically similar to *P. vivax*. This species cause oval or mild infection and is rarest of four malaria parasites of humans. *P. ovale* is difficult to diagnose because of its similarity to *P. vivax* and 8 Merozoite are usually formed but there is range of 4 to 16. The variation of malaria epidemiology is not limited by continents or between countries. There is also variation in the distribution of plasmodium in the single country.

2.1.2. Vectors.

Malaria is transmitted through the bite of infected female mosquitoes of the genus *Anopheles*. When an appropriate infected mosquito species bites the plasmodia (sporozoans stages) of the genus *plasmodium* are spread to person by mosquitoes of the genus *Anopheles* at least 65 different species of this genus involved. In world, there are over 537 species of *anopheles* most (78%) of which have been formally named (HerbachRE, 2013) .Among these 70 species can transmit human malaria parasites and 41 are dominated vectors globally. In Africa there are over 140 *anopheles* species of which at least eight are effectively vectors of malaria (Choumet, 2012). The *Anopheles* mosquito, which transmits the malaria parasite from one human being to another, thrives in warm, humid climates where pools of water provide perfect breeding grounds. It proliferates in conditions where awareness is low and where health care systems are weak (UNICEF, 2000).

Figure.1.Anopheles mosquito (WHO, 2012)

Figure 1 indicate Anopheles mosquito which can transmitted the malaria parasites .The 3 most dominant vector in the continent are *Anopheles gambiae* and *Anopheles arebiensis*(in the *Anopheles gambiae* complex) and *Anopheles funestus. Anopheles gambiae* complex contains the most wide spread species in the sub Saharan Africa (Harbach, 2013). Malaria vector requires water to complete its life cycle egg, larva, pupa and the adult. While between 200-1000 eggs can be laid, the quantity is influenced by the amount of blood taken in. Blood-feeding usually starts at dusk and continues until dawn (Aynalem, 2008).

2.2. Malaria in the World

Malaria is prime concern of 109 countries, but 35 countries account for 98% of malaria deaths worldwide. Only five of these countries (Nigeria, Democratic Republic of Congo, Uganda, Ethiopia and Tanzania) represent 50% of deaths and 47% of malaria cases (Khaireh *et al*., 2012).In areas with high substantial reduction in malaria transmission has been achieved globally, particularly in endemic countries between 2000 and 2012 (Anoor, *et al.*, 2014).

Malaria is an infectious disease of man and animals. In Africa region continues to bear 90% of malaria cases and 91% of malaria deaths worldwide between 2000 and 2015. Malaria incidence rates (new malaria cases) fell by 37% globally and by 42% in Africa during this same period ,malaria mortality rates fell by 60% globally and by 66% in the Africa Region (WHO ,2015).

Over this period the malaria mortality rate was reduced by 42% in all age groups and by 48% in children fewer than five years of age. Approximately 3.3 million deaths were prevented between 2001 and 2012, of which 91% were children under five years of age in Africa. The reduction was mainly associated with scaled up support by international donors, socio economic developments, the deployment of a artemisinin based combination treatment, wider courage of long lasting insecticidal nets (LLISNS) and indoor residual spraying in malarias areas (WHO, 2013). Declining health services and increasing poverty in parts of Africa and South Asia are also playing an important part in malaria's comeback. The improvements in the malaria were largely due to the development of the health services and socio- economic development taking place at the same time. The more people are aware of the risks of malaria and can afford to be treated promptly and take necessary personal protection measures, the less malaria is able to spread (UNICEF, 2000).

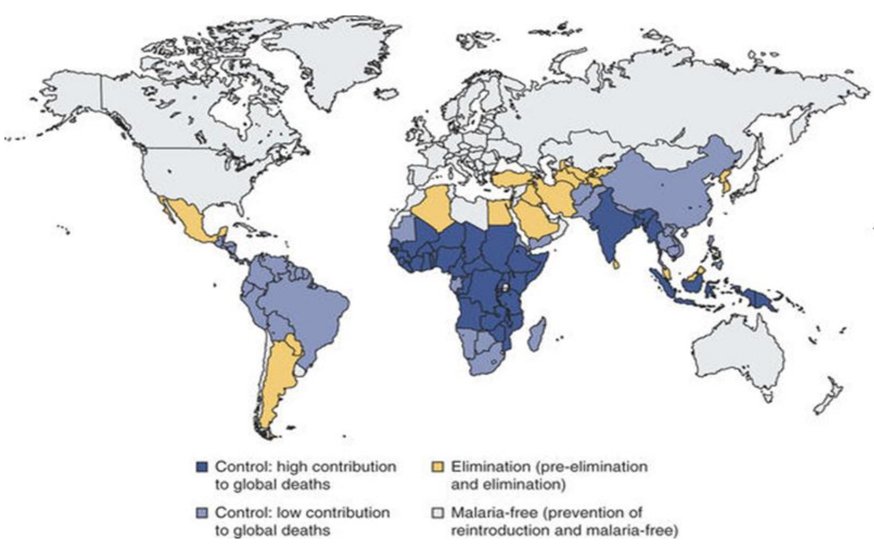

Figure 2 distribution of malaria in the world (WHO, 2015)

According to world health organization malaria report, an estimated 3.4 billion people are at risk of malaria and it was estimated that 207 million cases of malaria occurred globally in 2012

(WHO, 20I3). The number of under five malaria deaths has declined from 440, 000 in 2010 to 285,000 in 2016. However, malaria remains a major killer of children under five years old, taking the life of a child every two minutes (WHO, 2018).

2.3. Malaria disease burden in Africa.

The number of people at risk of malaria in parts of Africa south of the Sahara region grew to over 74% (about 600 million) at the end of the 20^{th} century (Dress *et al*., 2006). The study done about trend of malaria in Rwanda show that declines in malaria indictors in children less than 5 years during 2007-2010 were more striking than in the older age group. It is one of the major disease of poor people in developing countries and the leading cause of available death especially in children and pregnant women. Sub Saharan Africa carries the bulk of the global malaria burden, with 71% of cases and 86% of global deaths. A person in Africa dies of malaria every10 seconds (Tortora, 2010). African regions continue to shoulder the heaviest malaria burden (WHO, 2015). Women and young children are most at risk affects five times as many people as AIDS, leprosy, measles and tuberculosis combined. According to Nigeria National malaria control program in (2012) stated Nigeria alone accounts for the quarter of the malaria Burden in Africa malaria accounts for an estimated 66% of all health facilities attendance and is responsible for 30% of deaths among the children and 11% of maternal mortality in Nigeria .To the fact that this was initially the main target group for ITN distribution (Karma *et al*., 2012).

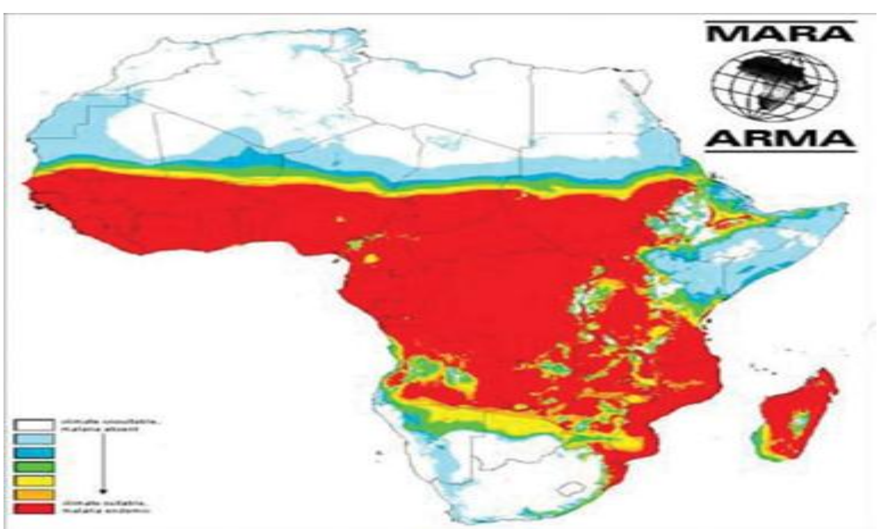

Figure. 3. The distribution of malaria in Africa (WHO, 2013)

In a district in central Kenya, the coverage with ITNs in the area is estimated to be 65% substantially higher than the reported on the coast and 35% of households reported use of the some mosquito reduction method such as environmental management or repellents (Wendy, *et al*., 2010).Malaria accounts up to 60% of all health facility visits in the eastern African region. The World Health Organization and the World Bank rank malaria as the largest single component of the disease burden in Africa, causing an annual loss of 35 million future life-years from disability and premature mortality. In Africa, malaria is responsible for about 20-30% of hospital admissions and about 30-50% of outpatient consultations (WHO, 2012).

2.4. Malaria in Ethiopia

2.4. 1 Trends of malaria prevalence in Ethiopia

Malaria is one of Ethiopia's for most health problems. Bimodal type of malaria transmission major September to December, following the main rainy season from June to august and minor, April to may, follow a short rainy season from February to March. Focal out breaks are common and the distribution varies from place to place depending on climate and altitude (Deresse *et al*.,2004).Malaria in Ethiopia is characterized by wide spread epidemics occurring every five to eight years with most recent epidemic occurring 2003/2004 (FMOH. ,2004) .In 2014 /2015 ,the total number of laboratory confirmed plus clinical malaria cause were 2,174 ,707 ,of those causes 1,867 ,059 (85.9%) were confirmed by either microscopy or rapid diagnostic tests (RDT) out of which 1,188,627 (63.7 %) *were P .falciparum* and 678 ,132 (36.3 *%) P.vivax* (MOH, 2015).

