ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGICAL SCIENCES

Prevalence of Malaria, Knowledge and Practices towards malaria and insecticide treated net Utilization among communities in Mygaba town, Western Tigray, Ethiopia.

BY:

Tsegay G/Maryam

A Thesis submitted to school of Graduate studies of Addis Ababa University in partial fulfillment of the requirements for the Degree of Master of Science in Biology.

Addis Ababa, Ethiopia

October, 2019

ACKNOWLEDGEMENT

Primarily, my deepest gratitude goes to the creator of this world God, who did these things possible.

Then I would like to thank my advisor Dr. Fitsum Tigu for his un served guidance and encouragement on every stage of this thesis work. I appreciate for his nice approach, constructive comments, willingness to share experience and smooth treatments.

Next, I would like to express deepest gratitude to mygaba Health center for providing me the necessary information, allow the laboratory facilities and technical supports. I am very grateful to all those who directly or indirectly involved in my thesis work specially mygaba health center laboratory technicians.

Finally, I would also like to express my thanks to the study participants for their willingness to participate in the study without them the study would not have succeeded.

Last but not the least; I would like to thanks for Addis Ababa University College of natural and computational sciences for gave me this chance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBRIVATIONS AND ACRONYMS

GOE	Government of Ethiopia
ITN	Insecticide Treated Net
KAP	Knowledge, Attitude and Practice
SPSS	Statistical Package for Social Sciences
MIS	Malaria Indicator Survey
PMI	President's Malaria Initiative
HEW	Health Extension Worker
CSA	Central Statistical Agency
MOP	Malaria Operational Plan
USAID	United State
FMOH	Federal Ministry of Health

ABSTRACT

Malaria is one of the major public health problems in many tropical developing countries including Ethiopia. Thus, comprehensive epidemiological information on the transmission and distribution of malaria in different localities is a key factor for the development of appropriate control strategies. The objective of this study was to assess the magnitude of malaria and insecticide treated net utilization among communities in Mygaba Town, Western Tigray, and Northern Ethiopia. A community based cross-sectional study was carried out to determine Knowledge and practice of communities towards malaria and utilization of ITNs during March to April 2019. Random sampling technique was carried out to select representative study participants among the community members. Data was collected using standardized questionnaire, laboratory examination of blood samples and five years' retrospective documents from the Health Center of Maygaba were investigated from 2015-2019. SPSS version 20 software package crosstab was used for the frequency distribution of independent variables. The organized data were presented in the form of tables, graphs and percentages. Majority 368 (91.3%) of the study participants were good and above knowledge on malaria infection, transmission and the vector. According to study result, most 316 (78.4%) of the study participants knew that malaria is communicable disease, of which 239 (75.6 %) of respondents known that malaria can be transmitted from infected to a healthy individual by mosquito bites. 332 (82.4 %) and 354 (87.8%) of study participants were aware of where to get the right treatment and also had a good knowledge about ITNs utilization respectively. Among the study participants, 257 (63.8%) of respondents have at least one ITNs and 173 (67.3%) of them were slept under ITNs during night time. The occupation, education and knowledge about methods of treatment of malaria had strong relationships with knowledge of ITNs utilization ($P < 0.05$). The overall malaria prevalence was 4.7%.

***Keywords*: -** Maygaba, ITNs, *Plasmodium falciparum, Plasmodium vivax*, Malaria, Prevalence

1. INTRODUCTION

1.1. Background of the Study

Malaria is one of the major tropical diseases which are adversely affecting the public he alth and the economic development of many developing countries. It has so far been a life threatening parasitic disease transmited by the bite of female, *Anopheles* mosquitoes. About half of the world population, 3.3 billion is at risk of malaria infection and around 250 million cases occur annually, leading to approximately 1 million deaths each year (WHO, 2008). The disease is the leading cause of death in children under the age five and pregnant woman in developing countries. The vast majority of cases reside in the African continent followed by south East Asia and Mediterranean regions.The disease remains one of the most important causes of human morbidity and mortality with enarmous medical and economic impact in the world (WHO, 2017).

The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2015, the region home to 90% of malaria cases and 92% of malaria deaths. 13 countries in sub-Saharan Africa accounts for 76% of malaria cases and 75% deaths globally. In areas with high transmission of malaria, children under five are particularly susceptible to infection, illness and death, more than two thirds (70%) of all malaria deaths occur in this age group between 2010 and 2015, the under-five malaria death rate fell by 29% globally (WHO, 2015).

In Ethiopia malaria causes 70,000 deaths each year and accounts for 17% of out patient visits to health institutions (MOP, 2008). It also accounts for 15% admissions and 29% of inpatient deaths. It has also been documented in the nation wide child survival study that malaria affects school attendance by 20% and contributes to 47% of the child deaths (Carter Center, 2007). *P. falciparum* and *P.vivax* are the two predominant *Plasmodium* species distributed all over the country, accounting for 60% and 40% of malaria cases respectively (MOH, 2004). The main malaria control strategies in Ethiopia includs ,but not limited to, early diagnosis and prompt treatment, vector control, epidemic managgement and personal protection through the use of insecticide treated nets (FMOH, 2008).

Malaria in Ethiopia is not only a health issue, but also a food security and environmental issue. The disease is a major impediment to socio-economic development as the main transmission seasons coincide with peak agricultural harvesting times. It has also been identified as potential impediment in conservation, irrigated agriculture and settlement in low land fertile areas that are very critical in the effort to improve food security and improved household income (CDC, 2008). In addition, due to fear of malaria in the low lands the population is largely settled on the highlands which has caused over population, ecological degradation and reduced productivity (CDC, 2008).

As Ethiopia is found in Africa, South of Sahara, which is favorable forthe multiplication of *Plasmodium* and the vector, the health hazards caused by malaria are very seri ous.Ethiopia is a tropical country with high temperature through out the year.The avail ability of many rivers and lakes provide favorable environments for the breeding of *Anopheles* mosquitoes and the development of the malaria parasite (Ashenafi Weldemic hael, 2008). *An. arabiensis* is the sole primary malaria vector in Ethiopia (Abose *et al*., 1998). It is widely distributed in the country and usually the vector of epidemic malaria. The second most frequent vector species in the country is *An. pharoensis*. Other less important vectors are *An. funestus* and *An. nili*, which were, in the past, important vectors of malaria in limited areas of Ethiopia; however, they are extremely scarce and much localized in their distribution (Tulu *et al.*, 1993).

Malaria transmission in Ethiopia is unstable and seasonal and determined byaltitude and climate, with the majority of the country's population living in the malaria prone areas (Graves *et al*, 2008). In the past, the distribution of malaria followed the topography: normal at altitudes >2000 meters above sea level, moderate transmission at 1500-2000 meters above sea level and endemic transmission at <1500 meters above sea level; malaria epidemics recorded upto 2,400 meters above sea level during increased temperature and adequate precipitation are conducive for both vector survival and parasite development with in the vector(Aynalem Adugna ,2007).

According to Gish (1992) and MOH (2002), the epidemiology of malaria in a given country is determined by different factors. These are conducive environments for the transmission, the presence of suitable *Anopheles* mosquitoes, the presence of *Plasmo*

dium, and the presence of an intermidiate host for the parasite. Environmental factors such as change in land use and land cover, rainfall, altitude and temperature affect the *Anopheles* breeding and have been used to predict malaria transmission risk.

Areas with greater amounts of precipitation and higher temperatures are expected to have greater malaria transmission, as these conditions favor breeding of many *Anopheline* species as well as parasite reproduction with in the mosquitoes (Hotez *et al*., 2006). Agriculture and urbanization may affect malaria transmission, as well; highly cultivated areas have increased suitable habitat for most of the primary vectors (Hotez *et al*., 2006).

ITNs are being distributed in all malarious areas of Ethiopia with the assistance of health extension workers, volunteer community workers and local administration. However, even if all households at risk are fully covered, nets must also be used consistently and correctly if they are to have maximum impact (Biadgilign *et al*., 2012). The coverage and proper utilization of ITNs which is one of the most promising malaria preventive measure in the country is also limited due to lack of sustainable distribution and issues related to replacement of nets, seasonality of malaria, and poor knowledge of the community with regard to the link between mosquitoes and malaria (FMOH, 2008).

Like other malarious areas of Ethiopia, ITNs are among the major malaria vector control strategies in malaria prone areas of Tigray Region, out of 717,813 malaria exposed households in the region, 533,939 (74%) households received at least one ITNs (personal communication to representative of Malaria Department in Tigray Health Bureau and Zewdneh Tomas *et al*. (2011). And in Wolikait district there were about 36,320 malaria exposed households in the Woreda, 29,116 (80.2%) households received at least one ITNs in 2018 (personal communication Health Bureau Wolikait).

(Gashaw Dagne and Wakgari Deressa. ,2008) reported that, owning at least one Long lasting insecticide net per household increased in Tigray, followed by Amhara and South Nation Nationalities people region, but Oromia had the lowest achievements in net ownership. Numerically the result of the study showed similar trend 79.1% in

Oromia, 84.5% in South Nation Nationalities people, 90.0% in Amhara and 92.0% in Tigray.

1.2. Statement of the problem

World Health Organization (WHO), estimates that 207 million cases of malaria occurred globally in 2012 (uncertainty range 135–287 million) and 627 000 deaths (uncertainty range 473 000–789 000) (WHO, 2012). *Plasmodium falciparum* causes most of the deaths in sub-Saharan Africa. An estimated 90% of all malaria deaths occur in Africa of which the majorities are children under five (91%) (WHO, 2012).

The use of ITNs is one of the main malaria control strategies in Ethiopia to reach the national targets to achieve malaria elimination within specific geographical areas with historically low malaria transmission and achieve near zero malaria death in the remaining malarious areas of the country (FMOH, 2015).

In Ethiopia, the Federal Ministry of Health (FMOH) conducted continuously mass distribution of LLINs between 2005 and 2007, targeting to distribute two LLINs per household in malaria endemic areas and further 15 million were distributed in 2010 and 2011 to replace LLINs distributed previously (FMOH, 2006). Despite this rapid scale up of each kebele since 2005, it is unlikely that all LLINs are still in use after six years (FMOH, 2012).

Identification of awareness gaps, monitoring of behavioral changes on malaria disease recognition and use of preventive and control measures such as the use of ITNs are a priority area for the Government of Ethiopia with a special emphasis on increasing coverage and use of ITNs as per the national malaria guidelines (FMH, 2012).

Increase in ITN access does not necessarily translate to equal increase in utilization (Teklehaimanot *et al.,*2007). Because, the success of ITN utilization depends on several factors: such as, willingness of people to use nets, inconvenience to hang the nets, educational background, place of residence, age and gender differences, and colour of nets (Teklehaimanot *et al.*, 2007).

There was no community based study which shows the true picture of prevalence of malaria and its influencing factors in Wolkait woreda. Therefore, the aim of this study was to identify the prevalence of malaria and proper utilization of ITNs and to create awareness on the prevention of malaria and proper utilization of ITNs of the Maygaba Towns and rural Villages of Maygaba.

1.3. Objectives

1.3.1 General Objective

The general objective of the present study was to asses the magnitude of malaria, knoweldge and practices towards malaria and ITN utilization among the rural and urban communities of Mygaba town, western Tigray, Northern Ethiopia.

1.3.2 Specific Objective

- To analyze the trend and patern of malaria cases for the past five years (2015-2019) in the study area.
- To determine the prevalence of malaria infection in the study population.
- To identify the main *Plasmodium* species causing malaria in the study population.
- To asses peoples' knoweldge and practice about prevention of malaria.
- To assess the utilization of insecticide treated bed nets in the study population

1.4 Significance of the study

The result will be useful to evaluate the progress of the woreda towards achieving the regional and national target and to take immedate actions in planing and implementation of preventaion and control strategies, to identify gaps in ITN utilization and to design copporiate information ,education and communication interventions towards improving its utilization among study population, to be used as a base line for the district Health Office to develop appropriate strategies to increase ITN utilization among the study population and to generate infrmations that helps malaria control program to improve ITN polices and design intrventions to prevent malaria.

2 LITERATURE REVIEW

2.1 Malaria Parasite

The genus *Plasmodium* contains more than 100 different species.They cause malaria in many types of animals and birds, as well as humans (WHO, 2007). Four distinct *Plasmodium* species infect humans: *P. falciparum, P. vivax, P. malariae,* and *P. ovale.* However, molecular methods have revealed the possible existence of other species morphological variants (CDC, 2004). The four major human *Plasmodium* species are found in tropical and sub-tropical regions through out the world and exhibited over lapping geographical distribution (CDC, 2004). Though each of the four species belongs to the same genus, each one has a distinctive appearance under the microscope and each one produce some what a different pattern of symptoms.

P. falciparum is wide spread in tropical and sub-tropical areas of Central and South America, Africa and Asia. It results in most severe infections and is responsible for nearly 90% of malaria related deaths in sub Saharan Africa (CDC, 2006). While *P. falciparum* predominates in warmer regions close to the equator, *P. vivax* on the other hand, predominates in more temperate regions. Since *P. vivax* can tolerate cooler temperatures, it is more geographically wide spread than *P. falciparum,* although transmission is usually low because it is season dependent (CDC, 2006).

P. malariae has a restricted distribution and ranks third in prevalence,but has a wide spread distribution. It is not usually life threatening (CDC, 2006), *P. ovale* is the rarest of the four species, and is mostly confined to tropical West Africa (WHO, 2007). All four species of *plasmodium* are known to occur in Ethiopia.However,*P. falciparum and P. vivax* are the most dominant malaria parasites in the country ,accounting for 60 % and 40% of malaria cases, respectively (WHO, 2007). *P .malariae* accounts for less than 1% and *P.ovale* is rarely reported (Tulu Assefa,1993).

The young ring forms of *P. falciparium,* as usually seen in the peripheral blood are very small. In many of the ring forms there may be two chromatin granules and marginal forms are fairly common. Succeeding develop mental stages of asexual erythrocytic stage do not generally occur in the blood, except in sever, pernicious‘cases (Tulu

Assefa, 1993). Although erythrocytic schizogony in *P. falciparium* is complet in 48 hours and periodicity of developmente is therefore of typically certian type, there frequently occurs in this species two or more broods of parasites, the segmentation of which is not synchronized, so that the periodicity of symptoms in the patienttend to be irregular (CDC, 2006).

