Prevalence of Malaria Infections Among Patients in Gimbie Adventist Hospital Western Wollega, Oromia Regional State, Ethiopia

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Abstract
Malaria is a disease caused by protozoan parasites belonging to the genus Plasmodium. The five species of the parasite in human are P. falciparum, P. vivax, P. malariae, P. ovale and P. knowlesi. It is a major cause of morbidity and mortality worldwide, especially in young African children. Therefore, the objectives of this study were to assess the prevalence of malaria infection and associated factors among patients attending Gimbie Adventist Hospital in West Wollega, Oromia, Ethiopia. First, a retrospective study was carried out for the past ten years (2006-2016) to study the prevalence of malaria in the study area. Second, malaria suspected patients based cross-sectional study was carried out from March to June, 2017. A random sampling technique was carried out to select representative study participants among the patient’s members. Structured questionnaires (n=130) and blood sample examinations were used for data collection. The data was entered and analyzed using SPSS 20 version. The prevalence of malaria in males was 71(65.7%) and in females were 37(34.3%). The greatest number of malaria case tested in the age group of 16-30 years old was 52(48.1%). Among 384 Malaria suspected patients who were recruited and ascertained for parasitaemia from the blood sample test, 108 patients were malaria positive. The overall prevalence of malaria infection was 28.1%, of which 58 (53.7%) were positive for P. falciparum and 34 (31.5%) for P. vivax and the remaining 16(14.8%) were mixed (P. falciparum + P. vivax). Major Plasmodium species identified in this study was P. falciparum (53.7%). Out of the screened patients 69.2% responded to sleep under the ITNs the previous night. The coverage of IRs was observed to be 12.3% during the study period. The higher prevalence of malaria could be the result of several factors as explained in this study. Therefore, effective malaria control measures should be implemented in order to reduce the prevalence of malaria infection among patients.

Keywords: Prevalence; Malaria; Gimbie; Plasmodium vivax; Plasmodium falciparum.

1. Introduction
Malaria is a disease caused by protozoan parasites belonging to the genus Plasmodium. The five species of the parasite known to cause disease in humans are P. falciparum, P. vivax, P. malariae, P. ovale and P. knowlesi. P. falciparum and P. vivax account for more than 95% of the cases of malaria in the world and P. knowlesi, whose usual host is the Kra monkey, has been found endemic in humans in parts of South-East Asia [1]. Malaria is transmitted by the bite of infective female Anopheles mosquitoes [2]. It is a major human health threat in tropical and subtropical regions of the world [3, 4]. Malaria kills about 1 million people each year [5]. In 2018, there were about 405000 deaths from malaria globally, compared with 416000 estimated deaths in 2017, and 585000 in 2010 [6]. About 90% of all malaria deaths in the world occur in Africa, south of the Sahara [7, 8].

Malaria constitutes a major public health problem and impediment to socioeconomic development in Ethiopia. It is estimated that about 75% of the total area of the country and 65% of the population is estimated to be at risk of infection [9]. P. falciparum accounts for about 60% of the cases of malaria and P. vivax accounts for about 40% [10]. The switch from the previously predominant P. vivax to P. falciparum has been reported in some areas of Ethiopia [10, 11].

In Ethiopia, malaria control has an integrated approach that is vector control with long lasting Insecticide Treated Nets, Insecticide Residual Spray, early diagnosis and treatment, environmental modification and education that help to reduce malaria [12]. The major clinical features of malaria include, severe anemia due to reduced production and increased destruction of RBCs, cerebral complications due to micro-vascular obstruction in the brain, which causes impaired consciousness, convulsions and long term neurological deficits metabolic acidosis, reduced tissue perfusion, hypoglycaemia, hypoxia due to respiratory distress and pulmonary pathology and placental infection during pregnancy [13]. Whereas severe headache, fever, vomiting, sequestration of RBCs, anemia and loss of appetite are the clinical features of uncomplicated malaria [13, 14].
According to 2008 Gimbie Adventist Hospital report, 55% of the patients tested for suspected malaria had positive results. Although zonal information on prevalence of malaria and infection among patients has gradually been increasing, in Gimbie, there is no documented information on prevalence of malaria and infection among patients in Gimbie Adventist hospital. According to records from health facilities, there are year round infection among patients and seasonal malaria in the hospital. However, despite the existence of malaria and variety of health problems, community based studies on prevalence of malaria was not carried out in Gimie. Besides, even though, several studies have been done in rural Ethiopia to assess the knowledge, attitude and practice (KAP) about malaria, there has not been much effort to carry out similar study in urban Ethiopia including Gimbie Adventist Hospital. Accordingly, the objective of this study is to assess the prevalence of malaria infection and associated factors among patients attending Gimbie Adventist Hospital during the study period.