Ethiopia, the second most populous country in Africa, about 75% of the country's landmass is malicious approximately 68% (>54 million people) of the total population at risk of malaria. Areas which are less than 2, 000 meters of altitude above sea level are considered to be malicious infections (Breanne Hailseasssie and Ahmed Ali, 2008). The 2011 -2015 NSP will focus on sustained control and moving towards malaria elimination through an integrated community health approach especially in areas of un stable malaria transmission building on SUFI achieved by the 2005 -2010 strategically plan (FMO,2011). In 2002/03 the disease has been reported as the first cause of morbidity and mortality accounting for 15.5% outpatient consultations, 20.4% admission and 27% deaths (FMOH, 2007). The distribution and transmission of malaria in Ethiopia varies from place to place. Ethiopia can in regard to malaria, be divided into four epidemiological strata. The first stratum is the highland areas above 2500 meter which are considered to be free of malaria. Highland fringe areas between 1500-2500 meters constitute the second strata and are frequently affected by the disease. The third and the fourth strata consists of lowland areas below 1500 meters where the malaria transmission is either seasonal or occurs all year round (WHO, 2014).

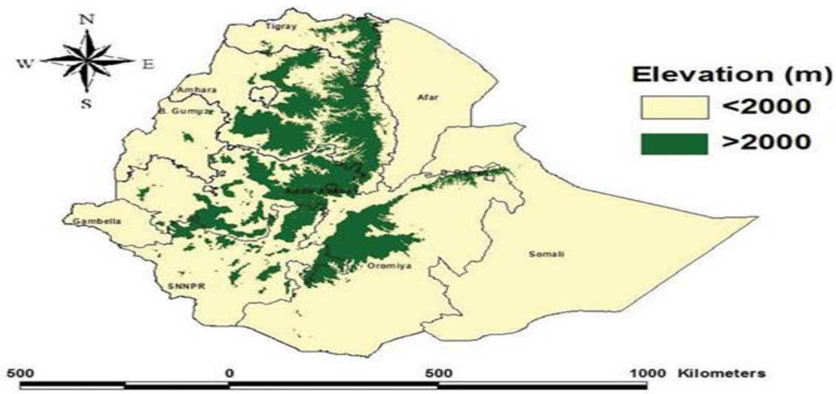

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Figure 4 Malaria distributions in Ethiopia (MOH, 2010).

Areas which are less than 2,000meters of altitude above sea level are considered to be malarias. Indeed the government of Ethiopia started taking measures through the health service extension program to improve the preventations and treatment of malaria distributing. Artemether lumefantrine, chloroquine and quinine free of charge either after diagnosis using a rapid diagnostic test (RDT) or through clinical diagnosis by health extension workers at health posts (Yewhalaw *et al.*, 2010). Transmission is limited by the lack of water collections for mosquitoes breeding a low humidity due to low rainfall and sparse vegetation.

Mean annual precipitation, in general, ranges from 800 to 2,200mm in the highlands (>1,500m) to less than 200 to 800mm in the lowlands (<1,500m). Rainfall decreases northwards and eastwards from the high rainfall pocket area in the southwest, and seasonality is not uniform (Tedros, Adhanom, 2010).The study conducted by Geshere *et al* (2014) stated that despite the apparent fluctuation of malaria trends in the study districts malaria causes occurred in almost every month and season of the year in Ilu Galan and Bako Tibe, but it fluctuate in Danno district ,However, the malaria Prevalence decline and remain almost the same throughout 2011 and 2012 in Ilu Galan .The same trends were observed in both Bako Tibe and Danno districts.

Although the malaria infection rates vary among the gender year to year the overall record review in the past five years in the districts showed that males were more affected than females in Dogoro (87.16 %) and Fincha (90.13%) but in Bako females were more affected than males (51.50 %). Risk of malaria is highest in the western lowlands of Oromia, Amhara, Tigray and almost the entire regions of Gambella and Benishangul Gumuz regions. In the eastern lowlands of Ethiopia (Primarily Afar and Somalia), malaria is endemic only along rivers, as this part of the country is largely dry away from rivers.

Malaria transmission in Ethiopia tends to be highly heterogeneous geo-spatially within each year as well as between years, long transmission season occurs relatively in the western low land areas, basin, river, valley and irrigation schemes. Due to the unstable and seasonal pattern of malaria transmission in Ethiopia, the population protective immunity is generally low as a result all age groups are at risk of infection and disease and Ethiopia is shared the highest burden of malaria infections in all ages in the East African region (WHO, 2015). The most vulnerable to malaria case are observed in children under five and pregnant women (MOH, 2014).

2.5. Malaria and climate

Global climatic change is a major contributing factor in the recent increase and propagation of malaria in many parts of the world, including Ethiopia .In Ethiopia, both altitude and climate determine endemicity of the disease. Thus, malaria is varying from place to place and from time to time due to high variability of climate and change is very vital for the ultimate malaria elimination (Barbara, 2014).The most significant determinant of the intensity of the parasite transmission is climate. The development of both the vectors and the parasite is temperature dependent. The optimum temperature range for parasite development in the female Anopheles mosquito (sporogony) is between 25^{o}c $_{and}$ 30^{o}c, and development cease below16^{o}c. Intermittent low temperatures delay sporogony, and the period immediately after the infective bite by the mosquito on an infected human host is the most sensitive to drops in temperature. Above 35^{o} C sporogony slows down considerably. Extremely high temperatures are associated with the development of smaller and less fecund adult mosquitoes .Thermal death of mosquito occurs at 40^{o}C to 42^{o}C. Altitude and temperature are strongly correlated with every 100 meter increase in altitude the temperature drops by 0.5^{0} C (Reiter, 2001).

The climatic factors frequently considered are temperature, rain fall, precipitation and humidity (*Ebi et al*., 2005).The study found that high temperature decreases daily survival probability of mosquito abundance, and the fraction of infected mosquitoes that survives an extrinsic incubation period Therefore, rainfall provides breeding sites for mosquitoes to lay their eggs, and ensures a suitable relative humidity of at least 50 to 60% to prolong mosquito survival (Reiter, 2001).

The epidemiological pattern of malaria transmission is generally unstable and seasonal, the level of transmission varying from place to place because of differences in altitude and rainfall patterns (MOH, 2013). The normal duration of the intense malaria transmission season is about 9 months beginning in April-May and lasting November (MOH, 2013). Changes have been observed in the epidemiology of malaria through time. Previously, malaria was known to occur in areas below 2000 m but currently it has been documented to occur even in areas above 2400 m, such as Addis Ababa and Akaki (MOH, 2004). A high malaria incidence climate season from august to november, a moderate malaria incidence climate season from april to july, and a low malaria incidence climate season from december to march. The malaria prevalence was observed declined in spring season and become relatively high at early summer season in recent years(2011 and 2012) and the resin Ilu Galan ,Bako Tibet ,Danna Districts of West shoa Zone ,Oromia Region ,Ethiopia (Geshere *et al*. 2014).In Ethiopia the location malaria of the house hold are found in various distance and altitudes from the mosquitoes breeding sites, malaria infection risk not evenly distributed and varies within district and kebeles (PMI,2015).Moreover due to the expansion of irrigation and construction of dams in the country increase the population of mosquito vector that increase malaria transmissions among the dwellers and workers in that area(Jalata *et a*l.,2013).Higher malaria prevalence in the dry seasons as observed in households that use irrigation, could be because irrigation activities vector peak biting activities occur.

2.6. Pathogenesis of the malaria

The disease of malaria and its symptoms are intimately related to its complex reproductive cycle. Infection is initiated by the bite of mosquito species of *Anopheles mosquitoes*, which carries the sporozites stage of the *plasmodium* protozoa in its saliva (Tortora, 2010). A mosquito infects human host with sporozites which remain in circulation for 30 minutes or less and this phase is called sporozites phase. Sporozites enter the tissue cells of liver where pre-erythrocytes schzogny of a sexual reproduction takes places (Moody, 2002). However, most Species of *Anophele*s do not feed exclusively on either humans or animals (Choumet, 2012). The infection by *P falciparum* cause malignant malaria in which the fever is accompanied by other complications. Malaria caused by *P falciparum* can be fatal within two or three days. Symptoms of malaria generally begin from 7 to 15 days after a bite from an infectious mosquito about the time when the red blood cells burst. The bursting cells release wastes and *toxins* (poisonous substances) along with Merozoite. Fever develops as the immune system responds to the toxins in the blood (Tortora, 2010).Ten days after infection fever develops and the body temperature increases rapidly to 40.6^{o}c to 41.7^{o}c.The fever may last as long as 12hrs accompanied by headache and nausea. After the fever, sweating starts and then temperature falls. The area of the abdomen over the spleen is tender.

In general fever that characterizes malaria usually occurs in periodic attacks every 72 hours from infection with *P. malariae* and every 48 hours from infection with the others. An attack begins with chills and shivering soon followed by a high fever and sweating then brings the temperature down Anemia may occur as a result of the bursting and destruction of red blood cells. In *P vivax* and *P. ovale* infections, some Merozoite can remain dormant (inactive) in the liver. This Merozoite periodically enters the blood stream triggering malaria relapse.

The complete life cycle of human malaria parasite consists of a period of development within the mosquito and a period of infection in man

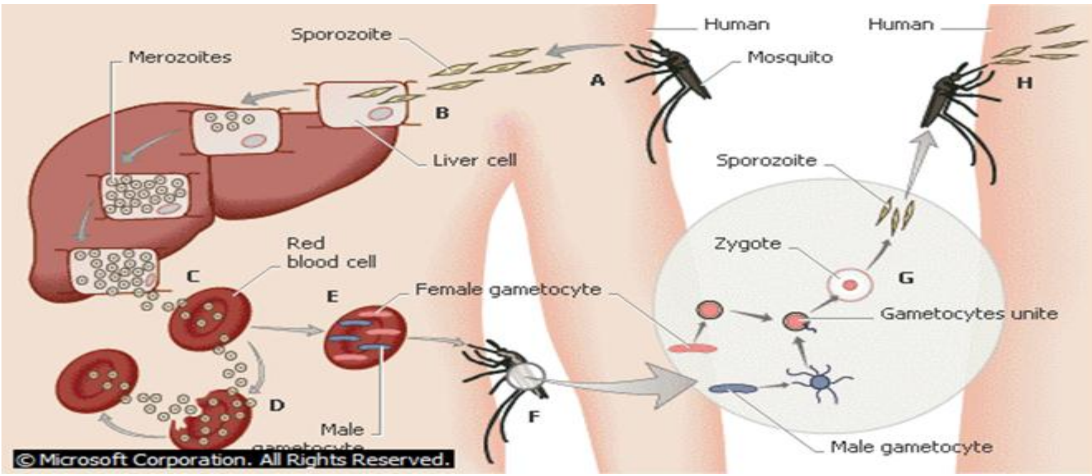


Figure 5. How Anopheles mosquito infect humans (source WHO, 2012).