Malaria is often classified as uncomplicated or complicated/severe.Uncomplicated mala ria can be caused by all four species and is characterized by periodic fever and chills, mild anemia and splenomegaly. Uncomplicated malaria is rarely fatal unless it is left untreated and it progresses to severe disease (Moriya and Kevin, 2009). Severe or complicated malaria is almost exclusively caused by *P. falciparum* infections (although occasionally by *P. vivax* and other species) and is associated with higher parasite burdens and vital organ dysfunction including central nerveous system (coma, seizures etc) and pulmonary compromise (pulmonary deems, respiratory distress etc.), acute renal failure, severe anemia and metabolic acidosis. This is more often seen in the case of severe *P. falciparum* infections Moriya and Kevin (2009). Most malaria deaths are associated with *P. falciparum* infections. RBCs infected with the maturing forms of these parasite express parasite proteins called PfEMP-1 associated with morphological structures ("knobs") that permit them to stick to endothelial cells lining the blood vessels and result in sequestration of these infected RBCs within the vascular bed of vital organs. When this occurs in the brain, the resulting cerebral malaria may lead to coma and death.Renal, pulmonary and gastrointestinal complications may also be seen. Congenital malaria and infection of the placenta may result in still birth, low birth weight infants, or prenatal mortality (RBM, 2003).

2.2 The Vectors of Malaria Parasite

Females of most species of mosquitoes require blood meal before the eggs can develop. Species that usually feed on humans are said to be anthropophagic. Anopheles gambiae (African malaria vector) are mainly anthropophagic, endophilic and endophagic. The resting and feeding behavior of malaria vectors is an important consideration in planning control measures (Mike, 2000). Temperatures from approximately 21℃-32℃ and a relative humidity of at least 60% are most conducive for maintenance of

transmission. In tropical regions temperature and humidity are often mediated by altitude. In Africa, altitudes above 1,500m are considered safe from malaria (Mike, 2000). However, it must be cautioned that with continuing global climate change, these figures may change, extending the range of mosquitoes well above those altitudes as ambient temperature rise. The mosquito density (number of female mosquitoes per human inhabitants) is a critical determinant of the intensity of infection. The malaria vector requires water to complete its developmental stage: egg, larva, pupa, and the adult. Blood-feeding usually starts at dusk and continues until dawn (Jaston, 2004).

2.3 Life Cycle of Malaria Parasites

Malaria infected mosquito bites on human beings. The *Plasmodium* species life cycle involves both vector mosquitoes and human host. It inoculates sporozoites in to the human blood-stream, and then the sporozoites travel to the liver. Upon sporozoite replication in the liver, merozoites release into the blood stream. The merozoites bind to the surface then enter the Red Blood Cells (RBCs) via a receptor-ligand interaction (CDC, 2004)

The parasite then undergoes growth through the ring and trophozoite stages, finally prod ucing schizonts containing multiple merozoites (erythrogenic cycle). Matured schizonts destruct RBCs and release merozoites in to the blood stream,which re-invade new RBCs (Figure 2). Occasionally, parasite maturation will result in the production of gametocytes which may be released in to the blood stream and are subsequently taken up by the mosquito, via a bite. Then gametocytes undergo the sexual stage of develo pment (sporogenic cycle) in the mosquito. When the mosquito takes her next blood meal, 10-14 or more days later, it can again infect a human host Lamb *et al.(* 2006) .

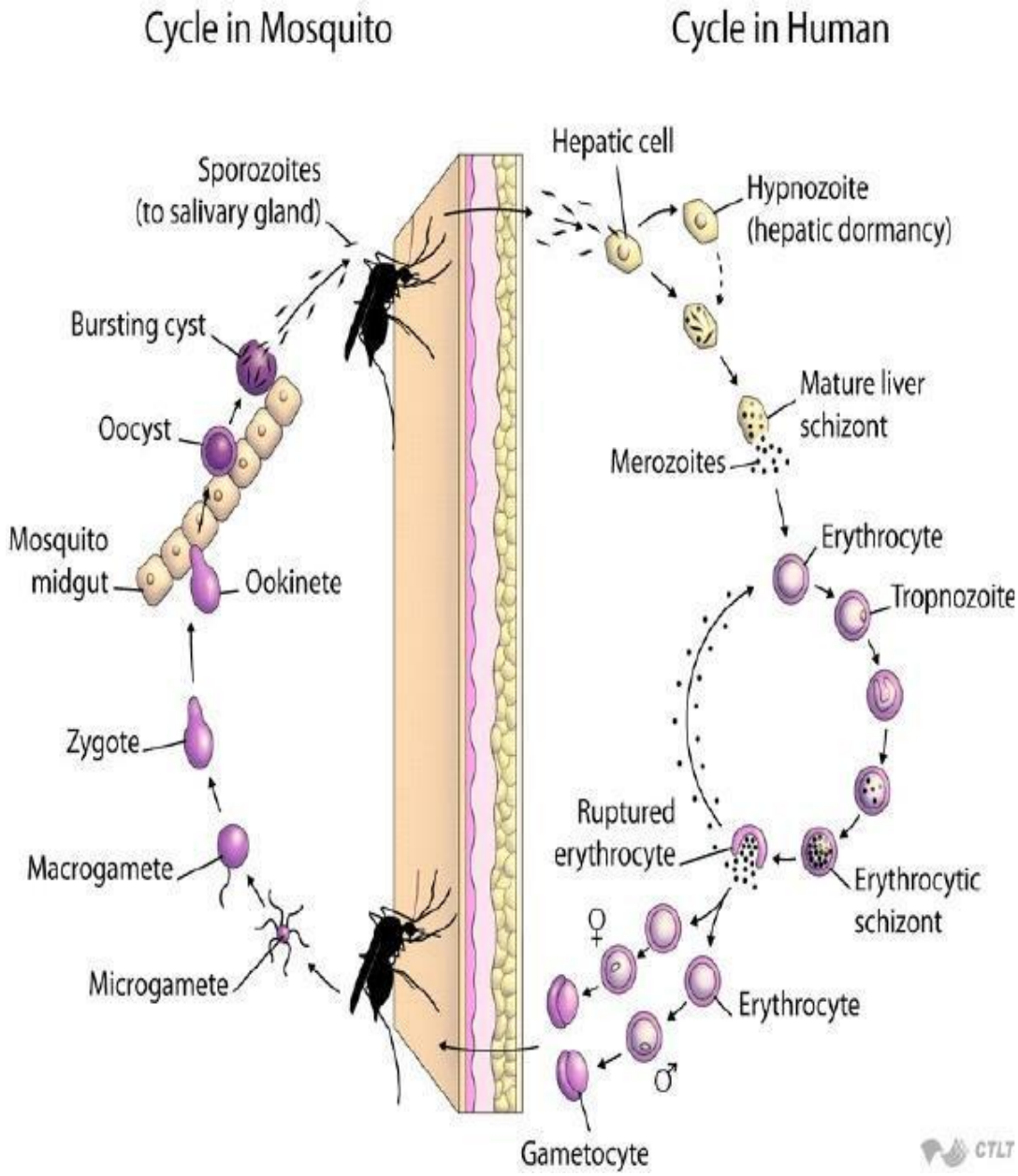


Figure 1. Life Cycle of Malaria Parasite (Lamb et al., 2006)

2.4 Global Epidemiology of Malaria

Malaria is the second most common cause of infectious disease-related death in the world, after tuberculosis. It is estimated to affect between 350 to500 million people annually and accounts for 1 to 3 million deaths per year (CDC, 2009). Sub-Saharan Africa has the largest burden of malarial disease, with over 90% of the world's malaria-

related deaths occurring in this region. Twenty-five million pregnant women are currently at risk for malaria, and, according to the World Health Organization (WHO), malaria accounts for over 10,000 maternal and 200,000 neonatal deaths per year (WHO, 2009).

Moriya and Kevin (2009) reported that ecological change, economic and political instability, combined with escalating malaria drug resistance, has led to a world wide resurgence of this parasitic disease. The combination of burgeoning international travel and increasing drug resistance has resulted in a growing number of travelers at risk of contracting malaria. It is estimated that as many as 30,000 travelers from industrialized countries contract malaria each year (Moriya and Kevin, 2009). However , this incidence is likely to be an under estimate because of the prevalence of under reporting.The majority of *P. falciparum* cases imported in to North America and Europe are acquired in Africa (85%) and travel to the African continent is currently on the rise.

Epidemiology of malaria is highly dependent on the transmission pattern of the parasite. An area supporting active malaria transmission is termed endemic whereas sporadic out breaks determine epidemic areas (WHO, 2000). The variation of malaria epidemiology is not limited by continents or between countries. There is also variation in the distributi on of *Plasmodium* in a single country. Malaria is widely spread throughout the tropical belt in to the sub-tropical lands, even to the edges of the temperate zones (Oyewole and Ibidago ,2007). Even at present, it is endemic in most of tropical and sub-tropical ecosystem world wide and exhibits great geographic diversity. This diversity is expressed in ecological and epidemiological characteristics in addition to the extensive polymorphism in the genes encoding antigenic proteins zones (Oyewole and Ibidago ,2007). It is the leading cause of death and disease in many developing countries, where young children and pregnant women are the groups most affected (Alamirew Dereje, 2002). Other risk factors are non- immune travelers, refuges, displaced persons and laborers entering endemic areas. Children particularly those under five, are at risk of developing severe malaria due to their relatively less developed immune systems, and the decline of passively acquired immunity (Alamirew Dereje, 2002).

2.5 Current Status of Malaria in Ethiopia

Malaria in Ethiopia is well described in national documents, demonstrating the threat to larger number of the population from P. *falciparum* and *P. vivax*, the major *An. arabiensis* vector and the high variability across different transmission strata. This variab

ility is produced in part by geography and climate and in part by recent scale up of control measures. This variability requires that the country address very different situations with prevention and control tools, but it also provides the opportunity to actively create and extend malaria free areas (Aschalew Alelign and Tadesse Dejene, 2016).

Malaria is pervasive to Ethiopia; 75% of the landscape areas below 2000 m above sea level is malarious, which is fertile low land areas and suitable for agriculture(Yared Legesse *et al*., 2007). More than 54 million populations live in these areas and are at risk of malaria (Yared Legesse *et al*., 2007). In Ethiopia major epidemics occur every 5-8 years, but focal epidemics were occurring every year. *P. falciparum* and *P. vivax* are two Species commonly known to cause malaria in Ethiopia accounting for 60% and 40% proportion, respectively Tsige Ketema et al. (2011).

The distribution and transmission of malaria in Ethiopia varies from place to place. For example, the distribution of malaria in Ethiopia is largely determined by altitude. Altitude affects the pattern of malaria distribution in Ethiopia through its effect on temperature. Risk of malaria is highest in the western lowlands of Oromia, Amhara, Tigray and almost the entire regions of Gambella and Benishangul Gumuz regions (Figure 2) (Aschalew Alelign and Tadesse Dejene, 2016). The midlands of Ethiopia between 1,000 and 2,200 meters' altitude experience seasonal transmission of malaria with sporadic epidemics every few years. In the eastern lowlands of Ethiopia (primarily Afar and Somali), malaria is endemic only along the rivers, as this part of the country is largely dry away from rivers (FMOH, 2015). Transmission is limited by the lack of water collections for mosquito breeding and low humidity due to low rainfall and sparse vegetation. The central highlands of Ethiopia are free of malaria mainly due to the low

temperatures, which slows the development of the vector and the parasite (Tsige Ketema *et al*., (2009).

Much of the Woina Dega Zone (Altitude 1500 – 2500 meters) is also malaria free, especially the zone in the 2000 – 2500 meters above sea level. Malaria in Ethiopia often occurs below 2000 meters, with short-lived transmission following the rains. However, malaria epidemics have been recorded up to 2400 meters during periods when increased temperature and adequate precipitation are conducive for both vector survival and parasite development within the vector (Tedros Adhanom *et al*., 2006).

A malaria indicator survey, 2007 indicated that parasite prevalence (as measured by microscopy) in Ethiopia and Oromia was 0.7% and 0.3%, respectively (USAID/CDC, 2010). According to this survey 60 out of 7,117 (1.0%) were positive for *Plasmodium* infection by microscopy, with 0.7% and 0.3% due to *P. falciparum* and *P. vivax*, respectively. Of the 6,775 matched individuals, 40 (0.6%) and 5 (0.1%) were positive for *P. falciparum* and *P. vivax*. No individuals tested positive for both *P. falciparum* and *P. vivax*. Prevalence of infection in children U5 was 0.9%. Of 45 positive individuals tested, 37 (87.0%) were children <15 years of age. Overall, 134 (2.0%) surveyed individuals tested positive for *Plasmodium* infection by RDTs, with 1.8% and 0.2% due to *P. falciparum* and *P. vivax*, respectively (Jima *et al*., 2010).

A Study conducted in Oromia and SNNPR regions of Ethiopia showed the overall malaria parasite prevalence of 2.4% (95% CI 1.6–3.5). Prevalence by cluster varied from 0 to 25%, with 55% of the 64 clusters having no positive cases. The malaria parasite prevalence differed markedly between Oromia, 0.9% (95% CI 0.5–1.6) and SNNPR, 5.4% (95% CI 3.4– 8.5) regions ($p < 0.001$). The prevalence was highest in the Eastern and North-Eastern Zones of SNNPR. The malaria species seen most frequently was *P. falciparum*: 69.4% of positive slides had *P. falciparum* and 30.6% had *P. vivax* Shargie *et al*. (2008). According to retrospective study at the Serbo Health Center, Kersa Woreda, Jimma, Ethiopia *P. falciparum* constituted the most pre dominant [64.6% (1946/3009 cases)], while *P. vivax* confirmed with 34.9% (1052/3009) cases Karunamoorthia and Bekele, D. (2009).