2. Materials and Method
2.1. Description of the Study Area
The study was conducted in Gimbie Adventist hospital, West Wollega, Oromia Regional state, in Ethiopia. Gimbie town is 444 kms from Addis Ababa. The town is found within the altitudinal ranges between 1500 to 2500m above sea level. It was one of the 22 Districts of the West Wollega Zone of Oromia Region which was geographically located between 8°43’ N latitude and 10°04’ E longitudes. June to September is the main rainy season and October to November the small rainy season. It has wet climatic condition with annual rainfall of 311mm to 525.2mm and its annual temperature is 10°C to 21.33°C the average annual temperature being 17.67°C.

According to the 2007 national census, the population of the District was 81,375 of which 44,303 were males and 37,072 were females. In the town there were health facilities that provide health care; these were 2 central referral hospitals, 1 health center and 5 clinics. Every Kebele had at least one health extension worker who was assigned to provide home-to-home health service to the community. According to the clinical records from the hospital, malaria infections were common in the town. Hence, malaria prevention and control interventions were being implemented. These included annual indoor residual spray (IRS), distribution of Long Lasting Insecticide-treated bed net (ITNs/LLINs) in selected areas and prompt treatment of malaria cases using ACT-Coartem as a first line treatment based on Rapid Diagnostic Tests (RDTs). Moreover, there had been malaria infection among patients based on targeted segment of the community from selected patients based on clinical report of the diseases. This had been carried out with the support of the Government services for malaria infection diseases.

2.2. Study Design
The design of the study was a patient based cross-sectional study, which was conducted on prevalence of malaria infection among patients visiting Gimbie Adventist hospital, during the period between March 1 and June 30, 2017. For this study, 384 malaria suspected patients were selected by simple random sampling method for blood smear test attending Gimbie Adventist hospital within study period of time. To conduct the study, the questionnaire were also prepared and distributed for respondents to get relevant information about the prevalence and associative risk factors of malaria.

The data collected for this research were both quantitative and qualitative in nature. Qualitative data was used to supplement and to fill gaps during the quantitative data collection process. Hence, both primary and secondary data were used. Secondary data was used to get number of malaria infected patients of the study area and it was obtained from unpublished documents of Gimbie Adventist hospital office. Primary data was obtained from the collection of blood sample of 384 malaria suspected patients and questionnaire survey.

2.3. Data Collection Tools
Data was collected using the following methods: structured questionnaire, secondary data and the results of blood sample test for Plasmodium species.

**Questionnaires:** The structured questionnaire was used to collect data. To conduct the study, twenty (20) closed ended questions were prepared and the questionnaires were translated to Oromiffa and re-translated back to English to make the reliability of the instrument. The questionnaire included the following information: age, sex, health service facility, knowledge about malaria, the practices of utilization of ITNs and residual spray, mode of transmission, control and prevention and also to identify associated risk factors of malaria at the study area.

**Blood sample test:** Thick blood sample was collected from 384 malaria suspected patients and analyzed to determine the prevalence of malaria infection among the patients in Gimbie Adventist Hospital in laboratory facilities. Thick blood films were taken as positive if one or more Plasmodium parasites are observed; and no hemoparasites if no parasites were seen after examining 100 high power fields. It was used to determine the prevalence of malaria and identify *Plasmodium* species in terms of age and sex.

**Secondary data (Retrospective study design):** The data was obtained from medical records of Gimbie Adventist Hospital during January 2006 to end of January 2016 to assess the prevalence of malaria infection among patients in terms of age and sex in the study area.

2.4. Source and Study Population
2.4.1. Source of Population
The population included all malaria suspected patients infected by disease in the study area for medical purpose starting from March 1, 2017 to the end of June 2017.
2.4.2. Study Population
Members of the all malaria suspected patients attending Gimbie Adventist hospital were the source of the study population for the questionnaire and parasitological blood film. Final sample size that was included in the study was 384 patients.

2.4.3. Inclusion Criteria
All malaria suspected patients who attended Gimbie Adventist hospital within March 1, 2017 to the end of June 2017 for blood smear test.

2.4.4. Exclusion Criteria
For questionnaire, community members who were mentally handicapped and individuals who were taking anti-malarial therapy or who had been treated with anti-malarial drugs within the past 4 weeks were excluded from the study.

2.5. Sample size Determination and Sampling Techniques
2.5.1. Sample Size
The sample size was determined to be all blood tested patients starting from March 1, 2017 to the end of June 2017. During this period, a total of 384 patients were included in this study. The sample size was determined using single population proportion formula of Cochran [15]. These were:

\[ n = Z^2 \frac{\alpha}{2} P(1-P)/d^2 \]

Where: 
- \( n \) = is desired sample size
- \( Z^2 \frac{\alpha}{2} \) = is the standard normal deviate at the required (95%) confidence interval (1.96)
- \( P \) = is 0.5 (probability of the target population to be included in the sample)
- \( d \) = is the level of statistical accuracy (margin of error) set usually at 0.05