The complete life cycle of malaria parasite in human and mosquito (Figure. 6.):-consists of a period development within the mosquito and period of infection in man host. Female anopheles mosquitoes require blood meals to undergo production of egg and these blood meals are the connection link between the human and the mosquitoes host in the malaria parasite life cycle. After ingestion of human infected blood, a period of development (10-14days) takes a place in the mosquito resulting in the production of sporozites. Abite of mosquito infects human host with sporozites, when the mosquitoes bites the infected humans suck the blood and gametocytes go in to along the blood. Once inside the mosquito the gametocytes develop in to mature gamtes.Red blood cells burst and gametocytes are released forming more mature gametes, male and female gametes fuse to form diploid zygotes. Zygotes develop into actively moving ookinetes that burrow into the mosquitoes midgut wall and form oocysts. Each oocyst undergoes growth and divisions produce more active haploid sporozites. After 8-15 days, the oocysts bursts and releasing sporozites into the mosquito body cavity, from which they travel to the mosquito salivary glands and move to the liver and invade hepatocytes. Initially elongated sporozites has transformed into a rounded form that matures within the hepatocytes to a schizont containing many Merozoite which is completed within 5 to 16 days. Then the Merozoite leave the liver and inter into the blood, the Merozoite in the red blood cell undergo asexual cycle produce more Merozoite. This cycle repeats 1 to 3 days that result in thousands of parasite infected cells in the host blood stream and the patient may develop sign and symptoms of illness and complication of malaria.

Some of the Merozoite transform into a sexual form called as male and female gametocytes that circulate in the blood circulation. In red blood cells (RBC) they pass through several stages of development, namely trophozoites, schizont, and finally merozoites.Some malaria parasite species remain dormant for extended periods in the liver (CDC, 2014). *P. vivax* has a dormant liver stage hypnozoite that can activate months after an initial infection, causing a relapse of symptoms. It only 1% of the (RBC) contain parasite with an estimated 100 billion parasite will be in circulation at one time in typical malaria patient (Tortora, 2010).

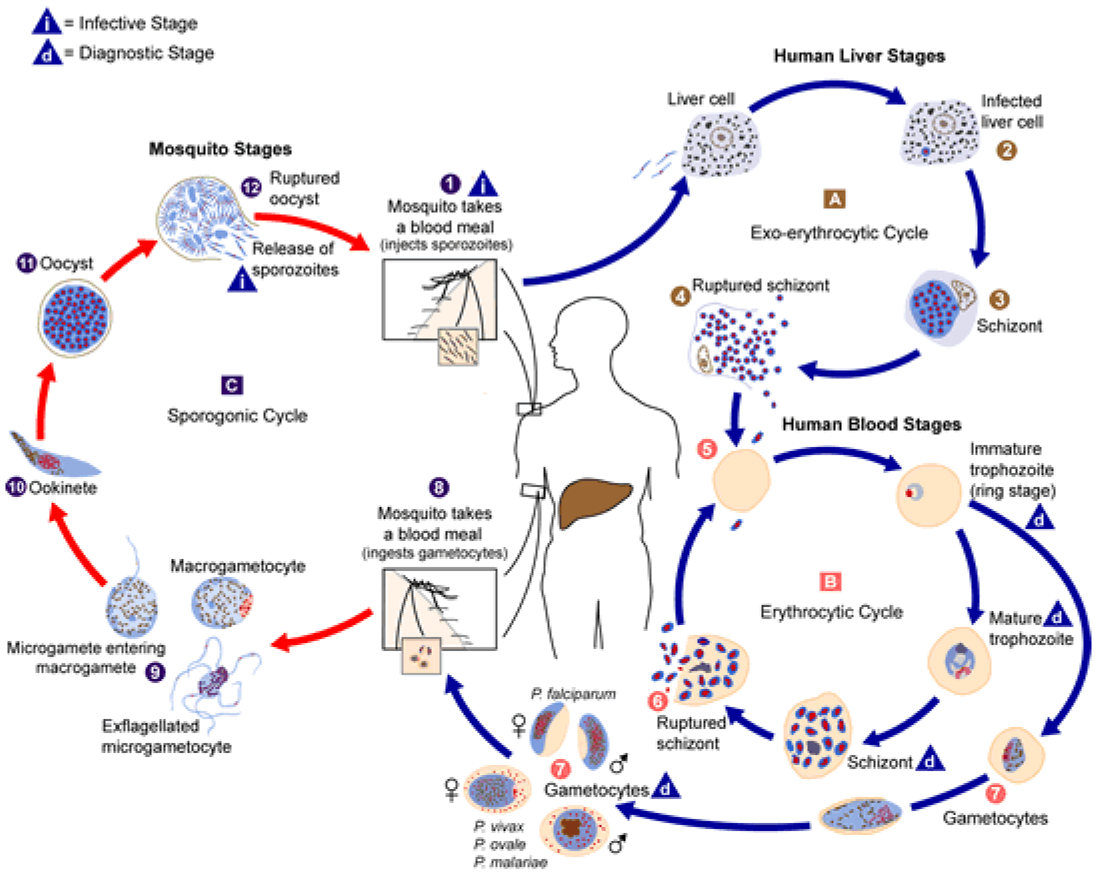


Figure.6.**The life cycle of malaria parasite in human and mosquito (CDC, 2014).**

2.7. Drug Resistant of Malaria

Drug resistance is the degree to which a disease or disease causing organism remains unaffected by a drug which was previously able to eliminate it. In the case of malaria it is the resistance of the malaria parasite *P falciparum* to chloroquine or other anti malaria's drugs (Taylor *et al.* , 1997).Widespread drug resistance against commonly used anti malaria drugs such as chloroquine and pyrimethamine/ sulfadoxine (Fansidar) has been reported all over the world. Epidemics are increasing in highland areas where malaria was uncommon, partly due to climatic changes including high rainfall patterns (WHO, 2012).

The drug resistant problem of malaria has dual faces. Those are resistant of the *Plasmodium* and resistances of Anopheles mosquito. According to, WHO (1996), the origin of drug resistant is inadequate regimens poor drug supply and poor quality and misuse of drugs. This problem is particularly great in the treatment and control of falciparum malaria almost in all endemic countries resistances to chloroquine has been found. Besides, a resistance to multiple drugs is common in the South East Asia (Abuse *et al.,* 1997).

2.7.1 Factors responsible for the generation of drug resistance

Natural selection: The process of selection will depend up on variety of factors, including the size of the infecting biomass, the immunity of the host and the pharmacokinetic profile of the drug susceptibility and fitness of the mutant (White, 1999). Selection can occur either when a primary infection consists in part of resistant parasites capable of surviving treatment or when a sub set of parasites with spontaneous mutation encounter residual concentration of a slowly eliminated ant malarial drug. The number of parasite exposed to selective pressure will be far greater in the first case than the second and thus will provide the greater opportunity for resistant mutant to arise and spread (Price and Nosten, 2001).

Substandard drugs: Wide spread use of sub therapeutic ant malarial regiments is also likely to play a major role in facilitating the emergence of drug resistance. Substandard drugs have been widely available in the private sector like pharmacies, clinics, drug shops and markets at all. Fake drugs with inadequate amount of active ingredient may kill off some susceptible parasites but leave those more likely to develop tolerance to multiply (WHO, 2011).

Mono-therapies: Mono therapies are perceived as having fewer side effects and often cheaper than the ACTs. However, it is easier for a parasite to develop resistance to a single drug treatment as it only needs to adapt to the characteristics of one drug (Krishna *et al,* 2004).If a treatment involving two or more drugs is used, it is likely to kill the parasite even if it has develop resistance, to one of the drugs (Elbashira and Adam, 2008).

Lack of compliance: Patients often stop therapy as soon as their acute symptoms have resolved. This habit of poor compliance may arise because of the occurrence of adverse side effects the cost of medication or because therapies are prolonged and complicated (White, 1997). Failure to take the full course of the drug means that while some susceptible parasites are killed, resilient ones live on leading to resistance to the drugs to which they were initially exposed (WHO, 2011).

2.8. Diagnosis of Malaria.

Among the core malaria diagnosis must be recognized promptly in order to treat the patient and prevent further spread of infection in community via local mosquitoes. To accurate diagnosis of malaria part of the effective case management based on detection of parasites on the blood through microscopy or RDT. Delay in diagnosis and treatment is a leading cause of death in the world. Malaria can be suspected based on the patients travel history, symptoms, and physical finding at examination. However, for definitive diagnosis to be made, laboratory test must be under taken to demonstrate the presence of the malaria parasite and there components (FMOH, 2017). Malaria diagnosis is difficult where malaria is not endemic any more for health care providers may not be familiar with disease (WHO, 2013). The objective of the strategy for malaria diagnosis specifies that by 2017, 100% of suspected malaria cases are diagnosed using microscopy or RDT within 24 hours of fever onset (PMI, 2016). The MOH policy microscopy is the primary means of malaria diagnosis at hospitals and health centers and for rural health posts RDT is a method of malaria diagnosis. It is particularly important to make an early diagnosis of malaria in young children and in pregnant women. These two groups may rapidly become very ill and may die within a few days. Pregnancy reduces the immune status of individuals and hence makes them more susceptible to malaria infection. Malaria during pregnancy is more difficult to treat, because the parasites tend to hide in the placenta making diagnosis and treatment difficult (WHO, 2012)

2.8.1 Clinical Diagnosis

Clinical patient diagnosis is physical diagnosis (subjective diagnosis) that is based on the patient's symptoms and from physical diagnosis. The first symptoms of malaria (most often fever chills, sweats. headaches, muscles pains, nausea and vomiting) are not specific and are also found in other disease such as flu common viral infection. Likewise, the physical findings are often not specific (elevated temperate, perspiration, tiredness). In sever malaria caused by *P. falciparum*, clinical finding (confusion, coma, neurological focal signs, severe anemia, respiratory difficulty) are more striking and increasing the index of suspicion for malaria. It possible, clinical findings should always be confirmed by laboratory test for malaria.