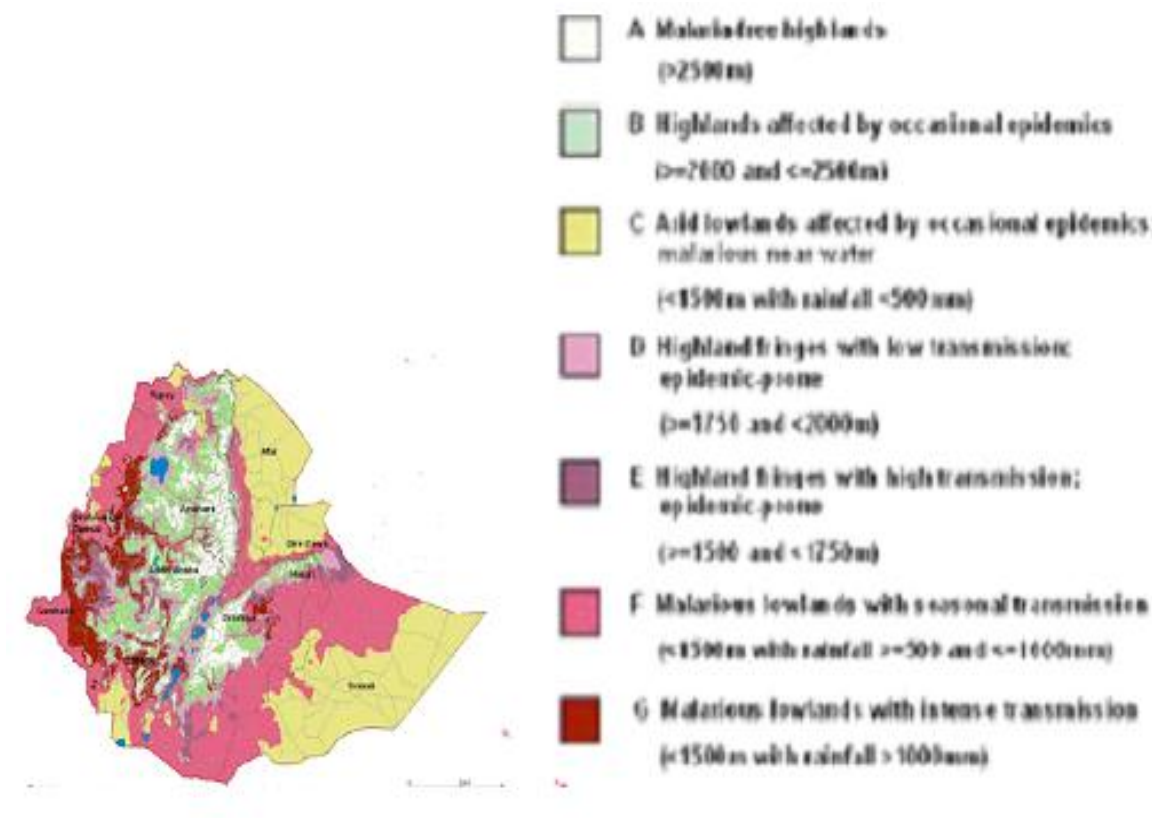


Figure 2.Distribution of Malaria in Ethiopia (Dawit Getnet et al., 2012).

2.6 Socioeconomic Consequences of Malaria

The socio-economic burden resulting from malaria is immense:1) the high morbidity and mortality rate in the adult population significantly reduces production acti vities; 2) the prevalence of malaria in many productive parts of the country prevents the movement and settlement of people in resource -rich low-lying river valleys; exposing a large population of the country to repeated droughts famine and overall abject poverty; 3) the increased school absenteeism during malaria epidemics significantly reduces learning capacity of students; 4) coping with malaria epidemics substantially increases public health expenditures (Wakgari Deressa., 2012).

The burden of malaria has been increasing due to a combination of large population mov ements, increasing large scale epidemics, mixed infections of *P .vivax* and *P. falcipa rum,* increasing parasite resistance to malaria drugs,vector resistance to insecticides

,low coverage of malaria prevention services, and general poverty (MOP, 2008). Out-patient consultations, in patient a dmissions and all in-patient deaths have risen by 21-23% over the last five years (MOP,2008). Quantification of the social and economic burden of malaria in Ethiopia is problematic since the victims live mostly in rural areas. Out of sight and out of mind of social scientists and other researchers, but some estimates a bound the social and economic consequences of the disease are sobering, with a large number of people kept from work by debilitating illness resulting in low productivity. While household malaria burden is likely to be under estimated by institution data, routine health reports clearly reveal the burden of malaria on the health system (Tedros Adhanom *et al*., 2006).

Malaria transmission peaks bi-annually from September to December and April to May conciding with major harvesting season with serious consequences for the subsistence economy of Ethiopia's countryside, and for the nation in general (Wakgari Deresa,2012). Vector activity peaks in the months often set a side for cultivation, weeding, harvesting and winnowing (Gabriel and James, 2005). Weddings and other culturally important activities also peak at this time. In other words, optimal climatic regimes for socio-economic activities in rural Ethiopia also favor the reproduction, propagation and there by the preyingup human blood of vector mosquitoes (Gabriel and James, 2005).

2.7 Diagnosis of Malaria

The most economic, preferred, and reliable diagnosis of malaria is microscopic examinat ion of blood films because each of the four major parasite species has distinguishing characteristics (Warhurst and Williams, 1996). Two sorts of blood film are traditionally used; thin films are similar to usual blood films and allow species identification because the parasite's appearance is best preserved in this preparation.Thick films allow the microscopist to screen a larger volume of blood and are about eleven times more sensitive than the thin film. So 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. With

the pros and cons of both thick and thin smears taken into consideration, it is imperative to utilize both smears while attempting to make a definitive diagnosis (Garcia, 2001).

From the thick film, an experienced microscopist can detect parasites levels (or parasitemia) as few as 5 parasites/1μLblood. Diagnosis of species can be difficult because the early trophozoites ("ring form") of all four species look identical and it is never possible to diagnose species on the basis of a single ring form; species identification is always based on several trophozites (Garcia, 2001).

2.8 Knowledge, Attitude and Practices of Communities towards Malaria

Findings of a study conducted in two indigineuous populations of Bangladesh revealed superficial knowledge on malaria transmission, prevention and treatment by the respondents(Syed *et al*., 2009). Poverty and level of schooling were found as important determinants of malaria knowledge and practices. Majority of the ill persons either did not seek any treatment (31%) or practiced self-treatment (12%). Also, there was a delay beyond twenty-four hours in beginning treatment of malaria-like fever in more than half of the instances (Syed *et al*., 2009). According to a study done in Swaziland a substantial number of research participants showed reasonable knowledge of malaria, including correct association between malaria and mosquito bites, its potential fatal consequences and correct treatment practices. Almost 90% (n= 320) of the respondents stated that they would seek treatment within 24 hours of on set of malaria symptoms, with health facilities as their first treatment option. In door residual spraying (IRS) coverage and bed net ownership were 87.2% and 38.8%, respectively. IRS coverage was more than 80% with in the targeted communities (Khumbulani *et al.*,2009). In a study in Khartom, Sudan, about76.6% of household heads reported delayed treatment seeking behavior for malaria Salwa *et al*. (2009).

As per the study conducted in Orissa, India Majority of respondents (n = 281) sought some sort of treatment e.g. government health facility (35.7%), less qualified providers (31.3%), and community level health workers and volunteers (24.3%). The single most common reason (66.9%) for choosing a provider was proximity. Over a half (55.7%)

sought treatment from appropriate providers within 48 hours of onset of symptoms. Respondents under five years belonging to scheduled tribe community and visiting a provider more than five kilometers were more likely to have delayed or inappropriate treatment (Ashis *et al*, 2010).

Surveys of malaria indicators conducted in 2007 in countries with high, stable tran smission:mozambique revealed a parasite prevalence rate of 2.4% in 2842 children fewer than 5 years of age. A community-based survey data from two districts indicated parasite prevalence rates of 0.8% (68/8650) overall and 0.4% (9/2123) in children under 5 years of age Samuel *et al*.(2008).

According to a study carried out in North-western Tanzania, 453 (90.1%) of the study subjects mentioned malaria as the most important disease in the area. Four hundred and sixty four respondents (92.1%) knew that malaria is transmitted through mosquito bite. A total of 436 (86.7%), 306 (60.8%) and 162 (32.1%) mentioned fever, vomiting and loss of appetite as major symptoms/signs of malaria, respectively and 278 people (87.2%) sought treatment from health facilities Safari *et al*.(2010).

2.9 Control and Prevention of malaria

The use of bed nets was significantly more frequent among those with higher income, more years of education (Kenny *et al*., 2006). According to a community based study done in Nigeria regarding preventive measures, 17 (4.2%), 37 (9.2%), 55 (13.8%), 39 (9.8%), 26 (6.5%), 26 (6.5%), and 45 (11.3%) of the study population reported sleeping under net, door and window screening, cover cloth, mosquito repellant/insecticides spray, environmental hygiene, herbal decoction and chemoprophylaxis respectively. Self-treatment (medication) accounted for 267 (66.8%) compared to a hospital treatment which accounted for 93 (23.3%). Late diagnosis, wrong medications, incomplete doses, lack of knowledge about malaria episode and *Anopheles* spp as malaria vector are some of the factors militating against prevention and proper management of the illness (Oyewole and Ibid Apo, 2007).

A study about socio-cultural predictors of health-seeking behavior for febrile under-five children in Mwanza-Neno district, Malawi shows that the majority of care givers were

able to recognize fever and link it to malaria. Traditional beliefs about causes of fever, unavailability of antimalarial drugs within the community, barriers to accessing the formal health care system, and trust in traditional medicine were all associated with delays in seeking appropriate treatment for fever Chibwana *et al. (*2009).

Malaria and other vector Borne-Diseases Team and in the FMOH's Communicable Disease Prevention and Control Department. The team's responsibilities included overall coordination of malaria and other vector-borne diseases control at national level, identification of implementation capacity gaps for Regional Health Bureaus (RHBs) and provision of training, formulation and dissemination of malaria national policy and technical guidelines, oversight of policy implementation, monitoring and evaluation of impact of operational program activities, and advocacy for malaria as a priority disease (Sheleme, 2007).

In a national representative malaria indicator survey (MIS) conducted in Ethiopia on 5,083 households, 3,282 (65.6%) owned at least one ITNs out of which 53.2% of all persons had slept under an ITNs the prior night, including 1,564 (60.1%) children <5 years of age, 1,891 (60.9%) of women 15 - 49 years of age, and 166 (65.7%) of pregnant women (Jima *et al*.,2010).

Overall, 906 (20.0%) households reported to have had IRS in the past 12 months and 131 (16.3%) children with reported fever in the two weeks preceding the survey, sought medical attention within 24 hours. Of those with fever, 86 (11.9%) took an anti-malarial drug and 41 (4.7%) took it within 24 hours of fever onset Jima *et al*. (2010).

A cross-sectional study conducted in three urban areas of Assossa zone, Western Ethiopia, showed the following results; about 48% of the study population was aware that malaria can be transmitted by mosquito bites (Yared *et al.*,2007*)*. Thirty percent (30%), of respondents were aware that mosquitoes carry disease causing microorganism, 95% were aware that mosquito's bite during night, and 61% were aware that mosquitoes rest at dark places inside the house. About 58% and 52% of respondents identified sleeping under a mosquito net and eliminating mosquito-breeding sites, respectively, as major malaria preventive measures. Respondents' education and

health status were associated with comprehensive knowledge on malaria preventive measures Yared Largesse *et al*. (2007). Another study conducted in the district of Samre Saharti, Tigray, Northern Ethiopia showed that most of the respondents (92.7%) were able to mention at least one symptom of malaria. Mosquito as a cause of malaria was recognized by nearly half of the respondents (48.8%). Most of the households had a bed net (85.9%). To have a literate person at home, to belong to the lowland stratum, to have received some type of health education and to own a radio were associated with the knowledge of malaria. A strong association remained between living in the lowland stratum, to own a radio and to live close to the health post and the use of ITNs. Being a house wife, lack of health education and to live further than 60 minutes walking distance to the health post were related to a delay on treatment finding from rural Tigray, Ethiopia (Paulander *et al*, 2009).

A study done in Butajira, Ethiopia, reported fever, headaches, chills and shivering were the most frequently mentioned symptoms of malaria reported by 89.7%, 87.5% and 81.3% of the study subjects, respectively. About 66% of the study community related the mode of transmission to the bite of infective mosquitoes and 43.7% of them believed that malaria could be transmitted from person to person through the bite of mosquitoes. Mosquitoes are mainly believed to bite human beings at night (73.2%), breed in stagnant water (71%) and rest in dark places inside houses during the day time (44.3%). Malaria was thought to be preventable by 85.7% of the respondents. Of these, 62.4% reported chemoprophylaxis, 39.6% mentioned indoor residual spraying and 25 indicated eliminating breeding sites as preventive methods Wakgari Deresssa *et al*. (1999).

2.9.1 Vector control

In Ethiopia controlling malaria vector has a long history of more than 50 years, but malaria remains a major cause of morbidity and mortality in Ethiopia (Tsige *et al*.,2009). Currently the main goal of vector control in Ethiopia is to reduce the level of malaria transmission. The main focus is: Improved targeting of localities for coverage and quality of indoor residual spraying, introduction, expansion and scaling up the use of ITNs and Application of environmental management and chemical larval control in areas where it could be cost effective (Yared *et al.,* 2007*).* Public and individual

measures- include: wearing long sleeves and pants during the dusk-to-dawn period; sanitary improvements, such as filling and draining areas of impounded water; installing screens and using bed nets; particularly the use of impregnated bed nets increases the effectiveness of the bed net; larvicides and biological control, for example using larvivours fish; and nightly spraying of screened living and sleeping quarters with insecticides (Dawit *et al.*, 2012).

According to Ethiopian Federal Ministry of Health malarias are defined as being located <2,000 m altitude. Of 5,083 surveyed households, 3,282 (65.6%) owned at least one ITN. In ITN-owning households, 53.2% of all persons had slept under an ITN the prior night, including 60.1%children <5 years of age, 60.9% of women 15 - 49 years of age and 65.7% of pregnant women. Overall, 20.0% households reported to have had IRS in the past 12 months. Of 747 children with reported fever in the two weeks preceding the survey, 131 or 16.3% sought medical attention within 24 hours. Of those with fever, 11.9% took an anti-malarial drug and 4.7% took it within 24 hours off ever onset (Jima *et al*., 2007).