Therefore the value of 
\[ n = Z^2 \frac{\alpha}{2} P (1-P)/d^2 \]
\[ = 1.96^2 \times .50(1-.50)/.05^2 \]
\[ = 384. \]

2.5.2. Sampling Technique
According to this, 384 malaria suspected patients attending Gimbie Adventist hospital within study period of time for blood smear test were selected by random sampling method for blood test examination. Blood sample was collected to prepare thick and thin blood film smears. Then thin smear was fixed by methanol and stain both thin and thick blood film smears in Giemsa staining (1:50 dilution) solution. Finally, the dried blood films were examined under microscope with 100x oil immersion. Species identification was done. The researcher collected and examined a blood sample twice in a week randomly within a study period to determine the prevalence of malaria, \textit{plasmodium} species in terms of age and sex and the researcher add another 130 respondents (prospective) from patients for questionnaire administration.

2.6. Variables of the study and Measurement
2.6.1. Dependent Variables
Dependent variables included knowledge about the prevalence of malaria, patient’s attitude on malaria transmission and practices to prevent malaria; purpose of DDT spraying (Indoor residual spraying), INTs use and medication for malaria, mosquito nets, and smear test.

2.6.2. Independent Variables
Independent variables included socio-economic characteristics such as; age, sex, marital status, education status, and housing condition and breeding site of mosquito.

2.6.3. Data Analysis
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 \textit{plasmodium} species. Data was represented by the percentage, frequency, and tables. Chi-square test was calculated to determine the association of some socio-demographic characteristics such as age, sex, ITNs use, usage of residual spray, and level of education with the prevalence of malaria parasite in the study participants. Statistical significance was defined at P-values less than 0.05 (P<0.05).

2.6.4. Ethical Consideration
Before conducting the survey, discussion was undertaken with the head of the office of Gimbie Adventist hospital on the purpose of the study and then the study patients were asked for consent. Then, based on their consent data was collected from each selected blood sample of patients. All data collected from the individual respondents is kept confidential. Finally, treatment and advice were provided to those malaria positive during smear test by nearest health sector and hospital. At the end of this study, the study result was also been given to the Gimbie Adventist hospital.
3. Results and Discussion

3.1. Annual Trends of Malaria Prevalence

Within the past ten years (2007-2016) a total of 48,208 patients visited in Gimbie Adventist hospital for malaria cases. Out of 48,208 patients, 22,053 were positive cases and 26,155 were negative cases. The overall prevalence of malaria was 45.7% within the last ten years. The minimum percentage being reported in 2013 (8.5%) and with maximum percentage being reported in 2007 (12.7%) following by 2008 (11.7%), 2009 (10.4%), 2010 (9.9%), 2016 (9.7%), 2011 (9.6%), 2015 (9.3%), 2012 (9.2%) and 2014 (9.1%) respectively. Generally, prevalence of malaria reached peak in 2007 accounted for 12.7% of the total (Figure 1).

Figure 1. Microscopically confirmed annual prevalence of malaria cases in Gimbie Adventist hospital

According to the document recorded in the hospital, the identified plasmodium species were Plasmodium falcifarium and Plasmodium vivax reported within each year. In the Plasmodium parasite species the P. falcifarium being the predominant species of the study area and accounted for 11,008 (49.9%) and p. vivax accounted for 9,611 (43.6%) of malaria prevalence within the study area where as mixed cases account for 1,434 (6.5%).

The minimum percentage of P. falciparium was reported in 2012 (45.7%) the maximum percentage being reported in 2007 (49.9%). On the other hand, the minimum percentage of P. vivax (33.8%) was reported in 2015 the maximum percentage (48.1%) being reported in 2008. But, P. vivax was greater than P. falcifarium only in 2008 (48.1%) and 2012 (48.1%). Mixed cases were very low throughout the study period (Figure 2).

Figure 2. The Annual prevalence of plasmodium species that is confirmed in Gimbie Adventist hospital

3.2. Prevalence of Malaria Parasites in Relation to Sex and Age Group

According to the record in the past ten years in the study area, males were more affected than females by malaria parasites with rate of 59.7% (13,169) and 40.3% (8,884), respectively. The lowest malaria infections of males were recorded in 2015 with prevalence of 51.5% (1,056) and the highest malaria infection of males were recorded in 2008 with prevalence of 62.1% (1,600) followed by 2007 (57.2%), 2016 (63%), 2013 (70.9%), 2010 (60%), 2009 (56.7%), 2012 (61.9%), 2014 (61.2%), and 2011 (54.2%). The highest malaria infection of females were recorded in 2007 (42.8) and the lowest were in 2013 (29.1) (Table 1).
Malaria was reported in all age groups in the study area but the age group 16-30 years olds were more affected with the prevalence of 31.5% followed by 31-45(24.9%), 0-15(18.7%), 46-60(16.3%) and above 61 years old were less affected with prevalence of 8.6% (Table 2).