2.8.2. Microscopic diagnosis

Using blood film diagnosis malaria parasite can be identified by examining under "blood smear" on a microscope slide. Blood films were stained with Giema stain for 10 minute to identify prior to examination give parasites a distinctive appearance. This technique remains the gold standard of laboratory confirmation of malaria. Blood smear stained with Giemsa, showing a white blood cell (on left side) and several red blood cells, two of which are infected with *P. falciparum* on right side (WHO, 2O11)

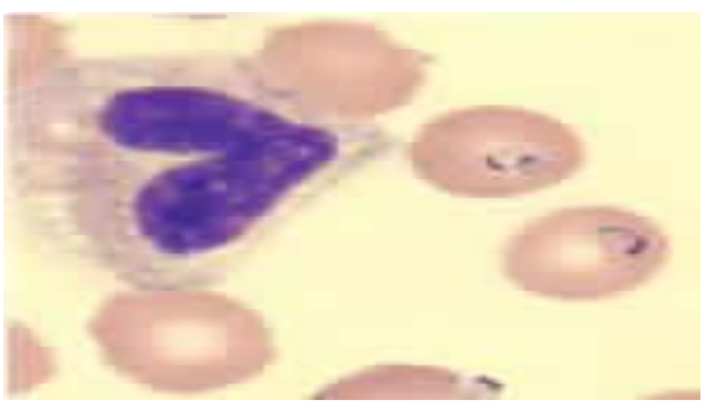


Figure7.Giemsa staining of blood cells showing infected two red blood cells (WHO, 2010)

The reliable diagnosis of malaria is microscopic examination of blood films because each of the four major parasite species has distinguishing characteristics. To identify the parasite two sorts of blood film are traditionally used. Thin films are identifying parasite species and infective stages were mixed with methanol before Giemsa staining because the parasite's appearance is best preserved in this preparation. Thick films allow the microscopes to screen a larger volume of blood and are about eleven times more sensitive than the thin film. Picking up low levels of infection is easier on the thick film, but the appearance of the parasite is much more distorted and therefore distinguishing between the different species can be much more difficult (Warhurst and Williams, 1996). Diagnosis of species can be difficult because the early trophozoites (ring form) of all four species look similar and it is never possible to diagnose species on the basis of a single ring form species identification is always based on several trophozoites (Richard *et al*., 2006*).*

2.8.3. Molecular Diagnosis.

Molecular diagnosis involves the detection of DNA sequences by using polymerase chain reaction (PCR). However, this technique may be slightly more sensitive than smear microscopy; it is often limited utility for diagnosis of acutely ill patients in standard health care setting. PCR is most powerful for confirming the species of malaria parasite after the diagnosis has been established by either microscopy or RDT (Moody, 2002).

2.8.4. Antigen Detection

To detect antigens derived from malaria parasite. Such immunologic (immune chromatographic) test most often use dipstick or cassette format, provides results in 2-15 minutes. However, before malaria RDTs can be widely adapted, several issues remain to be addressed, including improving their adequate performance under adverse field conditions. Serology detects antibodies against malaria parasites, using either immune fluorescence (IFA) or enzyme linked immune sorbent (ELISA) .Serology does not detect current infection but measures past exposure (Moody, 2002).

2.9. Treatment

Treatment should follow national recommended protocols (UNICEF, 2000).If chloroquine fails to clear the malaria infection; an alternative drug needs to be used. The NMSP states that ACTs, especially Artemether lumefantrine (AL) should be available at all public health facilities to treat all *P. falciparum* infections, whereas chloroquine continues to be first line treatment for *P. vivax* cases. For pregnant women oral quinine remains the treatment of choice for uncomplicated *P. falciparum* during the first trimester of pregnancy. If resistance to chloroquine is known to exist, other treatment is recommended. For example, pyrimethamine/sulfadoxine (Fansidar) or mefloquine may be used as first line drugs in areas of chloroquine resistance. Mefloquine is effective in the treatment of many cases of drug-resistant malaria, though resistance to mefloquine is growing in South East Asia. In addition, adverse reactions have been reported. Artemisinin is a natural product developed by Chinese scientists from the worm wood plant.

Artemisinin clears the parasite from the body more quickly than chloroquine or quinine. It is also considered to be less toxic than quinine. Combination drug therapies are being advocated for treatment of malaria, such as mefloquine plus artemisinin (WHO, 2012).

To mask the bitter taste of chloroquine, crushed tablets can be given to the child with banana or other local food. Quinine is the standard treatment for children with severe malaria (WHO, 2012).Pregnant women in malaria endemic areas are more susceptible to malaria infections because of their reduced natural immunity and may therefore develop complications such as fever and severe anemia. In some countries, national policies recommend routine use of anti-malarial drugs during pregnancy. Difficulties arise in providing pregnant women with prophylaxis in areas where there is resistance to chloroquine. Pyrimethamine/sulfadoxine (Fansidar) has been used as prophylaxis/intermittent treatment in Malawi and in Kenya with good. Pregnant women should attend routine prenatal clinic and should be protected from malaria by sleeping under treated mosquito nets. They should also receive ferrous sulphate and folic acid daily, to treat and prevent anemia. When pregnant women become ill with malaria treatment depends on national guidelines. Chloroquine, amodiaquine and quinine can all be safely given during pregnancy (UNICEF, 2000).

2.10. Malaria Prevention and Control in Ethiopia

Ethiopia fight against malaria was started more than half a century ago. Malaria prevention in Ethiopia was started more than 5 decades ago ,that was initially began as a pilot control project in 1950s and for the first time it was launched as national eradication campaign in the 1960s followed by a control strategy in the 1970s (WHO 2016).According to the national malaria indicator survey (MIS,2011) that was conducted following the scale-up of malaria control intervention in Ethiopia showed achieve in coverage of some malaria control interventions and malaria indicators between 2007 and 2011(MOH, 2012). Malaria showed a decline in Ethiopia over last five years as result of high coverage key malaria control interventions).

In Ethiopia the main malaria prevention and control activities are implemented based on, NSP 2011 -2015, aimed at strengthening and scale-up of malaria control interventions though prompt and effective diagnosis and treatment ,case management though roll out of the highly efficacious ant malarial drugs(MOH, 2010). Artemisinin- based combination therapies (ACTS), and selective vector control with special emphasis to scaling up LLITNs coverage and ensuring its utilization at house hold level, and targeted and timely application of IRS of households with insect side and environmental management (Degefa *et a*l.,2015). The strategic plan has set goals to achieve malaria elimination in areas with historically low malaria transmission and near zero malaria deaths in all the remaining parts of the country by 2015.To attain these goals it has set out the following specific targets such as, 100% of households in malarias areas own one LLINS per sleeping space. At least 80% of people at risk of malaria use LLINs, IRS coverage increased and maintained to 90% of households in IRS-targeted areas.100% have access to effective and affordable malaria treatment (FDROH, 2012).

Studies show that sleeping under a bed net can reduce child mortality from malaria by as much as 20%. The repellent in the nets can also reduce the number of mosquitoes in the surrounding area (Mohammed *et al.,* 2015). When 80% of households use bed nets in a community, studies suggest that mortality from malaria for those living within 300 meters is significantly reduced (ACIPH, 2009).As outlined in the NSP 2011-2015, Ethiopia has a target of 100% access to effective and affordable malaria treatment.

This requires improving diagnosis of malaria cases using microscopy or using multi species rapid diagnostic test (RDT) and providing prompt and effect malaria case management at all health facilities. Ethiopia has shown remarkable progress in reversing the burden and epidemics of malaria in the last two decades. Mortality and incidence rates of malaria declined by 96 and 89%, respectively, between 1990 and 2015. Ethiopia has registered remarkable progress in reducing the burden of malaria has declined significantly, which could be the result of improved coverage of high impact interventions, such as prompt treatment of cases using artemisinin based combination therapy (ACT), prevention and control of malaria among pregnant women using intermittent preventive therapy (IPT), use vector control methods including insecticide treated bed nets (ITNs), and indoor residual spray (IRS) (Abeku *et al*., 2015). As result , malaria deaths and admissions in children age under 5 fell by 81 and 73%, respectively, after the scale up of ITNs, IRS and ACT interventions between 2006 and 2011 (Areaway *et al.*, 2014). It is still among the ten top leading causes of morbidity and mortality in children under-5 years (Deribew, 2013). In Ethiopia, national malaria control strategic plan for 2014-2020 which serve as a guiding document of malaria control program in the country has been developed (MOH, 2014). The goals of malaria control strategic plan are:- By 2020, to achieve near zero malaria deaths, no more than one confirmed malaria death per 100,000 populations at risk. By 2020, to reduce malaria cases by 75% from the 2013 base line, to eliminate malaria in selected areas with historically low malaria transmission.

Malaria is an entirely preventable and treatable disease, provided the currently recommended interventions are properly implemented. These include vector control though the use of long-lasting insecticide treated nets (LLINS), indoor residual spraying (IRS), and in some specific setting larval control, chemoprevention for the most vulnerable populations. Particularly, pregnant women and infants, conformation of malaria diagnosis though microscopy or rapid diagnosis test (RDTs) for every suspected case, and timely treatment with appropriate ant malarial medicine in Ethiopia Malaria remains a major health problem where only 25% of the population lives in areas that are free from malaria (WHO, 2014). WHO (2016) report Vector control is the main way to prevent and reduce malaria transmission. Two forms of vector control are effective in a wide range of circumstances insecticide treated mosquito nets (ITNs) and indoor residual spraying (IRS). ITNs are the cornerstone of malaria prevention efforts, particularly in sub-Saharan Africa.