2.9.2 Parasite case management

Proper management of malaria cases is one component of malaria prevention and control strategies and programmes. Ethiopia introduced the use of artemether-lumefantrine (with the trade name Coartem) as first line treatment for falciparum malaria as early as July 2004, and full implementation at all health facilities was started in 2005 (FMOH, 2012; President's Malaria Initiative PMI, 2009). This treatment implies that the malaria patient only needs to take one pill to cure the malaria attack. Malaria diagnosis in health facilities is based on clinical, rapid diagnostic tests (RDTs) and microscopy. RDTs are available at the health posts while microscopy is available at higher level health care Institutions like health centers, hospitals or private clinics.

Management of malaria cases at health institutions continues to face many challenges to implement the strategy of early diagnosis, treatment and prevention of malaria in Ethiopia. Similarly, it was reported that fewer than 10% of patients in Mali had access to laboratory malaria confirmation services. In the same country, studies have indicated

that only 31.4%of under-fives, suspected to suffer from malaria, had received any anti-malarial drugs and only 15.1% of these had been treated within 24 hours of the onset of fever attacks (PMI,2008). Moreover, Lettenmaier (2003) has reported that anti-malarial drug sellers in many developing countries sell anti-malaria drugs under different brands with varying levels of efficacy. Some of these drugs do not meet the quality standards, which could contribute to anti-malaria drug resistance, another blow to the RBM strategy. Poor quality of diagnosis of malaria cases hinders the effectiveness of the clinical services at health institutions. In Ethiopia, there is no effective national and systematic evaluation of the quality of microscopy for diagnosis of malaria except one attempt in the Amhara region (PMI, 2009).

3 MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted in Mygaba Health Center in mygaba town in the western Tigrai Regional State, northern Ethiopia (Figure 3.1). The town of mygaba is located around 1257 kilometer and 437 kilometer north of Addis Ababa and west of Mekelle cities, respectively. Geographically, the town-is situated with 13°30′00″ and 14°07′00″ North latitude and 36°40′15″ and 37°48′00″ East longitude with an altitude ranges from 677 to 2755 meters above sea level. The study area has Kola agro ecological zone with annual temperature ranging 15^{O}C to 30^{O}C and annual rainfall ranging from 700–1800 mm.

The study area had 6 health post and one health center. According to the Mygeba town communication office, the total population of the area was about 30974 of which 15642 were males and 15332 were females. Maygaba Town and Maygaba rural areas had a total of 06 villages of which One were urban and the rest Five were rural villages with an estimated 7039 households. Each village had an average family size of 4.4 persons per household.

In Mygaba town the major economic activities are mainly related to petty trade, daily labor and urban agriculture such as dairy farming, irrigation, and poultry. Selling 'Beer, Tea, Injera and Tella' are the main means of income for women to sustain their life and educate their child. Major economic activities for rural areas of mygaba are agriculture depend on grows of cash crops such as sesame, cotton and sorghum, because of the district is known for its fertile soil. According to the District Health office, malaria transmission in the study area are mostly occurred bi- annually from September to October and from march to May. The study was conducted from March to April, 2019.

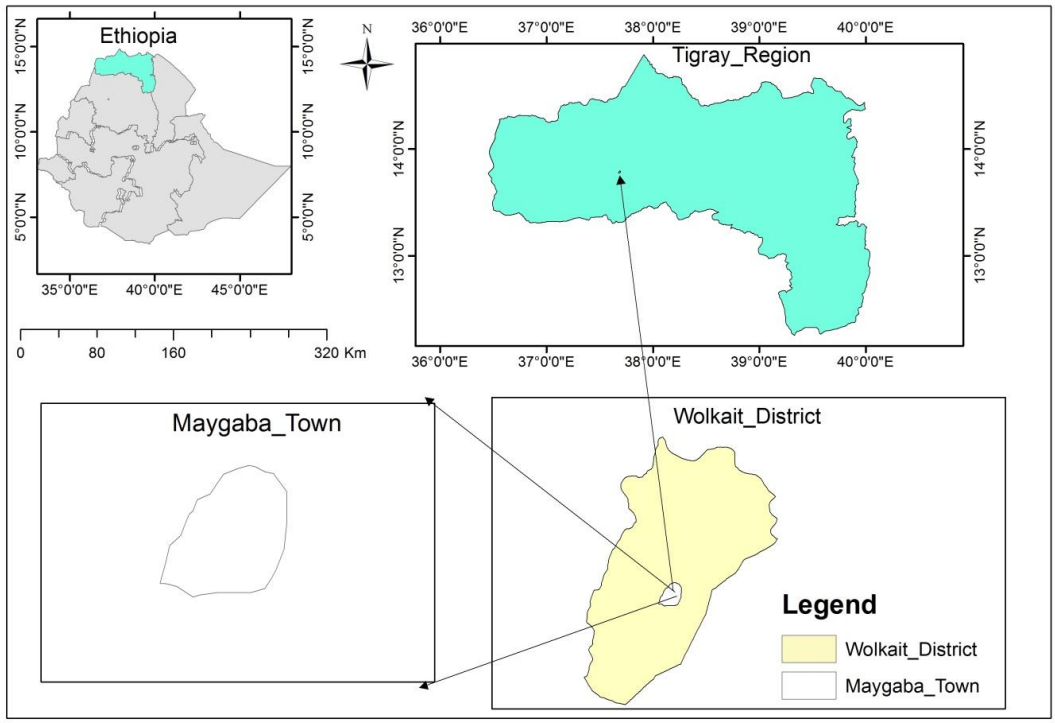


Figure 3. Topographic map of Wolkait Woreda and Maygaba Town Kebelle

3.2 The Study Design

A community based cross- sectional study was carried out to determine Knowledge and practice of communities towards malaria and utilization of ITNs during March to April 2019. The study involved questionnaires survey and laboratory examination of blood samples for parasites.The content of the questionnaire included general characteristics of the respondents issues, biomedical knowledge like awareness of malaria, treatment seeking behavior of the households and the practices of utilization of ITNs by households. The questionnaires was administered to selected heads of the households in the study area. And documents of the people diagnosed in the past five years (2015-2019) was used as a secondary retrospective data source from Mygeba Helth center.

3.3 Study Population

Members of the households living in the five villages and one urban from the district were the source of the study participants for the questionnaire survey and parasitological blood film. According to the Mygeba town communication office, the area had an estimated total population of five villeges and one urban were 30974 of whom 15642 were males and 15332 were females. The total population of targeted areas for this study was 16781 of whom 8474 were males and 8306 were females. Out of 16781 in Korarit Kebele 7266, 4962 in Mayaba Kebele and 4553 in Adijamus Kebele . Finally, 422 households sample size were selected randomly that was included in the study using the cluster method.

3.4 Sample Size Determination and sampling procedure

The sample size of the study estimated by taking maximum prevalence of 50%. The sample size was determined by the following formula's= Z^2 P (1-P) /d^2 (Naing *et al.*, 2009). Where, Z= 95% confidence interval (1.96), P= prevalence of the disease (50%) and d= marginal error = 5% (0.05), N = sample size

$N = Z^2 P (1-P)/d^2$

$N= (1.96)^2 x\ 0.5x\ (1-0.5) / (0.05)^2$

N = 384 people

Contingency = 10%= (0.1) (384) = 38

384+38= 422 the study participants were used in the present study. Therefore, a total of 422 of sample size were included in the present study to get more accurate value. Random sampling method was used to select the representative sample size of head of the households.

3.5 Eligibility Criteria

Inclusion criteria: The following inclusion criteria were used to recruit the participants' questionnaire: The participants were permanent member in the community, adult (above 18 years old, a women or head of the household). For malaria prevalence studies all individual members of the selected households who were willing and were no anti-malaria therapy in.

Exclusion criteria: For questionnaires survey, community members who were unable to communicate and mentally handicapped were excluded. Individuals who were taking anti-malarial therapy or who had been treated with anti-malarial drugs within the past 4 weeks were also excluded from the study.

3.6 Data Collection

Data was collected using standardized questionnaire, laboratory examination of blood samples and retrospective documents from the Health Center of Maygaba were used.

3.6.1 Questionnaire Survey

The study utilized structured questionnaires which were prepared and adopted from different literatures by the principal investigator. It was used to generate information related to study population' basic socio-demographic characteristics, their knowledge, practice and utilization of ITNs. Information was obtained from head of the households or representatives of the households.

The questionnaire had two sections. The first section included basic socio-economic and demographic background of the study participants. These were age, sex, educational level, occupation, family size, etc. The second part dealt with study participants knowledge about malaria and utilization of ITNs. The questionnaire was developed in English and later it was translated into the national language (*Amharic*). Then the actual data collection through this questionnaire was carried out by visiting each of the study subjects at their home from March to April 2019.

3.6.2 Blood Sample Collection and Clinical Examination

Blood samples from sample populations were collected from pricking their finger-tips with the help of laboratory technician by using disposable blood lancet. Thin and thick films was made on the same slide side by side, and then properly labeled and the thin blood smears were fixed with methanol at the sites. After air drying in a horizontal position, the slide was placed in the slide box. Finally, the samples were carefully transported to the District Health Center for parasitological examination. The thick smear was stained with Giemsa solution while the thin smear was stained with 3% Giemsa solution for 30 minutes. Staining and blood smear examination was performed following the standard protocol (Garcia, 2001).

3.6.3 Microscopic Examination of Blood Samples for Malaria Parasites

The presence of malaria parasites on thick blood smear was examined by using high power magnification objective (40x) and the identification of *Plasmodium* species from the thin blood smear was done under the oil immersion objective (100x). The thick smear was used to determine the presence of malaria parasites and the thin smear was used to identify the type of *Plasmodium* species infection. Both microscopic examination and rapid diagnosing test methods were used for species identification and it was used as an alternative because of shortage of many and chemicals to use the microscope.

3.6.4 Collection of Malaria prevalence Data

The health records particularly the laboratory confirmed malaria cases of the past five years, from 2015-2019, were collected using the health record review format developed by the laboratory technician.

3.7. Data Quality Control

Before going to data collection, pretest of the questionnaire was done among 5% of the sample in nearby inhabitants and the necessary correction and structuring of the questionnaire was made. The data was checked for accuracy and consistency on daily

basis by the principal investigator during data collection. The first drop of blood was wiped out to avoid contaminants and interstitial fluid; scratch clean free, new slides was used. The thickness of blood film was monitored; each time a smear was made. Any inappropriately made, stained, fixed or dried slide was discarded and replaced by a newer one.

3.7 Data Analysis

The data were analyzed by linking to months, seasons, years, sexes and malaria parasite species. Statistical analysis was carried out using SPSS version 20 software. Descriptive statistics was used to give a clear picture of population characteristics such as age, sex, and the distribution of *Plasmodium* species. Chi square test was calculated to determine the association of some socio-demographic characteristics such as age, sex, level of education with the prevalence of malaria parasite in the study population. Statistical significance was defined at *P-values* less than 0.05 ($P<0.05$).

3.8 Ethical Consideration

The study was carried out after obtaining permission from Health Bureau of Wolkait Woreda and Addis Ababa University of Zoological Science Department. Before conducting the investigation, the researcher discussed about the study with rural administrative bodies in the study area. All the study participants were clearly informed about the purpose of the study and kindly asked to participate. All malaria positive study population was treated using appropriate anti-malarial drugs by appropriate health workers.

4 RESULTS

4.1 Prevalence of Malaria Infections Among the Study Participants

Among the total participants who gave blood for malaria infection test, 19 (4.7%) of them were confirmed microscopically positive for malaria parasite infection. Out of 19 malaria infected study participants, 12 (63.16%) and 7 (36.84%) of them were males and females respectively. In this study the prevalence of malaria was found to be higher among males as compared to females (Table 1).

Regarding prevalence of malaria infection along participants' age, the age group 18-30 was constituted for 84.2% of malaria prevalence and followed by 31-40 age group, (10.5%) and (5.3%) above 41 age groups respectively . The prevalence of malaria was found to be higher among the young age group as it compared to old age group study population. This might be activities of youngsters like irrigation farming activity in night or old age group obtained immunity from repeated exposure for malaria parasite. Table 1 showed that as age in year increases among study participants prevalence of *Plasmodium* decrease and young males were more infected by malaria parasite than young females because of their outdoor activities. In the present study, out of 19 malaria positive individuals, 12 (63.16%) and 7 (36.84%) were *P. falciparum* and *P. vivax*, respectively (Table 1).

Table 1.Prevalence of Plasmodium species infection by age Mygaba Town, During March – April 2019.

Age Group & Sex	**No Examined**	**Malaria Parasite**		
		Pv+ (%)	**Pf + (%)**	**Total No + (%)**
18-30 M	126	4(9.3)	6 (11.1)	10(20.4)
F	71	2(3.4)	4 (10.6)	6 (14.04)
31-40 M	80	0	1(1.2)	1 (1,2)
F	70	1 (1.4)	0	1 (2.0)
> 41 M	42	0	1 (2.4)	1 (2.4)
F	14	0	0	0
M	248	4 (1.6)	8(3.2)	12 (4.8)
F	155	3 (1.9)	4 (2.6)	7 (4.5)
Total	403	7 (1.2)	12 (2.98)	19 (4.7)

Pf=*Plasmodiumfalciparum* Pv=*Plasmodium vivax*

4.2 Socio-Demographic Characteristics of Study participants

Summary of socio-demographic characteristics of the study participants are presented in Table 2. Of the total 422 respondents, the rate of response was 95%. That means 403 respondents were participated. Of the study participants, 248 (61.5%) were males and 155 (38.5%) of them were females. In relation to the study participants mean number of age was 1.65 (SD=0.712), of 197 (48.9%) of the study participants were 18-30 years old, 150 (37.2%) of them were 31-40 years old and 56 (13.9%) were above 41 years old. Regarding the occupational status of the study participants 219 (54.3%) were farmers, 10 (2.5%) were merchants, 114 (28.5) were students, 57 (14.1%) were house wife and 3 (0.7) un-employed (Table 2).

With respect to the educational status of the study participants, 216 (53.6%), 173 (42.9%) and 14 (3.5%) had no formal education, completed elementary school and secondary school, respectively. Regarding the study population availability of livestock, 349 (86.6%) had livestock and kept in house whereas, 54 (13.4%) had no livestock at

all. The family size of study participants, 46 (11.4. %) had 1-3 persons, 106 (26.3%) had 4-5 and 251 (62.3%) had greater than five persons per house respectively (Table 2).