### Table 1: Annual prevalence of malaria between male and female

| Year | No of Infected | Sex |  |
|------|----------------|-----|---|
|      | Male | %    | Female | %    |
| 2007 | 2793 | 1598 | 57.2   | 1195 | 42.8   |
| 2008 | 2576 | 1600 | 62.1   | 976  | 37.9   |
| 2009 | 2290 | 1299 | 56.7   | 991  | 43.3   |
| 2010 | 2174 | 1305 | 60     | 869  | 40     |
| 2011 | 2119 | 1148 | 54.2   | 971  | 45.8   |
| 2012 | 2035 | 1259 | 61.9   | 776  | 38.1   |
| 2013 | 1878 | 1332 | 70.9   | 546  | 29.1   |
| 2014 | 2009 | 1230 | 61.2   | 779  | 38.8   |
| 2015 | 2049 | 1056 | 51.5   | 993  | 48.5   |
| 2016 | 2130 | 1342 | 63     | 788  | 37     |
| Total| 22053| 13169| 59.7   | 8884 | 40.3   |

### Table 2: Prevalence of malaria in Gimbie Adventist hospital by age group and study years

| Year | Age groups | 0-15 | 16-30 | 31-45 | 46-60 | >61 | Total |
|------|------------|------|-------|-------|-------|-----|-------|
| 2007 | 408        | 14.6 | 29.4  | 670   | 24    | 568 | 20.3  | 325  | 11.6 |
| 2008 | 495        | 19.2 | 31.6  | 600   | 23.3  | 476 | 18.5  | 190  | 7.4  |
| 2009 | 404        | 17.6 | 33.9  | 503   | 22    | 452 | 19.7  | 154  | 6.7  |
| 2010 | 435        | 20   | 30.4  | 556   | 25.6  | 313 | 14.4  | 209  | 9.6  |
| 2011 | 422        | 19.9 | 31.8  | 519   | 24.5  | 259 | 20.3  | 245  | 11.6 |
| 2012 | 416        | 16.3 | 32    | 586   | 30.3  | 256 | 13.2  | 157  | 8.1  |
| 2013 | 318        | 16.9 | 36.4  | 684   | 36.4  | 249 | 16.9  | 151  | 8    |
| 2014 | 402        | 20   | 31.1  | 506   | 25.2  | 318 | 15.8  | 159  | 7.9  |
| 2015 | 413        | 20.2 | 30.1  | 616   | 30.1  | 25  | 15.1  | 198  | 9.7  |
| 2016 | 407        | 19.1 | 31.1  | 662   | 26.5  | 388 | 18.2  | 109  | 5.1  |
| Total| 4120       | 18.7 | 6955  | 31.5  | 5484  | 24.9 | 3597  | 16.3 | 1897 | 8.6  | 22053 |

Source: Secondary data (malaria cases recorded document from Gimbie Adventist Hospital)

### 3.3. Result Obtained from Blood Sample Tested Patients Attending Gimbie Adventist Hospital

From the total of 384 patients examined their blood and suspected to have malaria in Gimbie Adventist Hospital were participated, 199 (51.8%) were males and 185 (48.2%) were females. Table 3 below shows that, out of 384 patients 108(28.1%) were positive and the highest cases of malaria were observed in males than females by malaria parasites with rate of 71(65.7%) and 37(34.3%), respectively. The highest malaria infection of males was in June with prevalence of 44(11.5%) followed by May 33(8.6%), April 19(4.9%), March 12(3.1%). The association between sex and the prevalence of malaria was also observed and the results were statistically significant ($X^2$=15.4, P=0.000, df =1). Generally, malaria prevalence peak was observed in June 44(11.5%) and lowest in March 12(3.1%) in 2009 (Table 3).

| Month | Sex | M | %   | F | %   | Total |
|-------|-----|---|-----|---|-----|-------|
| No of examined | M | 199 | 51.8 | 185 | 48.2 | 384 | 100 |
| No of infected | M | 71  | 65.7 | 37  | 34.3 | 108 | 28.1 |
| March | M | 10 | 83.3 | 2 | 16.7 | 12 | 3.1 |
| April | M | 13 | 68.4 | 6 | 31.6 | 19 | 4.9 |
| May | M | 21 | 63.6 | 12 | 36.4 | 33 | 8.6 |
| June | M | 27 | 61.4 | 17 | 38.6 | 44 | 11.5 |

Regarding the identified plasmodium species, from the total 384 patients, 58 (53.7%) were positive for *P. falcifarum* and 34 (31.5%) for *p. vivax* and the remaining 16(14.8%) showed mixed of them. The minimum percentage of *P. falcifarum* observed in March 7(6.5%) and maximum percentage observed in June 23(21.3%) and the minimum percentage of *P. vivax* observed in March 4(3.7%) and maximum percentage observed in March and June 14(13%). In the four study months *P. falcifarum* was greater than *P. vivax* and the minimum percentage of mixed cases was also observed in March 1(0.9%) and maximum percentage observed in June 7(6.5%) within months.
of the blood sample tested. From this, the more participated and risked malaria patient was malaria *P. falciparum* species (Table 4).