World health organization recommends universal access to and utilization at house level of long lasting insect side treated nets (LLITNs) and indoor residual spraying (IRS) as most powerful and effective strategies of vector control, to rapidly control malaria transmission, hence reducing the burden of malaria morbidity and mortality (WHO, 2012). In 2015, 106 million people globally were protected by IRS, including 49 million people in Africa.

NMSP: aim to provide 100% IRS coverage as a key malaria prevention measure in area where malaria burden is high and in high land fringe areas with the potential for malaria out breaks. The proportion of the population at risk of malaria protected by IRS declined from a peak of 5.7% globally in 2010 to 3.1% in 2015 (WHO, 2016). The national target is Roll Back malaria partnership in (2011), objectives: to reduce malaria case by 75% and malaria deaths to near zero from 200 levels by2015.to sustain 100% LLINs coverage in malaria risk areas. However, the malaria indicator survey showed that the ownership of LLINs in household in malaria area below 2,000m was 54.8% owning at least one LLIN and 23. 6% owning more than one LLIN.

World malaria report 2014, globally, malaria case decreased from227 million in 2000 to 198 million in 2013 and the incidence is projected to fall by 35% globally and by 40% in the who African region by 2015.In sub-Saharan Africa, the proportion of population protected by at least one vector control method has increased in recent years The prevalence of malaria parasite infection including both symptomatic and asymptomatic infection has decreased significantly with average infection prevalence in children aged 2-10 years falling from 26% in 2000 to14% in 2013, a relative decline of 46% (WHO, 2014). Recently ACTs are highly potent, short-half-life anti malarial drugs and they act very fast against the parasite. The drugs able to remove more than 90% of the parasite load within the first 6 hours of administration and the remaining parasite load is progressively cleared by the partner drugs that usually has longer half-life and acts slowly (WHO, 2015).

3. MATERIALS AND METHODS.

3.1 Description of the study area

Jardega Jarte is one of the woredas found in the Horo Guduru Wellega Zone of Oromia Regional State (Figure 8). This district geographically lies between $10^{0}50^{'}$N longitude 36^{0} 30' E latitude. This woreda is bounded with Amhara region to the North, Horo Buluk and Habe Dongoro to the south, Amuru and Kiramu woredas to the West and Abay Chomen woreda to the East. It is located at the distance of 368 km far from Addis Ababa to the North Western direction and located at 54 km far from zone town (Shambu). In other hand 250 km from Addis Ababa. to Bako Asphalt road and from Bako to Jardega Jarte woreda 118 km pista road. Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia, this district had a total population of 70,774, of whom 37,510 (53%) were males and 33.264(47%) were females. Administratively, Jardega Jarete woreda is divided into 24 kebeles, 72 sub-kebeles, and 3 town administrations.

There are three agro- ecological zones in this district with the proportion of 20% low land 54% Mid-land, 26% high land and 0% chill/Freezing zone. The mean annual temperature ranges from 16^{o}c to 27^{o}c and the annual average rain fall amount is 1200-2000mm (RLEPOJ\ J D, 2013).The highest temperature occurs from February up to March and the lowest temperature from July to August and an elevation and the altitude of the region range from 1500-2670 meter above sea level (mas1).

Jardega Jarete district has four (4) health centers, 19 rural and three urban health posts and one hospital which are under construction. .From these only three (3) has five years (2015-2019) of recorded data of malaria patients (Dandy, Haro lago and Akeyu) health centers. The remaining health center and health posts no recorded data of five years microscopic confirmed results. Therefore, the study was based on only three heath center (Dandy, Harolago andAkeyu). Among the interventions that are implemented in the woreda indoor residual spray (IRS), distribution of long lasting insecticide nets (LLIN) and environmental control and promote treatment of Malaria cases using Coartem for *P. falciparum* and Chloroquine for *P. vivax* as a first line treatment.

Based on examination they use compound microscope and when there is no electric light they use a generator as a reserve rather than using RDT. In this study area, peak malaria transmission is biannually from September to December and June to August.

According to the data obtained from woreda agricultural office the total cereal crop production in the last five year is increased to 923,302 quintals in 2017/2018 at an average of 28 quaint per hectare, major crops such as teff, maize, wheat, barley, nug, etc have been widely grown in the districts .The woredas has huge live stock population, making a sub spaniel contribution to the regional economy. The total livestock population size is about 131,634 cattle, 23,640 sheep, 10,331 goats,14,485 pack animals (donkeys ,horses and mules) 1,023 equines and, camels, 62,449 poultry (CSA,.2012) .

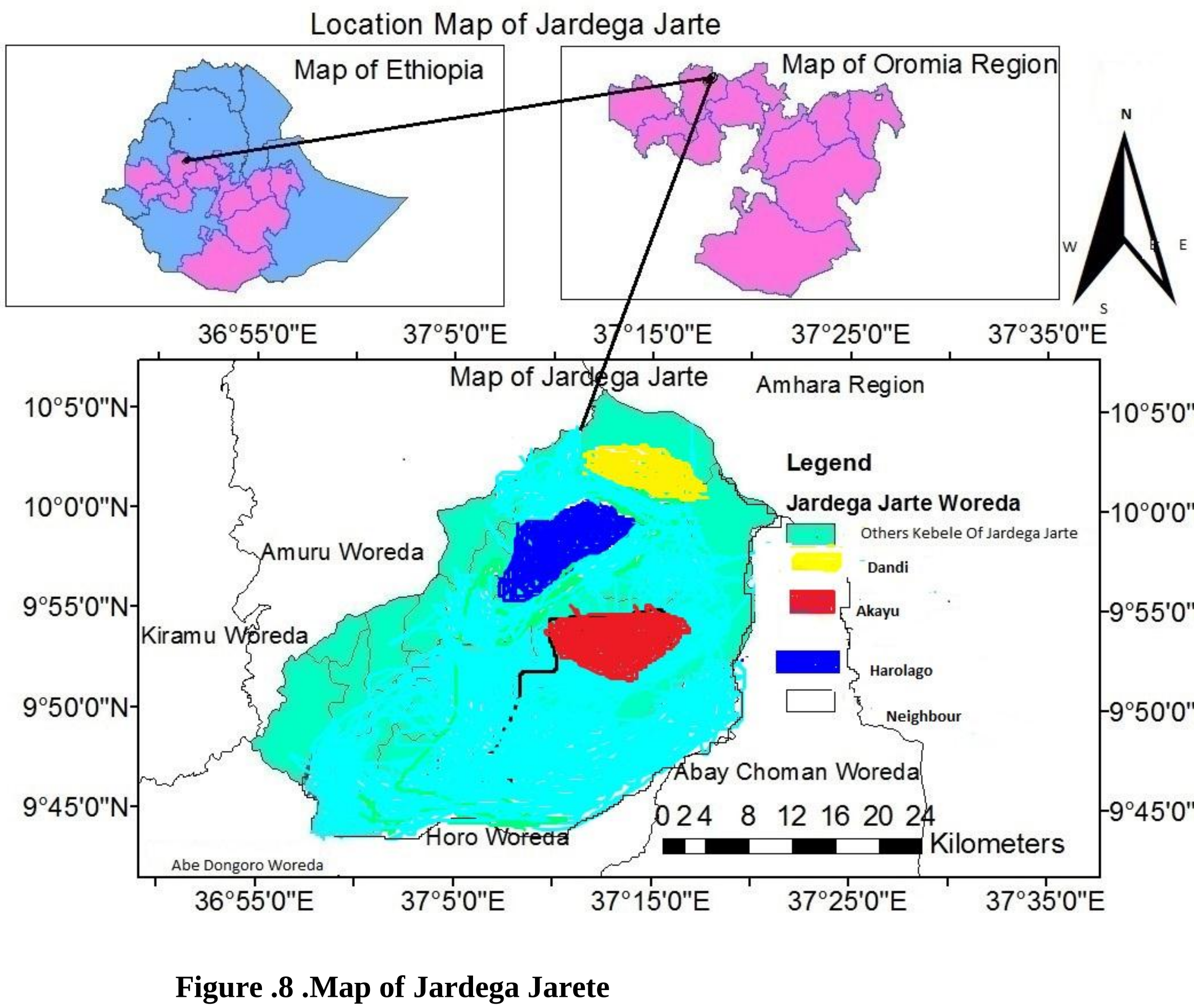


Figure .8 .Map of Jardega Jarete

3.2. Study design

A retrospective study was conducted to determine the prevalence of malaria by reviewing a five year clinical data from the three Jardega Jarete health centers (Dandy, Haro lago and Akeyu) a record data collected from September 2018 to May 2019 (prospective). Past five-year (2015-2019) year.

3.3. Study population and data collection

The study participants were all malaria suspected individuals who had complained of febrile illness and screened patients in the laboratory all of malaria positive was recorded in registration book from 2015-2019 year in the study area. The target populations for the study were all population suspected malaria cases and attending the three health centers. The selection of these health center facilities was done by using purposive sampling technique, because malaria patients were registered in an organized manner in these three health center compared to many private health facilities available in the district. During the study period socio demographic and laboratory data were collected from patient's registration book.

3.4 Data Analysis

All data from clinical records were checked for completeness and cleaned for any inconsistencies to analyze. The data were entered into excel and analyzed using SPSS version 20 software package. The chi-squared test was used to determine the difference between years, seasons (months), age, and sexes as well malaria parasite distribution for retrospective data were analysis using descriptive methods statically significance in percentage and presented by using figures and tables. Statistical significance was defined at P-values less than 0.05 ($P<0.05$).

3.5. Letter of cooperative

The letter cooperative was obtained from the Department of Zoological Sciences and submitted to Health center of Jardega Jarete district all information gathered from recorded secondary data.