Most of study participants, 272 (67.5%) were married, 76 (18.9%) were single, 36 (8.9%) were divorced and 19 (4.7%) widowed. With house type of the study participants, 231 (57.3%) had advanced housing units which are made of steel iron sheet roof, stone wall and with one or more rooms, and houses made of steel roof and wood wall with one room. The remaining 172 (42.7%) had conventional housing units which include grass roof, wooden, wood or cement wall and had at least two rooms (Table 2).

Table 2.Socio-Demographic Data of the Study Participants (N=403) in Maygaba Town, March-April 2019.

Socio-demographic data	Frequency	Percentage
Sex		
Male	248	61.50%
Female	155	38.50%
Age		
20-30	197	48.90%
31-40	150	37.20%
>41	56	13.90%
Village		
Korarit	164	40.70%
Maygaba	147	36.50%
Adijamus	92	22.80%
Marital status		
Married	272	67.50%
Single	76	18.90%
Divorced	36	8.90%
Widowed	19	4.70%
Family size		
1-3 persons	46	11.40%
4-5 persons	106	26.30%
> 5 persons	251	62.30%
Education		
Illiterate	216	53.60%
Elementary School	173	42.90%
Secondary school	14	3.50%
Occupation		
Farmer	219	54.30%

Merchant	10	2.50%
Student	114	28.30%
House wife	57	14.10%
Jobless	3	0.70%
Livestock		
Yes	349	86.60%
No	54	13.40%
Housing unit		
House made from iron steel roof and stone wall	231	57.30%
House made from grass roof and wood	172	42.70%

4.3 Knowledge on Malaria Infection, Transmission and Vector

The study result indicated that most of the study participants, 316(78.4%) knew that malaria can be transmitted from an infected person to a healthy person. The rest 87 (20.7%) indicated that either malaria cannot be transmitted from person to person or they had no idea at all (table 3). The participants knowledge about malaria mode of transmission was higher, where 239 (75.6%) knew that malaria can be transmitted from person to persons by mosquito bites. while,77 participants (24.3%) wrongly related malaria transmission with different factors, of these 33 (10.4%) of respondents associated the cause of malaria with dirty environment and 44 (13.9%) related malaria transmission with bad season (Table 3).

Regarding mosquitoes biting time, the majority of the study participants (86.6%) responded that mosquitoes bite mostly at night time and the remaining 15 (6.3%) and 17 (7.1%) responded that mosquitoes bite during the day time and day and night time respectively (Table 3).

Table 3. Knowledge on malaria infection, transmission and vector (N=403) in Maygaba Town, March -April 2019.

Question items	Frequency	Percent
Have you heard about Malaria?		
Yes	368	91.30%
No	11	2.70%
I do not know	24	6%
Is malaria Communicable?		
Yes	316	78.40%
No	64	15.90%
I do not know	23	5.70%
If you Yes to the above question how malaria is transmitted (n=316)		
Mosquito bite	239	75.60%
Bad season	44	13.90%
From dirty environment	33	10.40%
IF you say Mosquito, what is mosquito biting time? (n=239)		
Day time	15	6.30%
Night time	207	86.60%
Day and Night	17	7.10%

4.4 Practices of malaria control and prevention

The most frequently reported (81%) malaria prevention methods by the study participants was the use of ITNs, followed by use of local Gabi (12.10%), using smoke from burning leaves and cow dung (4.20%) and environmental sanitation (2.7%). In the present study, ITNs was mentioned as primary method of malaria prevention. Majority of the study participants, (84.1%) know that malaria is treatable whereas, (15.7%) of them did not knew that malaria is treatable. In this study, participants who know that malaria is treatable were larger than those who had misconception towards malaria treatment. Presently, because of the globalization and advancement of the technology of mass media, people are aware of where to get the right treatment. So, most of the

residents in Maygaba town get their treatment from the nearby health center. As the data analysis indicated (82.3%) of the study group was getting the treatment from governmental health center. On the other hand, (8.9%) of the respondents were getting their treatment from pharmacy. And the rest (6.5%) participants were traditionally threating themselves and the few (2.4%) were unknown (Table 4).

Table 4. Malaria prevention by study population (N=403) in Maygaba Town, During March-April 2019

Items	Frequency	Percent
Is malaria preventable		
Yes	332	82.40%
No	24	6%
I do not know	47	11.60%
Which prevention method of malaria do you use mostly (n=332)		
Environmental sanitation	9	2.70%
Use of ITNs	269	81%
Using smoke from burring leaves and animal product	14	4.20%
Local Gabi	40	12.10%
Is malaria treatable		
Yes	339	84.10%
No	21	5.20%
I do not know	43	10.70%
If you said yes to the above question, where do you get treatment you used? (n=339)		
Traditional healers of village	22	6.50%
Health center of village	279	82.30%
Pharmacy	30	8.90%
Others	8	2.40%

4.5 Knowledge and Utilization of ITNs Aamong Study Participants

4.5.1 Knowledge and Attitude of Participants on ITN usage and Possession

As the result shown in (Table 5), most of the study participants (87.9%) knew ITN. Whereas, (12.20%) study participants didn't Knew what ITN mean. With respect the source of information about ITN, out of 305 who had information about ITN, 227 (74.4%) of them received information from health service providers and the rest 65 (21.3%) and 13 (4.3%) received information from radio and leader of Kebele (Table 5).

In terms of possession of ITN, the majority of the study participants (63.8%) reported that, they had at least one insecticide treated bed net while (36.2%) participants had no bed net (Table 5). With respect of ITN number per household, 184 (71.6%) of the study participants claimed that they had one ITN, 39 (15.2%) and 34 (13.2%) had two and three ITNs, respectively. Out of 146 study participants who didn't have ITN, 64 (43.8%) of them had no ITN because their net was old and damaged and the rest 82 (56.2%) reported that they had no ITN at all because of unavailability of ITN in their area (Table 5).

Majority of the study participants 337 (83.6%) had knowledge concerning the benefit of ITN and sleeping under ITN, however very small respondents, 66 (16.4%) were didn't know the benefit of sleeping under ITN. Out of the 337 study participants who had awareness of the benefit of ITN, 292 (86.6%) of them used ITNs to prevent mosquito bite, 35 (10.4%) to get comfort and 10 (3%) for other purpose .In this study, most of the respondents reported that they used ITN for prevention of mosquito bites (Table 5).

Table 5. Knowledge and Ownership of ITNs among the Study participants (N=403) in Maygaba town, during (March-April 2019).

Items	Frequency	Percent
Do you have ITN?		
Yes	257	63.80%
No	146	36.20%
Have you ever heard about use of ITN?		
Yes	305	75.70%
No	98	24.30%
If your answer is yes for the above question what are your sources of information's? (n=305)		
Radio	65	21.30%
Health worker	227	74.40%
Kebele leader	13	4.30%
How many ITN, you have (n=257)		
One	184	71.60%
Two	39	15.20%
Three	34	13.20%
If you said No to the above question what is your reason not to have		
Old & damaged	64	43.80%
No availability ITNs? (n=146)	82	56.20%
Do you know the benefit of sleeping under ITNs?		
Yes	337	83.6%?
No	66	16.40%
If you yes, the above question, what is the benefit of sleeping under ITNs(n=337)		
Do not get bitten by mosquito	292	86.60%
To get comfort	35	10.40%
Others	10	3%

4.5.2 Utilization of ITN

The result showed that, 173 (67.3%) were slept under ITN the night prior to survey, whereas, 84 (32.7%) did not utilize their ITN night prior to survey. One hundred three (40.1%) of the respondents replied that, they had used for less than two years and 154 (59.9%) were used it for more than two years. Frequency of ITN utilization as reported by the study participants those who have ITN, majority of them 172 (66.9%) have utilized ITNs during malaria transmission time and others 73 (28.4%) and 12 (4.7%) have utilized ITNs as regularly and sometimes respectively (Table 6).

Regarding groups given priority to sleep under ITN in the family as reported by study participants out of 257 had at least one ITN, only 23 (9%) of them claimed that they give priority for children under five, others 155 (60.3%) of them give priority for pregnant woman and children and 79 (30.7%) of them give priority for mother to utilize ITN. Out of 257 respondents who had ITN, only 67 (26.1%) retreated their ITN with chemicals, whereas 190 (73.9%) replied that they did not retreated their bed nets (Table 6). The major reason given for not retreating bed nets, were lack of awareness about the importance of treating mosquito bed nets and lack of chemicals to retreat the nets.

Table 6. Practices and Frequency of ITN Utilization (n=403) in Maygaba, during (March –April 2019).

Items	Frequency	%
Have you /your family members slept under ITNs last night (n=257)		
Yes	173	67.3%
No	84	32.7%
What is your ITN utilization experience? (n=257)		
1-2 years	103	40.1%
>2 Years	154	59.9%
How often do you / your family use ITNs? (n=257)		
Regularly	73	28.4%
During transmission time	172	66.9%
Sometimes	12	4.7%
Priority groups to sleep under ITNs in the households (n=257)	79	30.7%
Mother and Children	155	60.3%
Pregnant Woman	23	9%
Children under 5		
Did you treat your ITNs for the second time (n=257)?		
Yes	67	26.1%
No	190	73.9%
What is your reason for not treating your ITNs for the second time? (n=190)		
Lack of awareness	89	46.8%
Lack of chemicals	101	53.2%

4.6Association bitween Some Selected Socio-Ddemographic Data and Knowledge about Malaria and ITN Utilization

Out puts of association between the knowledge about ITNs utilization and socio-demographic variables and some malaria knowledge are presented in (Table 7). The study participants' age groups had statistically insignificantly association with their knowledge about ITNs utilization. The result in which the first and second age groups scored higher knowledge, because of their repeated exposure of ITNs education, knowledge of ITNs benefit and knowledge of malaria prevention (Table 7).

The educational status of the study participants was associated with knowledge about ITNs utilization and it was statistically significant (x^2=7.612, P=0.006). Elementary and above educational status, (74.9%) had good knowledge about ITNs utilization, of these 35.3% and 39.6% of them scored good and higher knowledge about ITNs utilization, respectively. Only 65.3% of illiterates had good knowledge about ITNs utilization (Table 7).

family size of the study participants,1-3 persons (11.4%), 4-5 persons (26.3%) and greater than five persons (62.3%) were scored high knowledge about ITN utilization respectively and statistically insignificant association with knowledge about ITN utilization (p=0.145). In contrast to other socio-demographic factors, i.e. sex, didn't show any significant association with knowledge about ITN utilization and occupation show significant association with knowledge about ITN utilization (p= 0.13).

Knowledge of the study participants about malaria transmission and prevention methods had statistically insignificant association with knowledge about ITNs utilization (x^2 =5.738, p= 0.226). The study participants related malaria transmissions with mosquito's bite, (70.3%) of them scored good knowledge about ITNs utilization. The study participants' knowledge about prevention and treatability of malaria had statistically insignificant and significant association respectively, with knowledge about ITNs utilization at (p =0.785 and 0.002).

Table 7. Chi-square Association of Knowledge on Malaria and ITNs Utilization with Socio–Demographic Data (n=403) in Maygaba Town.

	Knowledge Utilization of ITNs				
Characteristics	**Poor (F%)**	**Good (F%)**	**High (F%)**	**X^2**	**P-Value**
Sex					
Male =248	75 (30.2%)	98 (39.5%)	75 (30.2%)	0.026	0.871
Female =155	47 (30.3%)	63 (40.7%)	45 (29%)		
Age					
18-30= 197	58 (29.4%)	81 (41.1%)	58 (29.4%)		
31-40=150	44 (29.3%)	62 (41.3%)	44 (29.3%)	0.851	0.654
>41 = 56	21 (37.5%)	22 (39.3%)	13 (23.2%)		
Family size					
1-3person=46	15 (32.6%)	18 (39.1%)	13 (28.3%)		
4-5person=106	36 (34%)	42 (39.6%)	28 (26. 4%)	3.861	0.145
>5person=251	71 (28.3%)	100 (39.8%)	80 (31.9%)		
Occupation					
Farmer=219	69 (31.7%)	86 (39.5%)	63 (28.9%)	6.219	0.013*
Non-Farmer=184	52 (27.7%)	89 (47.3%)	47 (25%)		
Education					
Illiteracy=216	75 (34.6%)	87 (40.3%)	54 (25%)		
Elementary School and above=187	47 (25.1%)	66 (35.3%)	74 (39.6%)	8.201	0.006*
Malaria transmission methods					
Mosquito bite=239	71 (29.7%)	101 (42.3%)	67 (28.0%)	7.612	0.226
Others=77	22 (28.6%)	26 (33.8%)	29 (37.7%)		
Is malaria treatable?					
Yes=339	102 (30.1%)	133 (39.2%)	104 (30.7%)	16.98	0.002*
I do not know=21	13 (61.9%)	4 (19.1%)	4 (19.1%)		
Is malaria preventable					
Yes=332	100 (30.1%)	133 (40.1%)	99 (29.8%)	0.074	0.785
I do not know=24	15 (62.5%)	5 (20.8%)	4 (16.7%)		

* Significant at $p<0.05$, F=frequency, %=percent

4.7 Trends and Patterns of Malaria Infections in Mygaba town and Mygaba rural Villages from Year 2015-2019 in Health Center

The prevalence of malaria among outpatients at Mygaba from the year 2015-2019 is shown in Table 8. In the health center follows almost similar (decrease) trends in each year. Significant rise in malaria prevalence was observed between 2016 and 2017 years. This was much higher than the other three years. As the information obtained from the delegates of the health center, there were about three initial problems for the rise of the prevalence of malaria. For instance, there was unseasonable rain fall was made the prevalent dramatically to increase. The other cause for the prevalence to rise was that the workers of the health center sent to the countries training centers to upgrade their skill of the carrier and that made the gap to become misdiagnose. The last means for the prevalence was shortage of man power in that health center to take the controlling action against spreading diseases. As it is shown in Table 8, more males were infected than females, (Table 8).

The overall recorded reviews within the past five years indicated that both *P. falciparum* and *P. vivax* species were the common malaria parasite reported each year in the study area. The predominant malaria species were *P. falciparum* followed by *P. vivax* accounting for (60.8%) and (39.2%) of malaria infection respectively in the area during the years 2015-2019, which is also in agreement with the cross-sectional study result has been confirmed by blood sample examination as well (Table 8).

Table 8. Distribution of Malaria Cases by sex and age Trend in Maygaba town, Western Tigray, Ethiopia (2015- 2019).