Table 4. Distribution of *plasmodium* species in Gimbie Adventist hospital from March to June in 2009 E.C.

| *P. species* | Sex   | March (T) | April (F) | May (T) | June (M) | Total (T) |
|--------------|-------|-----------|-----------|---------|----------|-----------|
| *P. falciparum* | M (%) | 6(5.6)    | 7(6.5)    | 11(10.2)| 14(13)   | 38(35.2)  |
|               | F (%) | 1(0.9)    | 4(3.7)    | 6(5.6)  | 9(8.3)   | 20(18.5)  |
|               | T(%)  | 7(6.5)    | 11(10.2)  | 17(15.7)| 23(21.3) | 58(53.7)  |
| *P. vivax*    | M(%)  | 3(2.8)    | 4(3.7)    | 8(7.4)  | 8(7.4)   | 23(21.3)  |
|               | F(%)  | 1(0.9)    | 1(0.9)    | 3(2.8)  | 6(5.6)   | 11(10.2)  |
|               | T(%)  | 4(3.7)    | 5(4.6)    | 11(10.2)| 14(13)   | 34(31.5)  |
| Mixed         | M(%)  | 1(0.9)    | 2(1.9)    | 2(1.9)  | 5(4.6)   | 10(9.3)   |
|               | F(%)  | (-)       | 1(0.9)    | 3(2.8)  | 2(1.9)   | 6(5.6)    |
|               | T(%)  | 1(0.9)    | 3(2.8)    | 5(4.6)  | 7(6.5)   | 16(14.8)  |
| Total         | T(%)  | 12(3.1)   | 19(4.9)   | 33(8.6) | 44(11.5) | 108(28.1) |

The number of malaria cases during the period from March to June 2009 was classified under five age groups, 0-15 years, 16-30 years, 31-45, 46-60 and greater than 61 years old. Malaria infected all age groups but the age groups of 16-30 years olds were more affected with prevalence of 48.1% followed by 31-45, 0-15, 46-60, and greater than 61 years age groups, with prevalence rates of 30.6%, 12%, 8.3% and 1%, respectively. The greatest number of malaria cases was tested in the age group of 16-30 years old (48.1%). The association between the prevalence of malaria and the age groups were found to be statistically significant ($X^2=48.28$, $p=0.000$, $d=8$) (Table 5).

Table 5. Prevalence of malaria in Gimbie Adventist hospital related to age groups and months.

| Month | Age groups | 0-15 | 16-30 | 31-45 | 46-60 | >61 | Total | % |
|-------|------------|------|-------|-------|-------|-----|-------|---|
| March | 2          | 16.7 | 6     | 50    | 1     | 8.3 | -     | 12 | 11.1 |
| April | 4          | 21.1 | 8     | 42.1  | 5     | 26.3| 1     | 19 | 17.6 |
| May   | 2          | 6.1  | 17    | 51.5  | 12    | 36.4| 2     | 33 | 30.6 |
| June  | 5          | 11.4 | 21    | 47.7  | 13    | 29.5| 4     | 44 | 40.7 |
| Total | 13         | 12   | 52    | 48.1  | 33    | 30.6| 9     | 108| 100  |

Source: Own survey data

### 3.3.1. Comparison of Prevalence of Malaria in Terms of Sex

Comparison of malaria cases detected from the results of recorded data and a blood sample was the same on the males and shown high in both study period of time. In males the percentage of malaria prevalence was slightly increased (59.3% to 65.7%) and females were decreased (40.3% to 34.3%) (Table 6).

Table 6. Comparison of sex specific malaria infections in the study area.

| Sex    | The study period | 2007-2016 | % | March, 2017-January, 2017 | No | % |
|--------|-----------------|-----------|---|--------------------------|----|---|
| Male   |                 |           |   |                          | 13169 | 59.7 |
| Female |                 |           |   |                          | 8884  | 40.3 |

### 3.3.2. Comparison of Prevalence of Malaria in Terms of Age Groups

Comparison of malaria cases detected from the results of recorded data and a blood sample tested shows that malaria affected all age groups in both study period of time, but the age group of 16-30 years olds were more affected in both 2007-2016 and 2017 with the prevalence of 31.5% and 48.1% respectively. Generally, on the age groups of 16-30 and 31-45 years olds the malaria prevalence has increased in 2017 study periods of time. However, on the age groups of 0-15, 46-60, and >61 year olds prevalence has decreased significantly (Table 7).