4. RESULT AND DISCUSSION.

4.1. The prevalence of malaria in Jardega Jarete district from 2015-2019 years.

In this study area a total of 25, 868 blood samples at the three health centers (Dandy, Horo lago and Akeyu) were submitted for malaria diagnosis for the last 5 years (2015-2019) in JardegaJarte district. From these 15,361 (60 %) were males and 10,507 (40%) were females. From the blood film samples 4,336 (16.7%) were microscopically confirmed as malaria cases (Table 1).

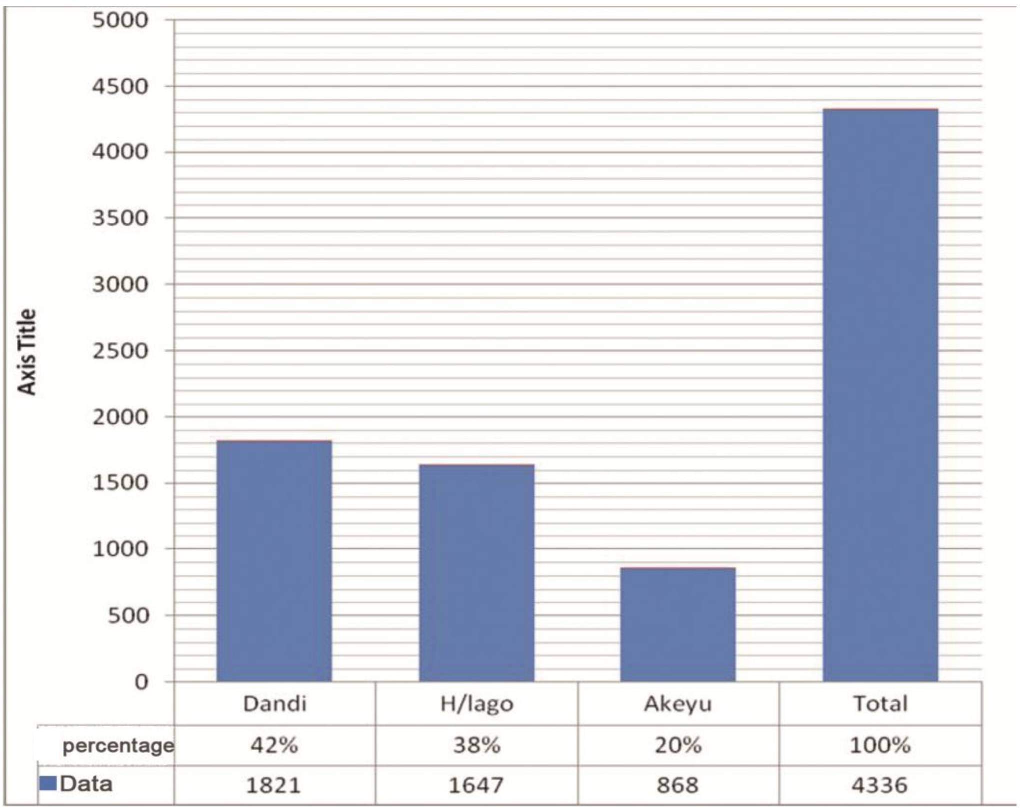
Table.1. Prevalence of Malaria amongst out patients vesting the three health centers of Jardga jarete district from 2015-2019 year.

Year	No of blood sample			No of positive sample		Total	I/rate	Trend	M;F	
	No	M	F	M(% age)	F(% age)	Total	I/rate	Trend		
2015	6600	3960	2640	503(11.6)	353(8.1)	856	12.9%	-	1.4;1	
2016	6756	3716	3040	193(4.4)	140(3.2)	333	4.9%	7.1%	1.4;1	
2017	5640	3566	2074	681(15.7)	476(11)	1157	20.5%	11%	1.4;1	
2018	3450	2126	1324	642(14.8	387(8.9)	1029	29.8%	6.0%	1.6;1	a<0.05 df=4
2019	3422	1993	1429	581(13.3)	380(8,7)	961	28%	13%	1.6;1	x^{2}=33.25
Total	25,868	15,361(59.3%)	10,507(40.6%)	2,600 (60)	1,736(40)	4,336	16.7%		1.5;1	p<0.001

The prevalence of malaria was 29.8% in year 2018, 28% in year 2019, 20.5% in year 2017, 12.9 in year2015, and 4.9 in year 2016. The district showed variations from year to year ranging the highest record of 29 .8% in 2018. The lowest prevalence of malaria registered 4.9 in 2016. However, the study showed a fluctuating pattern category of the high prevalence of malaria (>20 %.) in the years 2017, 2018, 2019, medium prevalence of (12.9%) in the years of (2015) and lower prevalence of (4.9%) in the years 2016 showing in the past five years (Table1).

The data collected from the three Health Centers in the district showed variations in the prevalence of malaria (Fig.9). The highest prevalence of 42% was recorded from Dandy Health Center followed by prevalence of 38% and 20% from Harolago and Akeyu Health Centers, respectively.

Figure.9.Total prevalence of malaria in studies site from 20015-2019 years.



4. 2.The Pattern of *plasmodium* infections in Jardga Jarete district from 2015-2019year.

The prevalence of malaria in this study showed significant variations compared to the status of malaria infections in different parts of the country for the last five years (Table 2).The prevalence of malaria in this study over the 5 years (16.7%) was similar to that of 16% recorded from Dilla (Molla *et al.*,2015)and 17% record Metema from (Getachew *et al* 2006-2012) but significantly higher than the prevalence of 7% Arbaminch ,11.45% in Arsi Nigel, and 11.53% in Motta and studies almost covered the same period between 2005-2016) (Table 2).

On the contrary, the malaria prevalence in Jardga jarete district was much lower than the infection rate of 39.6% from Kola dib (Abe be *et al.*, 2012), and 33.27% from Serbo Health Centre (Karunamoorthi and Bekele, 2009) (Table2). This was because the study sites included study periods (2002-2011, 2003-2008) that may not have been covered by prevention and control activities of malaria in Ethiopia implemented according to national strategic plan (NSP) for malaria control and prevention.

Table 1. Summary of total prevalence of malaria disease compared to other studies.

Study site	Prevalence	Study period	References
J/Jarete	16.7%	2015-2019	On study
Metema	17%	2006-2012	(Getachew *et al.,* 2013).
Welaita	39.6%	2015	(Deresse *et al*.,2015)
Arsis Nigel	11.45%	2009- 2013	(Solomon and Mingiest, 2015).
Kola Dib	39.6%	2002-2011	(Abe be *et al.*, 2012).
Motta	11.53%	2006-2015	(Tilahun ,2016)
Arbaminch	7%	2010	(Balayneh, 2014).
Dilla	16%	2015	(Molla *et al.,* 2015)
Amuru	27.7%	2007-2016	(Arraso ,2016)
Serbo	33.27	2003-2008	(Karunamoorthi and Bekele,2009)

However, the prevalence of 16% of malaria in the Dilla woreda in 2015 (Molla *et al*., 2015) at the same period higher than the prevalence of 12.9% recorded in Jardga Jarete district in 2015.But a malaria infection of 4.9% in 2016 recorded in the Wereda was much lower than the ones detected from Motta 11.53 % (Tilahun, 2016).The differences in the prevalence of malaria in the country might be due to variations in methodological differences (sample size and years of study, primary data, secondary data, and vulnerability (location) of the study sites, and presence and absence of strong concerted national intervention plan and activities in the areas to control malaria. The highest peak was in 2004 which could be attributed to climatic factors of that particular year (Getachew 2006, MOH, 2004)

The rate of infection differed between males and females with a male to female infection ratio of 1:4:1 (2016) to 1:6:1 (2018) with average ratio of 1:5:1 (60:40) statically significant (x^2 =33.33, df = 5, P< 0.05), showing similar pattern of male and female outpatients visiting the health centers and the infection rate between the sexes (Table 1). The male and female ratio in this study (1:5:1) was slightly higher than the 1:4:1 recorded from both Metema (Getachew *et al.*, 2013), and Dilla (Molla *et al.*, 2015), but significantly higher than the others, and 1:1 ratio from Kola Dib (Ababa *et al.,* 2012) and Welaita Zone (Deresse *et al.*, 2013). Although malaria infection occurred more in males than females in most of the local studies, reports from Nigeria showed the contrary where females were more infected with ratio (F: M) of 1:2:1 (Kālu *et al.*, 2012), and 1:4:1 (Okonko *et al.,* 2005).In this study, the number of males affected by malaria was higher than the number of females were engaged in outdoor activities. This might be due to males stay outside their home during night time, to keep agricultural products, livestock such as cattle and they often migrated in to low land areas for seasonal works that are infested with malaria vectors and parasites.

Table. 2. Summery prevalence of malaria disease with respect to sex in J\Jarete District compared to other studies.

Study site	Sex		Years of Study	M:F (ratio)	Reference
	Male	Female			
J/Jarte	59.8%	39.9%	2015-2019	1:5:1	On study
Arbaminch	57%	43%	2010	1:3:1	(Balayneh ,2014)
Motta	57.47 %	42.57%	2016	1:3:1	(Tilahun, 2016)
Sibu sire	53.6%	46.4%	2004-2013	1:2:1	(Temesgen Gemechu *et al.*, 2015)
Chuchu	56%	43.96%	2016	1:3:1	(Belete ,2016)
Metema	58.7%	42 %	2006-2012	1:4:1	(Get chew *et al.*,2013)
Arsi Nigel	55%	45%	2009-2013	1:2:1	(Mingiest and Solomon, 2015).
Amuru	59.7%	40.3%	2007-2016	1:5:1	(Arraso , 2016)
Welaita zone	50.74%	49%	2008-2013	1:1	(Deresse *et al.* , 2015)
Dilla	58.9	41.1%	2015	1:4:1	(Molla *et al* .,2015)
Serbo	56.1%	43.9%	2012	1:3:1	(Karunamoorthi and Bekele, 2012)
Nigeria	46.5	53.5	2012	1:1:2	(Kālu *et al.*,2012
Nigeria	42	58	2002-2004	1:1:4	(Okonko *et al.*,2005)

In this study, malaria infection was recorded among all age groups (Table 4).The highest infection occurred on the age group of 31-45 years, with prevalence of 22.5 %, followed by the prevalence of 21.2% on the age group of 16-30 years and 18% on the prevalence of age group of 46-60 yeras and the age group of 6-15 years was recorded 13.4%. The least affected one was the age group of >60 years with a prevalence of 12 %. The data also showed similar pattern amongst the different age groups, except the 1-5, 31-45, and >60 age group years with M:F ratios of 1:4:1, 1:5:1 and 1:2:1 ,respectively (Table 4)

Table. 4. Prevalence of plasmodium species in respect to sex and age groups in J/Jarete district from 2015-2019 year.