Year	Age	NOof malaria positive	Male (%)		Female(%)	
			Pf	pv	pf	Pv
2015	18-30 M	43	23	20	----	----
	F	7			5	2
	31-40 M	10	6	4	-----	------
	F	5			4	1
	>41 M	10	8	2	-----	------
	F	4			2	2
2016	18-30 M	51	33	18	------	-----
	F	47			29	18
	31-40 M	20	13	7	-------	------
	F	16			9	7
	>41 M	17	16	5	------	-------
	F	10			6	4
2017	18-30 M	41	26	15	-----	-------
	F	29			16	13
	31-40 M	18	11	7	-----	------
	F	17			11	6
	>41 M	12	7	5	------	-------
	F	11			6	5
2018	18-30 M	38	23	15	-----	------
	F	12			7	5
	31-40 M	11	7	4	-----	-----
	F	7			4	3
	>41 M	9	5	4	------	------
	F	6			4	2
2019	18-30 M	21	16	5	-----	-------
	F	19			12	7
	31-40 M	14	8	7	---	----
	F	8			5	3
	>41 M	8	4	4	----	------
	F	10			5	5
Total		531	206	115	117	93

Pf=*Plasmodium falciparum* Pv=*Plasmodium vivax*

4.8 Assciations of Socio-Demographic charactersitics with malaria prevalence among Study Population.

Table 9 shows the association of some socio-demographic characteristics with malaria infection and the association of malaria infection with the sexes was not statistically significant (P = 1.00). Age of the study participants was statistically significant association with malaria infection (p =0.002).

In relation to educational status of the study participants, 14 (73.7%) and 5 (26.3%) illiterate and others educational status (Elementary school and above), respectively were positive for malaria. The educational status of study participants had statistically insignificant association with malaria infection (P =0.155, COR = 0.436). Regarding housing unit of study participants had statistically insignificant association with malaria infection (P=0.643).

In this study the occupations of the study population were grouped into two categories farmers and non-farmer groups which in turns includes; housewives, students and merchants. The study population, 14 (73.7%) and 5 (26.3%) were farmers and non-farmers respectively, were malaria infected groups (Table 9). The occupation of the study population had not statistically significant association with malaria infection (P=2.03, COR = 5.497). In this study farmers were infected more than other groups this was probably because of their work that, they stay outside at night. Because of high temperature in this area, mostly farmers accomplished their daily activities especially during night.

Table 9. Associations of Socio-Demographic Data of the Study participants with Malaria Infections (n=403) in Maygaba Town.

	Malaria Case			
Factor	**Yes (n=19)**	**No (n=384)**	**p-value**	**COR (95% CI)**
Sex				
Male	12	236	1.0	1.075(0.414-2.792)
Female	7	148		
Age				
18-30	16	181	0.002*	5.982(1.715-20.863)
>31	3	203		
Education Status				
Illiterate	14	211	0.155	2.296(0.811-6.500)
Elementary & above	5	173		
Occupation				
Farmer	14	211	0.155	0.436(0.156-1.233)
Non farmer	5	173		
Family Size				
above 5 per	15	243	0.222	2.176(0.708-6.684)
less than 5 per	14	141		
Livestock				
Yes	12	264	0.618	0.779(0.299-2-2.029)
No	7	120		
Housing Unit				
Conventional	7	165	0.643	1.292(0.498-3.352)
Improved	12	219		

*Significant at p< 0.05, COR = Crude Odds Ratio CI= confidence interval

5 DISCUSSIONS

Knowledge and awareness of study participants about malaria, its transmission and vector were assessed. The result revealed that three hundred sixty-eight (91.3%) of the study participants heard about malaria. This finding was in agreement with study from Myanmar where majority of study population had heard about malaria in their area Samuel *et al.* (2008). Majority of the respondents (75.6%) had knowledge about mode of transmission of malaria while the rest of the respondents (24.1%) had misconceptions about malaria transmission mode. This result clearly showed that, quarter of the studied community had no awareness about the malaria infection and their mode, of transmission. This may be because of inadequate health knowledge. However, respondents of this study had higher awareness than the study reported from North Central Nigeria Jengre where 40.6% had adequate and 62.7% inadequate knowledge about malaria transmission mode, respectively (Chiredan et al,2008). Overall result obtained from this study was higher than the same study conducted in Southern Ethiopia, where only 15.6% respondents had knowledge as malaria transmission was related with mosquito bites Terefe *et al*. (2015).

The most frequently reported (81%) malaria prevention methods by the study participants, in this study was the use of ITN and it was mentioned as primary method of malaria prevention. This finding was higher than the study reported by Gashaw Dagne and Wakgari Deressa (2008) which reported, 62.6% from ssouthern Ethiopia, Wonago Woredas was used ITN as malaria prevention method. And it was similar to the study from Tigray, northern Ethiopia Zewdneh Tomas *et al.* (2011) and Northwest Tanzania majority of respondents reported that they used ITN for prevention of mosquito bites. Most of the study participants (74.4%) replied that the source of information about ITN was from health service providers. This finding is in agreement with the study from Northwest Ethiopia where the majority of the study participant heard information from health professionals Yibeltal Berie *et al*. (2013). And it was lower than study conducted in Southern Ethiopia where, 87.8% study participants heard information from health professionals (Terefe *et al ,(*2015).

In terms of possession of ITNs, most of the study participants (63.8%) reported that, they had at least one insecticide treated bed net. This figure was in agreement with study conducted in Southern Ethiopia by Gashaw Dagne and Wakgari Deressa (2008) and North Western Nigeria by Abdullahi *et al*. (2014). Result of the current study was higher than the national malaria indicator survey of Ethiopia (MIS, 2011), and the study conducted in Western Ethiopia by Geletta Gashere *et al*. (2014) and Teshome Degefa *et al.* (2015).

In this study, most of respondents (86.6%) reported that, as they used ITN for prevention of mosquito bites, which is in agreement with the result from northern Ethiopia by Zewdneh Tomass *et al*. (2011) and lower than results from southern Ethiopia where 90.1% (Dejene Hailu, 2014) and 91.4% (Ayalew Astatkie, 2010) and higher than study conducted in Bungoma Kenya where 75% used ITN for prevention of mosquito bites (Ndwiga *et al*., 2014).

According to President's malaria initiative (2013) the proportion of the participants that slept under ITNs in the previous night is the measures of ITN utilization. In the current study (67.3%) of the study participants slept under ITN the night prior to survey. This finding was higher than result of study conducted in Western Ethiopia where only (64.9%) households utilize at least one ITNs Geletta Gashere *et al*. (2014), and from study conducted in North Western Nigeria where (58%) of households used ITNs the night before survey Abdullahi *et al.*(2014).

The educational statuses of the study participants was associated with knowledge about ITNs utilization and it was statistically significant (x^2=7.612, P=0.006). Elementary and above educational status (74.9%) had good knowledge about ITNs utilization, of these 35.3% and 39.6% of them had good and higher knowledge about ITNs utilization, respectively. This finding was similar with result of study conducted in Southern Ethiopia where educational status of study participants significantly associated knowledge of ITNs utilization Terefe *et al*. (2015) and Ndwiga *et al.* (2014). The study participants knowledge about prevention and treatability of malaria had statistically insignificant and significant association with knowledge about ITNs utilization at (p

=0.785 and 0.002). This result was similar with study finding from South Ethiopia Dejene Hailu (2014).

Among the total participants who gave blood for malaria infection test, 19 (4.7%) of them were confirmed microscopically positive for malaria parasite infection. The prevalence of malaria among the study participants was much lower than other findings (5.4, 6.3, 61.6, and 37.3%) from Southern, Western, North-Western Ethiopia and NorthWestern Nigeria respectively (Dejene Hailu, 2014), (Teshome Degefa *et al.*, 2015), (Abebe Alemu *et al*., 2014) and (Abdullahi Fana *et al.*, 2014). These big differences could be explained by the fact that, the control and prevention strategies which were in practice in study area particularly indoor residual sprays (IRS) or weather condition of the study area.

In this study the prevalence of malaria was found to be higher among males as compared to malaria infected females. A similar result was reported from ArbaMinch showed that the prevalence of malaria parasite was higher in males than in females and prevalence of *Plasmodium* decrease with increase of age (Belayneh Regasa 2014). In the present study, out of 19 malaria positive individuals, 12 (63.16%) and 7 (36.84%) were *P. falciparum* and *P. vivax*, respectively. The present study result was contrary with study conducted in Arsi-Negelle, where *P. vivax* (74%) and *P. falciparum* (19.8%) infection was reported by Mengistu Hailemariam and Solomon Gebre (2015), with study conducted in South-Central Ethiopia where *P. vivax* (86.5%) and *P. falciparum* (12.4%) infection were reported by Adugna Woyesso *et al*. (2013). According to the FMOH (2014), *P. falciparum* and *P. vivax* are the two predominant malaria parasites, distributed all over Ethiopia accounting for 60% and 40% of malaria cases, respectively.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The finding of this study shows the prevalence of malaria among study participants was 4.7%. Almost all age groups affected but the age group of 18-30 years were more vulnerable for malaria infection than the age groups greater than 31 years old. The prevalence of malaria in the study area shows difference among sexes, more males were infected than females. Both *P. falciparum* and *P. vivax* were dominant *Plasmodium* species and *P. falciparum* was dominant in the study area.

In the present study, most of study participants had good knowledge about the transmission of malaria and 75.6% of them knew that malaria can be transmitted from infected to a healthy individual by mosquito bites. .

The results also confirmed that, 63.8% of study participants were possessed at least one ITN. The ratio of ITNs within family is not adequate and there is no accessibility of ITNs in area during the study time. ITN utilization among study participants were good where 67.3% of them were slept under ITBNs during study time.

69.7% of the study participants‟ had good knowledge about utilization of ITN. The remaining 30.3% had poor knowledge about utilization of ITNs, this were due to the availability of ITNs, number of ITN per family, and knowledge about ITN and malaria.

Malaria occurrence appeared to follow different patterns in the study sites, low transmission during dry seasons and high transmission during wet seasons or in months next to main rainy season.

6.2 Recommendations

Based on the present findings, the following recommendations have been forward. To minimize the prevalence of malaria and to increase utilization of insecticide treated net.

- Woreda health office should undertake rapid and uniform replacement of ITNs among rural kebeles
- Health Extension Workers have to teach the community during the ITN distribution in order to alleviate the prevailing misconception and raise the overall knowledge of community about malaria and ITNs.
- Moreover, extra works must be done in increasing ITNs coverage in the study area to maximize the benefit of the intervention.
- The accessibility of bed nets with re-treating kit needed in study area and this should have to consider family size to avoid imbalance between family sizes.
- Future studies on the prevalence of malaria and its control practices using wider population are recommended.

7 REFERENCES

Abdullah Fana, Babtope Alo, Samuel Naphtali and mikah Salah. (2014). Malaria Prevalence and Insecticide Treated Nets Usage in Argungu.International Journal of Innovation and Scientific Research **6** (2): 149-154.

Abebe Alemu, Hans-Peter Fuehrer, Gebeyaw Getnet, Afework Kassu, Sisay Getie and Harald Noedi. (2014). Comparison of Giemsa microscopy with nested PCR for the diagnosis of malaria, North Gondar. Ethiop. J.M. **13**:1741.

Abose Tarekegn, Olana Dereje, Alamirew Dereje and Beyene Yoseph (1998). Re-Orientation and definition of the role of malaria vector control in Ethiopia; the epidemiology and control of malaria with special emphasis to the distribution, behavior and susceptibility to insecticides of anopheline vectors and chloroquine resistance in Ziway, Central Ethiopia and other areas. Geneva: Malaria Prevention and Control Programme, World Health Organization.

Adugna Woyessa Wakgari Deressa and Ahmed Ali. (2013). Malaria risk factors in Butajira area, South-central Ethiopia. A multilevel analysis.J.M.**12**:273.

Alamirew Dereje (2002). Determinants of symptomatic and asymptomatic malaria. Ethiop. Jornal of Health Development.**3**:56-64

Aschalew Alelign and Tadesse Dejene (2016).Current status of malaria in Ethiopia.Mekele Ethiopia.Actapara. Glob.**7** (1):01-06

Ashenafi Woime (2008). Changes in the Spread of Malaria in Ethiopia: Case study from Hawassa and Hosanna areas. Telemark University College, Norway. Medical **12**:312-314

Ashenafi Woldemichael. (2008). Changes in the spread of malaria in Hawassa and Hossaena 2006-2007

Ashis Das and Tksundari Ra. (2010). Factors affecting treatment-seeking for febrile illness in a malaria endemic block. Boudh district, Orissa, India: policy implications for malaria control. J.M**. 9:**377-399.

Available at:http://www.kck.usm.my/ppsg/stats_resources.htm

Ayalew Astatkie (2010). Knowledge and Practice of Malaria Prevention Methods among Residents of Arba Minch Town and Arba Minch Zuria District. Southern Ethiopia. Ethiop. J. H. Sci. **20** (3): 185-192.

Aynalem Adugna. (2007). Malaria in Ethiopia (http://www. Ethio-Demography and Health Organization).

Aynalem Adugna. (2009). Malaria in Ethiopia. Http: // www. Ethio Demography and Health.

Belayneh Regasa. (2014). Magnitude of Malaria Infection in Ethiopia,Arba Minch University, Microbiology and Pathology press. Ethiop. G. J. M.R**. 14** (7): 9-21.

Biadgilign S, Reda A, Kedir H.(2012). Determinants of Ownership and Utilization of Insecticide-Treated Bed Nets for Malaria Control in Eastern Ethiopia. Journal of Tropical Medicine. 2012:7.

CDC. (2004). Center for disease control and prevention department of Health and Human service http://www.cdc.gov/malaria/biologylRetrived on 12 February, 2009.

CDC. (2006). center for Disease control and prevention Department of Health and Human Services, Center for Disease Control and Prevention /http:wwwcdc. gov/malaria biology/Retrieved on December 20, 2009.

CDC. Malaria rapid diagnostic test. MMWR 2007; 686.

CDC. Simian malaria in a U.S. traveler---New York, 2008. MMWR 2009; 58; 22-32.