Table 7. Comparison in age groups of malaria infections between the result obtained from recorded data (2007-2016) and a blood sample test (March-June).

| Age groups | The study period | 2007-2016 | % | March, 2017-June, 2017 | No | % |
|------------|-----------------|-----------|---|------------------------|----|---|
| 0-15       |                 | 4120      | 18.7|                        | 13 | 12 |
| 16-30      |                 | 6955      | 31.5|                        | 52 | 48.1 |
| 31-45      |                 | 5484      | 24.9|                        | 33 | 30.6 |
| 46-60      |                 | 3597      | 16.3|                        | 9  | 8.3 |
| >61        |                 | 1897      | 8.6 |                        | 1  | 1  |
3.4. Socio-Demographic Characteristics of the Study Participants in the Study Area

Summary of some socio-demographic characteristics of the study participants are presented in Table 8. From the 130 individuals who were planned for participation, 55 (42.3%) were males and 75 (57.7%) were females. In the all respondents the age groups of 0-15 years olds were 21.5%, 16-30 years olds were 43.1%, 31-45 years olds were 20%, 46-60 years olds were 13.1% and greater than 61 years olds were 2.3% respectively. Regarding their educational level: About 109 (83.8%) primary education, 18 (13.8%) secondary education, and 3 (2.3%) had higher education (college).

Table 8. Socio-demographic characteristics of patients in the study area

| No | Demographic | No | %  |
|----|-------------|----|----|
| 1. | Sex         |    |    |
|    | Male        | 55 | 42.3|
|    | Female      | 75 | 57.7|
| 2. | Age groups(years) |    |    |
|    | 0-15        | 28 | 21.5|
|    | 16-30       | 56 | 43.1|
|    | 31-45       | 26 | 20  |
|    | 46-60       | 17 | 13.1|
|    | >61         | 3  | 2.3 |
| 3. | Educational level |    |    |
|    | Primary     | 109| 83.8|
|    | Secondary   | 18 | 13.8|
|    | College     | 3  | 2.3 |

3.5. Respondents’ Attitude and Practices Towards Malaria Control and Prevention Measures

From the total of 130 respondents, 108 (83.1%) were infected with malaria. Among this, 79 (60.8%) were moved to other malarias areas before that week and all infected 108 (83.1%) were taken anti-malaria treatments. Out of all participants only 11 (8.5%) used mosquito control and preventive measures which 4 (3.1%) were used ITNs and 6 (4.6%) were used IRS. 107 (82.3%) of the respondents contracted malaria even after they started to use ITNs or IRS and only 13 (10%) of the respondents were used ITNs throughout the year. Again, from the suggestion of the participants 74 (56.9) were not kept cattle out-door at night. 7 (5.4%) participants reveled that there were stagnant water around their house and 127 (97.7%) were drained it rapidly. Almost all 103 (79.2) respondents indicated that they did not use windows screened with mosquito wire mesh in their houses. Regarding the awareness of respondents, 102 (78.5%) said that the major cause of malaria was malnutrition and the suggestion of 8 (6.2%) respondents were malaria could be transmitted by eating meal together while 106 (81.5%) indicated that causative agent of malaria was mosquito (Table 9).

Table 9. For optional questions of patients in studied hospital on prevalence of malaria

| No | Statements of questionnaires | Responses of patients (n=130). | Yes | %  | No | %  |
|----|------------------------------|--------------------------------|-----|----|----|----|
| 1  | Have you contracted malaria? | 108                           | 83.1| 22 | 16.9|
| 2  | Have you been moved to other malarious areas before this week? | 79 | 60.8 | 51 | 39.2|
| 3  | Did you take anti-malaria treatment (drug)? | 108 | 83.1 | 22 | 16.9|
| 4  | Have you used mosquito control and preventive measures? | 11 | 8.5 | 119 | 91.5|
| 5  | Do you use ITNs to control and prevent the biting of mosquito? | 90 | 69.2 | 40 | 30.8|
| 6  | Is there IRS to your home to combat the spread of malaria? | 16 | 12.3 | 114 | 87.7|
| 7  | Have you contracted after bed net or IRS use? | 108 | 83.1 | 22 | 16.9|
| 8  | Use ITNs throughout the season of the year | 13 | 10 | 117 | 90|
| 9  | Keep cattle out-door at night? | 56 | 43.1 | 74 | 56.9|
| 10 | Is there stagnant water surrounding your house? | 97 | 74.6 | 33 | 25.4|
| 11 | If yes, do you drain it rapidly? | 127 | 97.7 | 4 | 3.1|
| 12 | Do you use window screen in your house? | 27 | 20.8 | 103 | 79.2|
| 13 | The major cause of malaria is malnutrition? | 85 | 65.4 | 45 | 34.6|
| 14 | Malaria can be transmitted by eating meal together? | 122 | 93.8 | 8 | 6.2|
| 15 | Is mosquito the causative agent of malaria? | 106 | 81.5 | 24 | 18.5|
3.6. Some of the Risk Factors Associated with the Prevalence of Malaria Infection among Patients

The association between the prevalence of malaria and the use of ITNs/LLITNs was statistically significant (P= 0.001). Also, the association between the prevalence of malaria and the use of IRS was statistically significant (P= 0.019). But, the association between the prevalence of malaria and the awareness of patients on the causes of malaria was not statistically significant (P= 0.850) (Table 10).