Parasite	Age groups							Total
	Sex	1-5	6-15	16-30	31-45	46-60	>60	
Total	M	322	329	517	578	442	277	2465
	F	238	253	405	399	339	237	1871
	T	560	582	922	977	781	514	4336
% age		12.4%	13.4%	21.2%	22.5%	18%	12%	16.7%
Ratio (M.F)		1:4:1	1:3:1	1:3:1	1:5:1	1:3:1	1:2:1	1:3:1

The value of the chi-square analysis also showed that age group and prevalence of plasmodium (parasite).The chi-square value shows that, at 1% probability level age of the samples had significant relationships with the prevalence of plasmodium diseases. The pattern of infection indicated that the disease affected largely productive age groups of 16-45 years. The cumulative prevalence of malaria in the active age groups of 31-45 and 15-30 was 43.7% which was less than the prevalence of 48.1% in Sibu sire (15-44age group) (Temesgen *et al*, 2015) and 50% in Kola Diba (15-44age group) (Alemu *et al.*, 2012). This might be associated with their daily activities. Farming is extensive in Jardega Jarete district due to the fact that young daily laborers move to low land area from different areas for application of farming and harvesting of crops. Because of the area was conducive for breeding of mosquitoes and survival of the parasite, this may exposed them to the bite of mosquitoes.

4.3. The trend of malaria infection by the *Plasmodium* species in J/Jarete District from 2015– 2019 years.

The data also showed that the prevalence of *P. falciparum* and *P. vivax* as causative agents of a disease of which *P. falciparum* was being the predominant parasite 2,561 (59.2%), followed by *P. vivax* 1,434 (33%) malaria prevalence respectively, whereas the mixed infection was 3,41 (7.8%) in study area (Table 5).

Table. 5. The distribution of plasmodium species in Jardega Jarete District from 2015-2019year

Years	*Plasmodium species*			Total
	Pf (% age)	Pv (% age)	Mi (% age)	
2015	521(12%)	279(6.4)	56(1.3)	856
2016	175(4)	115(2.7)	43(0.9)	333
2017	627(14.4)	451(10.4)	79(1.8)	1157
2018	620 (14.3)	342(7.8)	67(1.5)	1029
2019	618(14.2)	247(5.7)	96(2.2)	961
Total	2561(59.2)	1434(33)	341(7.8)	4336(100)

Note: Pf = *Plasmodium falciparum*, PV = *Plasmodium vivax*, Mi= Mixed infection.

This finding coincides with the malaria parasite distribution in Ethiopia which indicates *P. falciparum* and *P. vivax* was the two predominant malaria parasite, distributed all over the nation and accounting for 60% and 40% of malaria cases respectively (MOH, 2010). It was significantly higher than 50% of decline due to *P. falciparum* infection in Ethiopia (WHO, 2016). Similar pattern of distribution of the two Plasmodium species to the malaria infection recorded at the three health centers. The highest *P. falciparum* distribution of 24.8% was recorded from Dandy Health Center followed by Harolago (22.4%) and Akeyu (11.8%) respectively (Table 6).

Table 6. The distribution of plasmodium species in study location in Jarete district from 2015-2019 year

Year	Study site	Malaria parasite.				Ratio (Pf: Pv)
		Pf (%)	Pv (%)	Mi (%)	Total (%)	
2s015-2019	Dandy.	1075(24.8%)	602(13.8)	144(3.3)	1821(42)	1:8:1
	H/Lago.	973(22.4)	544(12.5)	130(3)	1647(38)	1:8:1
	Akeyu.	513(11.8)	288(6.6)	67(1.5)	868(20)	1:8:1
	Total	2561(59.2)	1434(33)	341(7.8)	4336(100)	1:8:1

Despite, the highest infection of 13.8% was detected by *P vivax* from Dandy Health Center followed by the 12.5% and 6.6% infections by the same parasite at Horo lago and Akeyu Health Centers respectively. *P. falciparum* was the most predominant parasite in study site and months with nearly 1:8:1 and 1:8:1 ratio over for *P. vivax* infections recorded from Dandy and Harolago Health Centers, respectively. This slight variation might be due to the presence of high malaria breeding sites attributed to relative agro ecological and altitude and relative differences among the population living and attending their respective health centers. This indicates location had impact on the distribution of the disease.

Table. 7. Summary of predominant malaria parasite in J/Jarete District compared to other studies.

	Malaria Parasite.				
Study site	Pf	Pv	Mi	Years of Study	References
Jardega Jarete	59.2%	33%	7.8%	2015-2019	On study
Ethiopia	60%	40%	-	2010	(MOH, 2010)
- Arbaminch	64.3%	25%	10.7%	2010	(Balayneh, 2014)
-Sibu sire	66.1%	30.5%	3.4%	2004-2013	(Temesgen *et al*., 2015)
-Metema	90.7%	9%	0.3%	2006-2012	(Getachew *et al.* , 2013)
-Kola Diba	75%	25%	-	2002-2011	(Alemu *et al.*, 2012)
-Buta lira	12.4%	86.5%	1.1%	2012	(Wyes *et al.*,2012)
-Arsis Nagalle	19.8%	74%	6.2%	2009-2013	(Mangiest and Solomon, 2015)
-Butajira	37.5%	62.5	-	2000-2009	(Tesfaye *et al*., 2012)
-Amuru	67.6%	24.8%	7.6	2007-2016	(Arraso, 2016)
-Dilla town	26.8%	62.5%	10.7%	2014	(Molla *et al.*, 2014)
Global	92%	4%	-	2016	*(WHO*, 2016)

Note: Pf = *Plasmodium falciparum*, PV =*Plasmodium vivax*, mi= mixed infection

The dominance of *P. falciparum* infection over the *P. vivax* infection at the national level was 60:40% (MOH, 2010). However several studies in Ethiopia showed the predominance of *P falciparum* with pattern of 60-66.1% in Arbaminch, and Sibu Sire, 75% in Kola Diba, and 90.7% distribution in Metema (Table 7), few studies showed the reverse in that *P. vivax* dominated the infection,62.5% (Dilla town),74% Arsi Negelle and 86.5% (Butajira). It is tempting to assume that, with few exceptions, the two parasites have a geographical distribution in that *P. falciparum* dominates north western and southern parts of the country; whereas *P. vivax* is widespread in the south central rift valley areas (Table7).

4.4. Seasonal distribution of malaria infection in J/Jarete Wereda

Particular distribution of the parasite for malaria infection showed that 59.2% of the infections were caused by *P. falciparum,* followed by 33% infection with *P. vivax* with a ratio of 1:9:1(December up to February) to that of 1:7:1 (September up to November) with an average of 1:8:1 showing variations among the seasons (Table 8). It was also shown that males were slightly more infected (1:8:1) by *P. falciparum* compared to females (1:8:1). The data also showed 7.8% of the patients suffered by mixed infections. Therefore the apparent fluctuation of prevalence of the disease in the study area, malaria infection occurred in almost every season of the years. The high peak of malaria infection was observed during spring (September-November) with prevalence of 25.8% followed by summer season (June-August) and autumn (March-May) with prevalence of 25.3% and 24.6% respectively (Table 8).

Table 8.Seasonal variations of plasmodium infection in J /Jarete district from 2015-2019 year.

Seasonal infection	No	*Plasmodium species*					% age
		Pf	Pv	Pf;Pv	Mi	Total	
Dec-Feb	6,123	610	323	1:9:1	67	1,000	23%
Mar-May	6,310	632	345	1:8:1	79	1,056	24.3%
Jun-Aug	6,567	650	362	1:8:1	91	1,103	25.4%
Sep-Nov	6,868	669	404	1:7:1	104	1,177	27.1%
Male Total	15,361	1,459	8,13	1:8:1	193	2,465	57%
Female total	10,507	1,107	6,17	1:8:1	147	1,871	43%
Total/average	25,868	2,561	1,434	1:8:1	341	4,336	16.7%

Note: NO = Number of screened, *Pf= P. falciparum, PV = P. vivax, Mi = Mixed*

The highest prevalence of malaria in the seasons spring (September-November) was 27.1% and the lowest prevalence of malaria was observed during winter (December-February) which accounted for 1,000(23%) in the study area. This study has also revealed that malaria prevalence might be depending on year, season and month of the past five years. The highest peak of malaria occurrence in almost all year was observed during the wet seasons.

Table. 9. Summary of seasonal variation of the prevalence of malaria in Jardega Jarete woreda from 2015-2019 year.

Study site	*Major and minor malaria cases in season*		Time of study	*References*
	Major	*Minor*		
Jardegajarete	*Sep-Nov (27.1%)*	*Dec-Feb (23%)*	*2015-2019*	*This study*
Ethiopia (National)	Sep-dec(Jun-sep) (56.2%)	*April – May (28%)*	*2010*	*(MOH,2010)*
Metema	*Sep-Nov (38.6%)*	*Dec-Feb (18.7%)*	*2006-2012*	*(Get chew et al.,2013)*
Motta	*Sep-Nov (38.6%)*	*Dec-Feb (18.7%)*	*2006- 2015*	*(Tilahun, 2016)*
Airs Nigel	*Sep-Nov (32.3%)*	*Dec-Feb (16.2%)*	*2010-2014*	*(Mangiest-and Solomon,2015)*
Amuru	*Sep-Nov (34.9%)*	*De- Feb (14%)*	*2007-2016*	*(Araraso,2016)*

In Ethiopia the major transmission of malaria follows the June to September rains and September to December but the minor transmission of malaria occurred from April to May following the February to March rains. Generally in Ethiopia, altitude and climate are the most important determinants for malaria transmission for seasonal and predominately unstable number of malaria cases (MOH, 2010).