Center for disease control and preventation. (2008). Department of Health and Human Services. /http: www.cdc.gov/malaria biology/

Centers for Disease Control and Prevention Web site, authors. Malaria facts. [Accessed August 1, 2009]

Chibwana, A., Mathanga, Don.P, Chinkhumba, T. and Campbell., (2009). Socio-cultural predictors of health-seeking behavior for febrile under-five children. Mwanza Nenodistrict, Malawi. J.M .**8**:219-250

Chirdan Ol and Ayuba Ib (2008).Impact of the health education on home treatment and prevention of malaria in Jengere, North Central Nigeria Annals of African Medicine7 (3):112-9

Dawit Getnet, Temesgen Zewotir and Hennery Mwambi. (2012). Prevalence and risk factors of malaria in Ethiopia.Malaria Journal , **11**: 195.

Dejene Hailu (2014). Malaria Prevention and Control in Ethiopia. Doctor of Literature and Philosophy in the subject Health Studies. University of South Africa. Dissertation. 211-213

Eholie J. (2009). Therapeutic Hand book for Malaria in Africa, 1st edition. Institutde Méd ecineetd 'Epidémiologie Appliquée. France**.** 7-21.

Estifanos Shargie, Teshome Gebre and Ngondi Jeremiah. (2008). Malaria prevalence and mosquito net coverage in Oromia and SNNPR regions of Ethiopia. J. P. H.8: 321, 1471-2458.

FMOH (Federal Ministry of Health). (2012). *National malaria guidelines*.3rd edition. Addis Ababa.39-41

FMOH (Federal Ministry of Health). (2011). Malaria Program Performance Review Aide Memoire. Addis Ababa Ethiopia. 2-10.

FMOH (Federal Ministry of Health). (2014). An Epidemiological Profile of Malaria in Ethiopia. National Malaria Control Team & Ethiopian Public Health Institute, Federal Ministry of Health. Addis Ababa, Ethiopia. Version 1.0.

FMOH (Federal Ministry of Health). National five year strategic plan for malaria prevention and control in Ethiopia 2006–2010. Addis Ababa, Ethiopia:: Federal Ministry of Health 2006.

FMOH (Federal Ministry of Health). National Malaria Guidelines. Addis Ababa, Ethiopia: : Federal Ministry of Health 2012.

FMOH (Federal Ministry of Health).National Strategic Plan For Malaria Prevention Control and Elimination in Ethiopia 2011-2015.

FMOH. Addis Ababa: Ethiopia Federal Democratic Republic of Ethiopia Ministry of Health; 2006. Proceedings of the National Workshop on the Review of the First Five-Year (2001-2005) and Preparation of the Second Five-Year (2006-2010) National Strategic Plan For Malaria Prevention and Control in Ethiopia.

Gabriel Senay and James Virdin. Developing Malaria Early Warning System in Ethiopia. 25th Annual ESRI International User Conference. Paper No. UC2409. San Diego. 2005.

Garcia, L.S. (2001). Diagnostic Medical Parasitology.4th ed. ASM Press, Washington, D. C.850-872.

Gashaw Dagne and Wakgari Deressa. (2008). Knowledge and utilization of insecticide treated nets among freely supplied households in Wonago Woreda, Southern Ethiopia. Ethiop. Journal of Health Development. (22):34-41.

Geleta Gashere.(2014).Trends of Malaria Prevalence in Ilu Galan, BakoTibe, and Danno Districts, West Shoa Zone, Oromiya Region., Ethiop. J. Bio and Chem.Rev. **31** (2): 678-693.

Gish, O. (1992). Malaria Eradication and the selective approach to health care, some lessons from Ethiopia. International Journal of Health Science **22:** 179- 192

Graves, P.M., Frank O. Richards, Jeremiah Ngandi, Paul M. Emerson, Estifanos Biru shargie. Tekola Endeshaw, Pietroceccato, Yeshwamebrat Ejigsemahu, Aryc W. Mosher Afework Hailemariam Mulat Zerhun, Tesfaye Teferi, Brhane Ayele, Ayenw Mesele, Gideon Yohannes, Abate Tilahun and Eshowe Gebre. (2008). Individual, household and environmental risk factors for malaria infection in Amhara, Oromia and SNNP regions of Ethiopia. Trans. R. Soc. Trop-Med-Hyg. **10** (16): 24-28.

Haque, U., Ahmed.SM. And Huda, M. (2009). Malaria Prevalence in Endemic Districts of Bangladesh Journal of Malaria **4** (8):1371-6737.

Hotez, P. R, A. s Fenwick, F, F.Jr. Richards, D. and Molyneux. (2006). Recent progress (in integrating the control of the neglected tropical diseases. Trends in Parasitology. Trop. J.M. Oxford University Press, (3): 85-90.

Jima Daddi, Asfaw Getachew and Bilak Hana (2010). Malaria indicator survey, Ethiopia: coverage and use of major malaria prevention and control interventions. J.M. **9**:58-63.

Karunamoorthia, K. and Bekelea, M. (2009). Prevalence of malaria from peripheral blood smears examination: A 1-year retrospective study from the Serbo Health Center. Kersa Woreda, Ethiopia. J.I and P.H. **2:** 171-176.

Kenny, S. and Klinkenberg, E. (2006). Border malaria in China knowledge and use of personal protection by minority populations and implications for malaria control: a questionnaire-based survey. J.M .**5**:105-120.

Khumbulani, W. and Musawenkosi, L. (2009). Community knowledge, attitudes and practices (KAP) on malaria in Swaziland a country earmarked for malaria elimination. Journal of Malaria **8**:29-31.

Lamb, J.T., Brown, D.F., Pot-cnik, A.J and Langhorne, J. (2006). Plasmodium Life Cycle. Expert Reviews in Molecular Medicine; http/www expert review org/Accession information; Cambridge University press. 1-24.

Lettenmaier, C. 2003. The role of communication in malaria control in Africa: a conceptpaper for the first RBM communication working group meeting. The Johns HopkinsBloomberg School of Public Health Centre for Communication Programmes.

Mazigo E.,Emmanuel O.,Wilhellmus M.,Maria Z., Eliminigaya J. and Humphrey D. (2010). Knowledge, attitudes, and Practices about malaria and its control in rural Northwest Tanzania. Malaria Research and treatment, **35** (1):1-9.

Mengistu Hailemariam and Solomon Gebre. (2015). Trend Analysis of Malaria Prevalence in Arsi Negelle Health Center. South Ethiopia. J.In. Dis and Im. **7(**1): 1-6.

Mike, S. (2000). Medical Entomology for students. Second edition; Liver pool School of Tropical Medicine. Liver pool, UK; **8**: .9-10.

Ministry Health State of Federal Democratic Republic of Ethiopia (MOH): National five years strategic plan for malaria control in Ethiopia: 2001-2005. Malaria and other Vector- borne Diseases Prevention and Control Department. 2008, Commercial Printing Enterprise, Addis Ababa, 58- 60.

Ministry of Health, author. Guidelines for malaria vector control in Ethiopia. Malaria control profile. 2004.

MOH. (2006). National five-year strategic plan for malaria prevention control in Ethiopia 2006– 2010. Addis Ababa. 2-10.

Moriya, T. and Kevin, C. (2009). Malaria: Burden of Disease. Parasitology. **9**:237-241.

Naing L, Winn T and Rusli BN (2009). Sample Size Calculator for Prevalence Studies.

Ndwiga ,T.Robert, M. and Odiver,W,(2014).Utilization of insecticide Treated Bed Nets among mother Attending MCH/FP in webuye District Hospital BungomaKenya. Journal of preventive Medcine 4;470-480

Oyewole and Ibidapo. (2007). Attitudes to malaria, prevention, treatment and managem ent strategies associated with the prevalence of malaria in a Nigerian urban center. A.J. Biotechnology **6** (21): 2424 -2427,

Paulander, J, Olsson, H., Lemma Hailemariam, Getachew Asefaw and Sansebstian, M. (2009). Knowledge, attitudes and practice about malaria. Rural Tigray, Ethiopia. J.Glo.H. Action **8**:37-43.

President's Malaria Initiative. (2008). Malaria operational plan (MOP) Mali.PMI

President's Malaria Initiative. (2009). Malaria operational plan (MOP), Ethiopia

President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia. FY 2008.

Roll Back Malaria. (2003). Africa malaria reports the burden of malaria in Africa.19

Safari, M., Fabian, M, and Josep, R. (2010). Knowledge, attitudes and practices about malaria among communities: Comparing epidemic and non-epidemic prone communities of Muleba district. North-western Tanzania. J.P. H. **10**: 395-435.

Salwa, M. Gayoum, E., and Hayder, A. (2009). Knowledge, practices and perceptions which affect acquiring malaria in man-made malarious area. Khartoum State, Sudan. Sudanese J. P. H. **4(**1): 15-17.

Samuel, M., Sonia, Liorenc.Q., and Pedr, A. (2008). A country wide malaria survey in Mozambique. Plasmodium falciparum infection in children in different epidemiological settings. Journal of Malaria 7:216-324.

Sheleme Chibsa. (2007). Malaria Vector Control Efforts and Challenges in Ethiopia. 4th WIN meeting, Basel Switzerland 4:9-65. Summary of Malaria Program. Carter Center. (2007). Atlanta, GA. 3-8P.

Syafrudin, K. (2009). Seasonal prevalence of malaria in West Sumba district. Indonesia Licensee Bio Med Central Ltd, M.J. 8(8) 1475-2875.

Syed, M., Rashidual.H. Ubydul, H. and Awlad, H. (2009). Knowledge on the transmission, prevention and treatment of malaria between two endemic populations of Bangladesh and their health-seeking behavior. Licensee Bio Med Central Ltd, M.J. 8:173211.

Tadelle Girum, Teha shmbej and Misgun Shwangzaw. (2016). Burden of malaria in Ethiopia, 2000-2016: Findings from the Global, Ethiopia Health Estimates.

Tedros Adhanom, Mitiku Haile, Karen H. Asfaw Getachew, Mekonnen Yohannes, Hailay Desta, Lindsay, S.W. and Beyene peteros. (1999). Incidence of malaria among children living near dams in northern Ethiopia: community-based incidence survey. Journal of Biomedical **319**: 663-666.

Teklehaimanot Awash, Sachs JD, Curtis C.(2007). Malaria control needs mass distribution of insecticidal bednets. The Lancet. 369(9580):2143-6

Terefe Fuge, Samuel Ayanto and Fiseha Gurmamo. (2015). Assessment of knowledge, attitude and practice about malaria and ITNs utilization among pregnant women in Shashogo District. Southern Ethiopia. Hossana College of Health Sciences. Ethiop. J.M .14:235.

Teshome Degefa, Ahmed Zynudin, Amyu Godesso, Yonnas Haile Michael, Kassahun Eba, Endalew Zemen, Daniel Emanna, Belay Brilie, Kora Tushune and Delenasaw Yewhalaw. (2015). Malaria incidence and assessment of entomological indices among resettled communities resettled in suburbs of Jimma town. Southwestern Ethiopia: a longitudinal study. Journal of Malaria **14**:24.

Tsige ketema, Kafelegn Getachew and Ketema Bacha, (2011). Therapeutic efficacy of chloroquine against Plasmodium vivax malaria in Halaba Kulito town, South Ethiopia. J. Para. Ve**, 4**: 46.

Tulu Assefa. (1993). Malaria, In: The Ecology of health and disease in Ethiopia, Kloos, H. and Zein, Z.A (Eds), West View Press, and 341-352p. USAID /CDC. (2010). Malaria operational plan (MOP) Ethiopia, FY 2010

USAID /CDC. (2010). Malaria Operational Plan (MOP) Ethiopia, FY 2010.

Wakgari Deresa, Ahmed Ali and Yemane Berhane. (2006). Review of the interplay between population dynamics and malaria transmission in Ethiopia Ethiopian Journal of Health and Malaria Development. **20**(3):137-144

Wakgari Deressa, Ahmed Ali, and Fikre Enqoselassie. (1999). Knowledge, Attitude and Practice about Malaria, the Mosquito and Antimalarial Drugs in a Rural Community. Ethiop.J. Health Dev. 17(2):99-104

Warhurst DC and Williams JE .(1996). "Laboratorydiagnosis of Malaria"*J Clinpathol**49***(7):533-8.doi:10.1136/jcp.49.7.533.PMC500564.PMID 8813948

WHO (world health organization); health impact assessment, 1st inter-ministerial conference in Africa, Geneva Switzerland; 2008.

WHO 2015. World Malaria Report 2015. World Health Organization, Geneva, Switzerland.

WHO. (2000). Expert Committee on Malaria: WHO Geneva, Switzerland. Twentieth Report, Technical Report Series, №.892

WHO. (2011). World Malaria Report. Country Profiles, Summary and Key points. World Health Organization, Geneva.

WHO. World malaria report: World Health Organization, Geneva, 2012. World Health Organization Web site, authors. Global Malaria Programme: pregnantwomen and infants. [Accessed July 30, 2009].

World Health Organization. (1998). World Health Report: Fifty Facts of Health. WHO, Geneva?

World Health Organization. Global technical strategy for malaria 2016-2030; 20 Avenue Appia, 1211 Geneva 27, Switzerland. Available at: <www.who.int/about/licensing/ copyright form/en/index.html> Accessed on 7 May 2017.

World Health Report 2002: reducing risks, promoting healthy life. Geneva, World Health Organization, 2002.

Wakgari Deressa, Adugna Woyessa, Ahmed Ali and Lindtjørn, B. (2012). Prevalence of malariainfection in Butajira area, south-central Ethiopia. *Malaria Journal* 11:84.From: http://www.malariajournal.com/content/11/1/84 (accessed 27 May 2012).

Yared Legesse, Ayalew Tegegn, Tefera Belachew and Kora Tushune. (2007). Knowledge, Attitude and Practice about Malaria Transmission and Its Preventive Measures among Households in Urban Areas of Assosa Zone. Western Ethiopia. Ethiop.J.H.D.**21** (2): 157-165.

Yared Legesse,Ayalew Tegegn, Tefera Belachew and Kora Tushune (2007).Knowledge ,Attitude and practice about malaria transmission and its preventive measures among households in urban areas of Assosa Zone ,western Ethiopia.Ethiop.Journal of Heal development ,**21(**2):pp,157-166

Yibeltal Berie, Alemayehu Belay, Kassahun Alemu, and Zemical Gizaw. (2013). Factors Affecting Utilization of Insecticide Treated Nets among People Living with HIV/Aids in Bahir Dar City. Northwest Ethiopia. Sci. J. Clinical Medicine. **2** (6):147-152.