Table 10. Chi-square risk factors associated with the prevalence of malaria infection among patients

| No | Variables                                                | categories | Total | Positive | Negative | X²  | Df | p-value |
|----|----------------------------------------------------------|------------|-------|----------|----------|-----|-----|---------|
| 1  | Do you use ITNs to control and prevent the biting of mosquito? | Yes        | 90    | 68       | 22       | 11.8| 1   | 0.001   |
|    |                                                          | No         | 40    | 40       | 0        |     |     |         |
| 2  | Is there IRS to your home to combat the spread of malaria? | Yes        | 16    | 10       | 6        | 5.5 | 1   | 0.019   |
|    |                                                          | No         | 114   | 98       | 16       |     |     |         |
| 3  | Is there stagnant water surrounding your house?           | Yes        | 97    | 87       | 10       | 11.9| 1   | 0.001   |
|    |                                                          | No         | 33    | 21       | 12       |     |     |         |
| 4  | Do you use window screen in your house?                  | Yes        | 27    | 16       | 11       | 13.8| 1   | 0.000   |
|    |                                                          | No         | 103   | 92       | 11       |     |     |         |
| 5  | The major cause of malaria is malnutrition?              | Yes        | 85    | 71       | 14       | 0.036| 1  | 0.850   |
|    |                                                          | No         | 45    | 37       | 8        |     |     |         |

4. Discussion

Malaria has been one of the major public health problems in many developing countries including Ethiopia, depending on the climatic conditions, geographical location, seasonal variation, and socio economic pattern of the population, varying degree of prevalence of malaria infection was reported from different studies [16].

First, this study was conducted on the prevalence of malaria infection among patients in Gimbie Adventist hospital within the past ten years from unpublished documents of the hospital. In the present study, the overall prevalence of malaria was 45.7% within the last ten years. The analysis of data record from Gimbie hospital showed that malaria prevalence was reduced in 2013 (8.5%) compared to that in 2007 (12.7%). This might be due to the control intervention measures (supply of sufficient INTs, anti-malarial sprays, etc) taken following the 2013 malaria epidemic. Also, the malaria prevalence was high in 2011 (11.7%) compared to that in 2013 (8.5%). The reasons for malaria increased during this period might be due to less attention to malaria control and preventive activities by different responsible bodies, lack of awareness of the community on use of ITNs, insufficient budget for malaria control and prevention activities.

Majority of the cases recorded in the study area was P. falciparum (49.9%) and the next p. vivax (43.6%) and mixed (6.5%), which was in contrast with the study conducted around Butajira, southern Ethiopia, where the prevalence of P. falciparium, P. vivax and both of them were shown to be 12.4%, 86.5% and 1.1%, respectively [17]. This may be due to climatic conditions and geographical location. Majority of the cases recorded in the present study were due to P. falciparum (49.9%), which was similar with most other reports [18-20].

The prevalence of malaria in case of sex, males were more affected than females by malaria parasites with rate of 59.7% and females were 40.3%. The reason why malaria affected productive age groups (16–30) and more males might be due to the fact that in Gimbie, agriculture is the main occupation and to keep the cattle and grain staying outside the home and sleeping in hut is common during the night time. Due to these different reasons, they exposed to anopheles mosquito bites, which can transmit malaria parasites.

Again, across-sectional study was conducted on prevalence of malaria infection among patients attending at Gimbie Adventist hospital based on cross-sectional study within four months (March, April, May, June) and three hundred eighty four (384) blood samples were collected from malaria suspected patients. The overall prevalence of malaria infection in the study area was 28.1%. The overall prevalence of malaria parasite infection in this study was higher than previous national and regional malaria prevalence reports of USAID/CDC (2010) which was 0.7% in Ethiopia and 0.3% in Oromia, respectively. The observed differences might be due to nature of study settings, seasonality of malaria, method of detection and the places location.

In this study Plasmodium falcifarum infection was highly prevalent than Plasmodium vivax. It showed that 58(53.7%) were Plasmodium falcifarum, 34(31.5%) were plasmodium vivax and 16 (14.8) were mixed infection. The prevalence of malaria in this study is complimentary to the study done in Assendabo teaching health center in 2003 where malaria causes were diagnosed and treated. The prevalence of P. falciparum is 32(51.6%) with 12(7.8%) mixed infection which show that the dominance of P. falciparum was similar to this study [21]. But, this study was different from the study conducted at AletaWondo in 2007 on 185 study subjects which indicates that 68(66%) were Plasmodium vivax and 35(34%) were P. falciparum infection from 103(55.7%) positive cases [12]. This may be due to difference in the study period, sample size used, study area and other factors.