4.5. Prevalence of malaria with respect to months in Jardega Jarete district from 2015-2019year.

Table 10 Prevalence's of plasmodium species with respect to months in J/Jarete wereda from 2015-2019 year.

Year	Month	Plasmodium species			Total	% age
		P f	Pv	Mi		
2015-2019	Jan	199	100	27	326	7.5%
	Feb	201	98	19	318	7.3 %
	Mar	201	117	28	343	7.9%
	Apr	211	111	21	346	8%
	May	206	119	25	350	8.1%
	Jun	222	134	31	387	8.9%
	Jul	217	121	33	371	8.5%
	Aug	232	124	30	386	8.9%
	Sep	213	119	26	358	8.3%
	Oct	236	135	42	413	9.5%
	Nov	220	150	36	406	9.4%
	Dec	203	106	23	332	7.7%
Total		2561	1434	341	4336	100%

Note*: Pf = Plasmodium falciparum, PV =Plasmodium vivax, Mi = Mixed infection*

Seasonal (monthly) distribution of malaria in the study area indicated that maximum number of malaria cases was observed in September to November. This might be the reason that following the rainy season which create stagnant water which is suitable environment to mosquito breeding. Prevalence of malaria with respect to months in Jardega Jarete district started to decline from December to February (table.10).

This might be associated with small rains and small scale irrigation. Malaria diagnosis must be recognized promptly in order to treat the patient and prevent further spread of infection in community via local mosquitoes. Delay in diagnosis and treatment is a leading cause of death in the world. Malaria diagnosis is difficult where malaria is not endemic any more for health care providers may not be familiar with disease (WHO, 2013).However increased attention to malaria control and preventive activities in line global and national malaria eradication still many factors might be responsible for malaria incidence changes such as parasite, vectors and host interactions, social and economic determinants include change in health care infrastructure, biological and economic factors, mosquito control measures, population immunity, local ecological environment, and governmental policy and drug insecticide resistance also have an impact on malaria prevalence. RBM partnerships and SP access to availabilities of strong preventive and controlling measure globally as well as at national level with the goal to reduce the burden of malaria by half up to 2010 and halving again by 2015.

The current study indicated that, the coverage of LLIN is encouraging and near to achieving the current national strategic plan to control malaria. The reason may be the area is malaria endemic; priority might have been given by the concerned stalk holders and fair distribution of LLINs in the study area. However, only 75% of them used their LLINs on the previous night. The most common reason reported from those not using LLINs were afraid of its toxicity, in doubt of preventability and unavailability due to is oldness thrown away. And the other problem might be they use their nets for other purposes such as to collect hay, protect chickens against predators, make rope to tie wood, to hunt fish as a net, screening window and put the net under the bed to protect fleas. These problems also understood by the malaria control and prevention focal person and head of health centre. The national strategic plan for malaria control and prevention in Ethiopia, NSP 2011 -2015, aimed at strengthening and scale-up of malaria control inter venations though prompt and effective diagnosis and treatment, case management though roll out of the highly efficacious ant malarial drugs (FDROH, 2010). Artemisinin- based combination therapies (ACTS), and selective vector control with special emphasis to scaling up LLITNs coverage and ensuring its utilization at house hold level, and targeted and timely application of IRS of households with insect side and environmental management. The two cornerstones were LLITNS and IRS particularly in sub-Sahara Africa (WHO, 2016).

The national malaria strategic plan states that community's participation to environmental management by eliminating mosquito breeding sites through draining and filling stagnant water is one of the control measures of malaria (MOH, 2015). However, malaria remains a major health problem for Ethiopia where only 25% of the population lives in areas that are free from malaria (WHO, 2014). It is still among the ten top leading causes of morbidity and mortality in children under-5 years (Deribew, 2013). Accordingly the WHO revised its fever treatment guide lines in 2010 to recommend anti malaria treatment (WHO, 2010).

5. CONCLUSION AND RECOMMENDATION.

5.1. Conclusion

In this study area a total of 25, 868 blood samples at the three health centers (Dandy, Horo lago and Akeyu) were submitted for malaria diagnosis for the last 5 years (2015-2019) in JardegaJarte district. From these 15,361 (60 %) were males and 10,507 (40%) were females. From the blood film samples 4,336 (16.7%) were microscopically confirmed as malaria cases. The prevalence of malaria in the study area was high and *P.falciparum* was the dominant species. The study showed that the prevalence of malaria was variable ranging from the highest record of 29 .8% in 2018 and lowest prevalence of malaria registered 4.9% in 2016 .This a fluctuating pattern with in the category of the high prevalence of malaria (>20 %.) in the years 2017, 2018, 2019, medium prevalence of (12.9%) in the years of (2015) and lower prevalence of (4.9%) in the years 2016,with average prevalence of 16.7% (Table1) in the study area.

The data collected from the three Health Centers in the Jardega Jarete Woreda from (2015 up to 2019) years showed variations in the prevalence of malaria. The highest prevalence of 42% was recorded from Dandy Health Center followed by prevalence of 38% and 20% from Harolago and Akeyu health Centers, respectively.

5.2. Recommendation

Based on these findings the following points were recommended:

- It is very crucial if patient records at health centers should include family identity (ID) so that spatial analysis of diseases can be carried out by linking cases history to the family.
- Further studies should be conducted to determine the status of malaria based on year round primary data to circumvent the problem of documenting and collecting data from secondary sources.
- Establishing a culture for LLINs, consistent use the most vulnerable groups such as children under the age of five years pregnant women.
- Spray appropriates in malarias kebeles indoor and outdoor before malarias become epidemic.
- Health care education on malaria should be enhanced and continued, the source of getting information on malaria through health workers and multimedia means need to be encouraged, strengthened and widely promoted.

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7. APPENDIX.

Appendix. I. Research Questions on the prevalence of malaria Health officer interview in the health center Jardega Jarete district.

- What was the prevalence of malaria in the Jardga jarete Wereda for last 5 years (2015-2019)?
- Is there any variation in prevalence of malaria between sexes and ages group in the study area?
- Which plasmodium species were dominant in the study area for the last five years?

Appendix. II. The prevalence of malaria with respect to month from secondary data in Jardega jarete district 2017 year.

Kebele		jan	Feb	mar	April	May..	Jun.	July.	August..	Sep.	Oct. ..	Nov.	Dec.	
Haro lago	Total dx	0	0	0	0	11	11	9	8	10	0	27	12	88
	Pos	0	0	0	0	11	11	9	8	1	0	13	0	53
Harodadi	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Sombo wato	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Agamsa	Total dx	0	0		0	0	0	3	12	11	6	6	5	43
	Pos	0	0	0	0	0	15	3	12	11	4	6	3	39
Abdidandi	Total dx	0		0	0	4	3	4	0	0	0	0	0	11
	Pos	0	0	0	0	0	3	4	0	0	0	0	0	7
Ifagudina	Total dx	0		0	0	7	0	2	9	10	6	11	0	45
	Pos	0		0	0	7	0	2	9	10	6	11	0	37
Dandi	Total dx	0	0	0	0	43	36	25	15	8	14	11	17	169
	Pos	0	0	0	0	0	3	4	0	0	0	0	0	7
Akeyu	Total dx	0	0	0	0	0	0	2	0		0	0	10	12
	Pos	0	0	0	0	0	0	2	0	0	0	0	2	4

Appendix .III .The prevalence of malaria with respect to month from Health center woreda secondary data in 2018 year.

Kebele		Jan	Feb	Marr	April	May	Jun	July	August	Sep	Oct	Nov	Dec	
Haro-lago	Total dx	13	21		31	25	2	7	6	25	9	3	28	170
	Pos	13	21		31	25	2	7	6	25	9	3	28	73
Harodadi	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Sombowato	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Agamsa	Total dx	6	0	18	17	22	16		0	0	0		14	93
	Pos	4	0	3	17	20	16	0	0	0	0	0	13	73
Abdidandi	Total dx	0	0	0	0	13	9	0	2	0	0	0	0	24
	Pos	0	0	0	0	13	9	0	0	0	0	0	0	22
Ifagudina	Total dx	11	0	0	5	4		0	12	2	0	0	0	34
	Pos	1	0	0	0	0	0	0	0	0	0	0	0	1
Dandi	Total dx	121	91	123	116	97	72	37	26	51	28	33	224	1019
	Pos	65	51	67	77	71	44	13	9	7	2	13	65	484
Akeyu	Total dx	0	0	8	0	20	0	0	5	0	18	7	10	68
	Pos	0	0	8	0	10	0	0	5	0	12	7	9	51

Appendix. IV. The prevalence of malaria with respect to month from secondary data in woreda 2019 year.

Kebele		jan	feb	mar	April	May	Jun	July	August	Sep	Oct	Nov	Dec	
Haro-lago	Total dx	0	30	15	6	3	6	10	0	18	5	8	10	111
	Pos	0	6	6	0	1	6	6	0	12	3	6	7	53
Harodadi	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Sombowato	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Agamsa	Total dx	0	5	5	10	4	3	0	0	2	3	5	7	44
	Pos	0	5	5	0	0	1	0	0	2	3	1	6	23
Abdidandi	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Ifagudina	Total dx	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pos	0	0	0	0	0	0	0	0	0	0	0	0	0
Dandi	Total dx	87	35	58	90	63	34	18	30	42	0	2	11	470
	Pos	40	29	35	53	26	9	5	4	4	0	2	4	211
Akeyu	Total dx	0	0	10	3	0	0	0	0	0	0	0	0	13
	Pos	0	0	10	1	0	0	0	0	0	0	0	0	11