Zewdneh Tomas. (2011). Knowledge, Attitude and Practice (KAP) about Insecticide Treated Net (ITNs) usage against Malaria in Kolla Tembien district. Tigray, Ethiopia. CNCS, Mekelle University **3** (2):64-77.

APPENDIX

Questionnaire (English version)

Addis Ababa University, School of Graduate Studies, Department of ZOOLOGICAL SCIENCES, Masters of Science in Biology. Questionnaire to be answered by household respondents selected from Maygaba town and Mygaba rural areas to collect data for the research in titled; Prevalence of Malaria, Knowledge and Utilization of ITNs among Communities in Mygeba town, Wolkait Woreda, Western Zone, and Tigray Regional State, Ethiopia.

Thank you in advance for your genuine response! Instruction: please select the appropriate answer you wish to give and circle your answer letter.

Part I: household Identification

Date_____ Village _____House number _____

Socio – Demographic characteristics of households

1. Gender of respondent A/ male B/ female

2. What is the number of your family? A/ ≤ 5 B / > 5

3. What is your age? A/ ≤ 20 B / 21-30 C/ 31-40 D/ > 41

4. What is your marital status? A/ Married B / single C/ Divorced D/ Other

5. What is your highest level of education? A/ Illiterate B / can read and write C / Primary Level D/Above secondary school

6. What is your occupation? A/farmer B,/marchant C / student D/ retried E/House wife

7. Do you have livestock **A**/ Yes B /No

8. States of residential house? A/ Mud & grass B/ steel (iron sheet) roof C/ cemented wall & floor D/ Others

II, Questions about knowledge related to malaria, treatment seeking behavior and prevention of malaria

9**.** Have you ever heard malaria in your area? A/ Yes B/ No

10. Is malaria transmissible disease? A / Yes B/ No C/ I don't know

11· what are the main symptoms of malaria diseases you know? A/sever B/ hotness B,// shivering C/ headache D/ backache E/ others

12· when dose Mosquito bite? A/ Day time B/ Night time C/ day & time D/ I do not know

13· How is malaria transmitted from person to person**? A /** by mosquito bite B/ by bad season C / through bodily contact with patient D/ By drinking dirty water F/ From dirty environment

14. Malaria can be preventable disease? A / Yes B /No C/ I don't know

15· Where do you and your family go to seek treatment for malaria? A/ traditional healer of Village B/ health centers of Village C/ simply take tablet D/ Other

16. Can malaria have cured? A/ Yes B/ No

17. If your answer for question number 16 is yes, what kind of methods you use to prevent malaria .A / take tablets B / use insecticide sprays C /Environmental Sanitation .D/ use of ITNs E/ use of local cotton sheet F /smoke from burning leaves and animal products G/ No answers H/ Other

III, Study population Knowledge of ITNs and possession of ITNs

18·Do you have ITNs in the home ?. A /yes B/ No

19· If your answer for question no 18 is No, what is your reason? A No one gave me ITNs in area B /old & damaged

20· How many ITNs do you have for family? A/1 B/ 2 C/ 3 D/ 4 E/ More than 4 F/ I have no ITNs

21· Is there availability/ supply of ITNs in Your village in present time? A /Yes B/No

22· Have you ever heard education about ITNs? A/ Yes B/ No

23· If your answer for question 22 is yes, what were sources of information? A/ radio B/posters C/ health worker's D/ newspaper E/ mosque/church F/ kebele /peasant representative. G/school H/friends I/other

24· Do you think that sleeping under ITNs has benefit? A/ Yes B/ No

25· If your answer for question no 24 is yes, what are the benefits of sleeping under ITNs? A/ I don't get by mosquito B /I don't get bothered by other insects C/ I don't get malaria D/others

26· when do you or your family sleep ITNs? A/ daily B/ during transmission time C/weekly D/other

IV: household utilization of bed nets.

27· who sleep under ITNs in your house? A/ children under 5 years B/ children above 5 years .C/ adults D/ pregnant women E/ father & mother F/ mothers and children < 5 years

28. Do you treat your mosquito net by chemical in the last six months? A/ Yes B/No C/ I have no ITNs

29 · If your answer for question no 28 is no, what is your reseason? A /lack of chemical B/ lack of awareness C / others

30· DO you ever wash your mosquito net last six months? A/Yes B/ No

IV. Assessment questions of households' knowledge about utilization of ITNs

Characters	Yes	No
1. Do you know what ITNs is?		
2. Last night family used ITNs?		
3· Families wash ITNs in the past six months		
4. Retreating ITNs		
5· I know the difference b/n treated and none treated bed net		
6. Can you hang correctly?		
7· How long have you used ITNs? 1/ Not at all 2/ 1-2 years 3/ > 2 years		
8. ITNs utilization frequency? 1/ Not at all 2/ Regularly 3 /During transmission		

ቁጥር 5212 / 03 / 11

ቀን 12 / 03 / 11

ለአዲስ አበባ ዩንቨርሲቲ

አዲስ አበባ

ጉዳዩ :- ድጋፍ ደብዳቤ /ክሊራንስ/ መስጠትን ይመለከታል

ከላይ ለመጥቀስ እንደተመኮርዉ ፀጋይ ገ/ማርያም ይሕደጎ የተባለ የአዲስ አበባ ዩንቨርስቲ ተማሪ በወልቃይት ወረዳ : በማይገባ ከተማ እና አከባቢ የወባ ስርጭትን በተመለከተ ጥናትና ምርምር እያካየደ በመሆኑ በመግለፅ ከተለያዩ ምስራቤቶች የይተባበሩት ደብዳቤ ይዞ በመምጣት በማእከል መባእታ ክንክን ጥዕና ማይገባ ስራዉን ከመጋቢት ወር 2011ዓ/ም መጀመርያ እስከ ሚያዚያ ወር 2011ዓ/ም መጨረሻ በማእከል ክንክን ጥዕና ማይገባ ብዙ ስራዎችን ማከናወን ችለዋል::ለጥናቱ ተጨማሪ መረጃዎችን በመስጠት እንድንተባበረው የሚከተሉትን መስራቤቶች የይተባበሩት ደብዳቤዎች ፅፈዋል::

1. የአዲስ አበባ ዩንቨርሲቲ የዞሎጂካል ሳይንስ ትምህርት ክፍል

2. የወልቃይት ወረዳ ፅህፈት ቤት ትምህርት 3. የወለቃይት ወረዳ ፅህፈት ቤት ጤና

- በኛ ጤና ጣብያ እና በኛ ጤና ባለሞያዎች /የላብራቶሪ ባለሞያዎች/ እየታገዘ የሚከተሉትን ስራዎች ማከናወን ችለዋል::

1. ከ2015-2019 ከመጋቢት ወር እስከ ሚያዚያ ወር ያለዉን የወባ ስርጭትን የሚያሳይ ዳታ መዝግበዋል::

. በ2015 ከመጋቢት እስከ ሚያዚያ

. በ2016 ከመጋቢት እስከ ሚያዚያ

. በ2017 ከመጋቢት እስከ ምያዚያ

. 2018 ከመጋቢት እስከ ሚያዚያ

. 2019 ከመጋቢት እስከ ሚያዚያ

2. ለጥናቱ ከተመረጡ ሰዎች በኛ የላብራቶሪ ባለሞያዎች በሁለት መንገድ የደም ናሙና በመዉሰድ የወባ ምርመራን እንድካሄድ አስደርገዋል ::

* ባለሞያዎች ለጥናቱ ከተመረጡ ሰዎች እቤት እና አከባቢ ድረስ በመሄድ የደም ናሙና ወደ ማእኸል መባእታ ክንክን ጥዕና ማይገባ በማስመጣት ምርመራ እንድካሄድ አድርገዋል::

* ለጥናቱ የተመረጡ ሰዎች ራሳቸዉ ወደ ማእኸል መባእታ ክንክን ጥዕና ማይገባ ድረስ በመምት የደም ናሙና ለባለሞያዎቻችን በመስጠት ምርመራ እንድካሄድ አድርገዋል ::

* በመጨረሻ በደማቸዉ ዉስጥ ወባ የተገኘባቸዉ በመለየት መዝግበዋል /positive/የሆኑ::

ወንድ = 12 **ሴት = 07** **ጠቅላላ ድምር = 19**

በደማቸዉ ዉስጥ / Plasmodium falisparum/ የተገኘባቸዉ ተመሪማሪዎች ::

ወንድ = 08 **ሴት = 04** **ጠቅላላ ድምር = 12**

በደማቸዉ ዉስጥ /Plasmodium vaivax/ የተገኘባቸዉ ተመሪማሪዎች ::

ወንድ = 04 **[illegible] = 03** **ጠቅላላ ድምር = 07**

3, በእኛ ድጋፍ እና ት[illegible]የባለ 03 ገጽ [illegible] መጠይቅ ለጥናቱ በተመረጡ ሰዎች እንደሞላ አስደርገዋል::

ከሰላምታ ጋር

አዲስ አበባ ዩኒቨርስቲ
የዞሎጂካል ሣይንስ ትምህርትክፍል

ADDIS ABABA UNIVERSITY
DEPARTMENT OF
ZOOLOGICAL SCIENCES

ለሚመለከተው ሁሉ

ጉዳዩ፡ ትብብር ስለመጠየቅ፡፡

የአዲስ አበባ ዩኒቨርሲቲ የዞሎጂካል ሳይንስ ትምህርት ክፍል የክረምት MSC ተማሪ የሆነው-----
Tsegay Gimanam Yhdego
The prevalence of malaria at Mizeba town
-----ላይ ጥናትና ምርምሩን ለመስራት በዝግጅት ላይ ይገኛል፡፡ ለዚህ ጥናት ተጨማሪ መረጃዎች በመስጠት እንድትተባበሩት እየጠየቅን ለሚደረግለት ትብብር በቅድሚያ ምስጋናችን እናቀርባለን፡፡

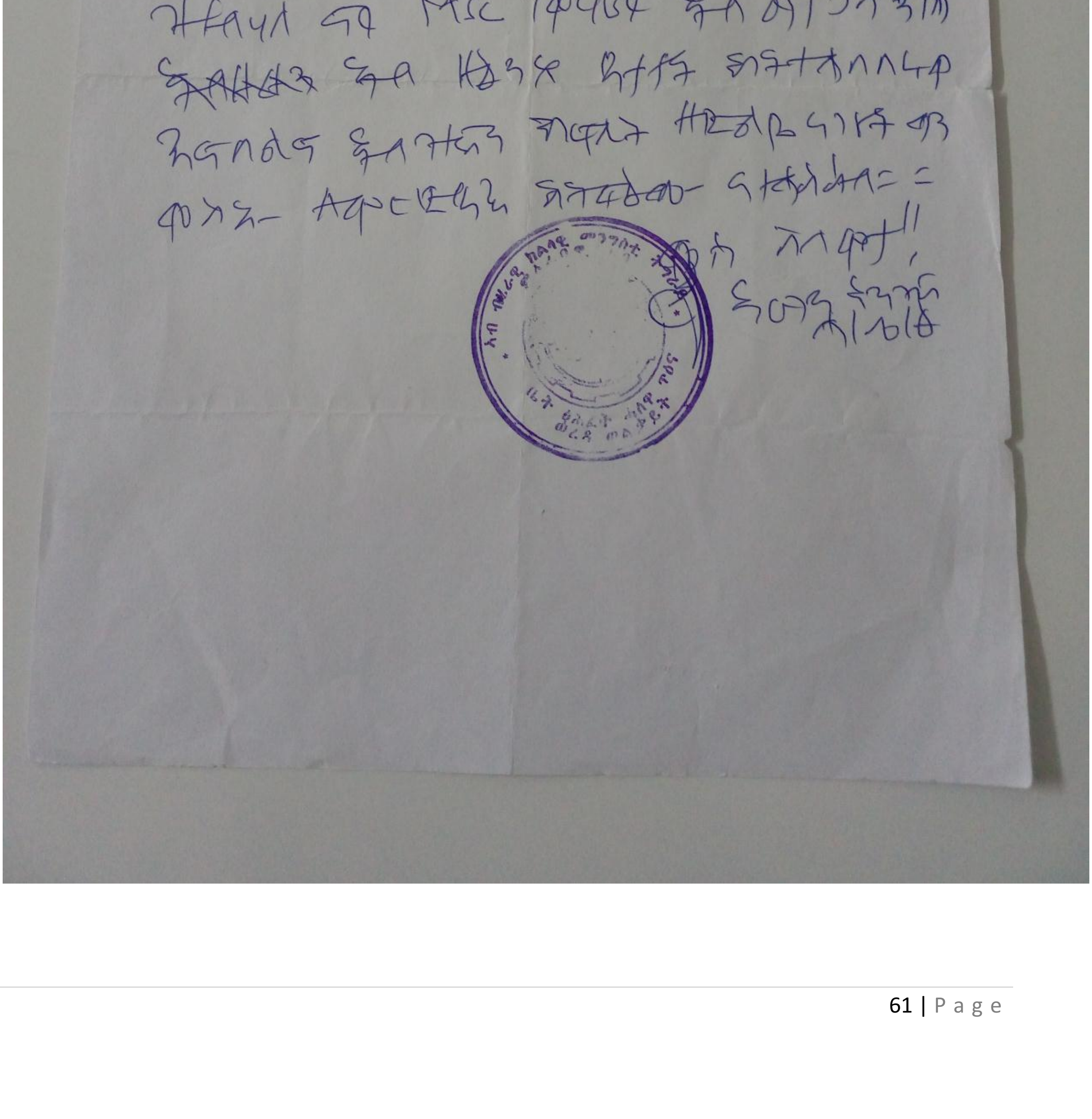
ከሠላምታ ጋር፣

አሸናፊ ዘጋሁኝ (ፕሮፌሰር)
የዞሎጂካል ሳይንስ ት/ክፍል ኃላፊ

for Head
Asnake Desalegn (PhD)

P.O.Box 1176
Addis Ababa

Tel: 251-8-95 92 17
Lifesciencefaculty@lifescience.aau.edu.et



ቁጥር [illegible]/3.1/11
ቀን 22/09/11

[illegible]

ጉዳዩ፡- ድጋፍ [illegible]

[illegible]