The study conducted in this area showed that high malaria prevalence was detected in a Month of June within four months (March, April, May, June). This may have been due to the malaria transmission in Ethiopia is generally seasonal and highly unstable due to variations in topography and rainfall patterns. Marked variations in the level of
transmission from place to place or seasonal fluctuations in the number of cases are the main features of malaria transmission in Ethiopia [22]. There was also association between sex and age group with prevalence of malaria. The highest cases of malaria were observed in males (65.7%) than females (34.3%). It was much higher than that reported in Kersa Woreda, Jimma district, Bangladesh which was 43.8% and 15.25%, respectively [18, 19]. The observed differences might be due to nature of study settings, seasonality of malaria, and method of detection.

The highest to the lowest pattern of prevalence of malaria was seen as 16-30=31-45=0-15> 46-60=61 age groups. Moreover, higher prevalence was seen in males of 16-30 age group year (48.1%). But, only a few prevalence of malaria parasite infection was seen among individuals of >61 age group years (1%). This was consistent with the findings reported in Kersa Woreda, Jimma [18]. This might be due to greater exposure of males of age group 16 - 30 years to the mosquito vectors due to outdoor activities during night. In contrary to the present study, Adugna, et al. [23] reported more prevalence of malaria infections in young aged groups than adult individuals in Butajira area. This might be due to the fact in the present study area that many adult males are working in outdoor activities during night which increases the risk for mosquito bites.

Furthermore, there was discrepancy between the retrospective annual overall malaria prevalence (45.7%) based on clinical record from Gimbie Adventist hospital, and the prevalence (28.1%) of malaria from the present study based on a cross-sectional study. The existence of discrepancy between the retrospective and cross-sectional prevalence values is a well-established phenomenon and has been reported in different malaria epidemiological studies. For instance, a study conducted in malaria prevalence in the community of Mekong Delta region showed that the retrospective malaria prevalence (62%) is higher than the cross-sectional malaria prevalence determination (2.4%) in the same survey period [24]. This study can be explained by the fact that the clinical records are based on patients that have been recorded to the hospital for seeking treatment while the cross sectional study is based on random sampling blood tests of malaria suspected patients. Generally, the prevalence of malaria was high on both study period in the same age groups (16-30) and sex (males).

In the socio-demographic characteristics of the study participants, Out of 130 research participants, 55(42.3%) were males and 75(57.7%) were females. From the total of 130 respondents, 108(83.1%) were positive and the highest cases of malaria were observed in males than females by malaria parasites with rate of 71(65.7%) and 37(34.3%), respectively.

Out of all participants only 11(8.5%) used mosquito control and preventive measures of which 4(3.1%) were used ITNs and 6(4.6%) were used IRS. Then, 107(82.3%) of the respondents contracted malaria even after they started to use ITNs or IRS and only 13(10%) of the respondents were used ITNs throughout the year. Thus, in reference to the national strategic plan of the Federal Ministry of Health which aims to attain a coverage of 60% with at least two ITNs by 2007 FMH [25], the coverage in the study area could be considered low. In this study usage of ITNs, IRS, window screen and the stagnant water were associated risk factors with malaria distribution.

Again, from the suggestion of the participants 74(56.9) were not kept cattle out-door at night. 7(5.4%) participants reveled that there were stagnant water around their house and 127(97.7%) were drained it rapidly. Almost all 103(79.2) respondents indicated that they did not use windows screened with mosquito wire mesh in their houses. With respect to sex, males constitute the highest number of patients due to unused ITNs, IRS, window screen and those that live around stagnant waters were more infected by malaria.

Regarding the awareness of respondents, 102(78.5%) said that the major cause of malaria was malnutrition and the suggestion of 8(6.2%) respondents were malaria could be transmitted by eating meal together while 106(81.5%) indicated that causative agent of malaria was mosquito. The association between the prevalence of malaria and the awareness of patients on the causes of malaria was not statistically significant (P= 0.850). Therefore, the respondents’ knowledge about malaria has no association risk factors with the prevalence of malaria.

In general, the difference in the overall prevalence and specific malaria species in this study and the study conducted at different places mentioned above might be again due to variation in the study area, period, sample size used, climatic condition, environmental factors and economic pattern of the population, difference in study subjects and other factors.

5. Conclusion  
Malaria is still a major health problem in Gimbie, West Wollega zone of Ethiopia. Plasmodium falciparum and Plasmodium vivax were unmoving predominant parasites detected. The highest peak of malaria cases was observed in 2007 and the minimum prevalence in 2009, and males are more affected than females in the study area. The high prevalence of malaria in both retrospective and cross-sectional studies was the same on the males and the age groups of 16-30 years old. The overall prevalence of malaria parasites in the study participants was 28.1 %. The majority respondents participated in survey questionnaires was between the age group 16-30 years old and their educational status was primary school. In this study, the patients were infected with malaria due to stagnant water, absence of window screen, lack of effective use of ITNs and IRS, as well as a low awareness of patients on the transmissions, control and preventive method on prevalence of malaria. The usage of ITNs, IRS, window screen and the stagnant waters were associated risk factors with malaria distribution.

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