

Evaluation of Malaria Prevalence among Patients Attending in Bibugn district, East Gojjam Zone, Ethiopia

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Abstract

Malaria is an important public health problem in Ethiopia, with more than 54 million people at risk of infection. *Plasmodium falciparum* and *P. vivax* are both present. The general objective of the study was to determine the prevalence of malaria and associated parasites through microscopic examination of blood films. Cross-sectional study was carried in the study sites. The study was conducted from October to December 2017 and March to April 2018. Out of 822 study participants, 46(5.6%) were malaria positive. Of these, 28(60.87%) were *P.vivax* and 18(39.13%) *P.falciparum*. The prevalence of parasites was significantly greater in rural villages (6.25%) than urban village (3.23%) More males were infected compared to females but not significantly *Plasmodium vivax* was higher in prevalence than *P. falciparum* in the study area. So the result contrast the national figure of malaria report. The findings of this study may be useful for those who work in malaria control and prevention program.

Introduction

Three human malaria species are present within Ethiopia, with *Plasmodium falciparum* and *P. vivax* the most frequent cause of malaria accounting for 60% and 40% of the cases, respectively (MoH, 2006). Prevalence varies according to localities and seasons (Delenasaw et al., 2009). *P. malaria* accounts for less than 1% and *P. ovale* has never been reported from health facilities, with the only report being that of Armstrong in 1969 (MoH, 2006).

The intensity of malaria transmission depends upon altitude, rainfall, and population movement. Based on this, areas below 2,000 meters are considered to be malarious. However, highland malaria recently has become common in the country partly as a result of human-induced climate and landscape changes. Two surveys showed an increase in malaria prevalence from 2007 (0.9%) to 2011 (1.3%) Prevention and control of malaria could be challenging in light of the existing climate change and land use change. Therefore, there is a need to assess areas with potential malaria risk (Woyessa, T. 2004).

According to Amhara region health office report 2012, Amhara region reported 1,127,241 malaria cases. The understanding of the possible causes, mode of transmission and individuals' preference and decision about adoption of preventive and control measures vary from community to community and among individual households.

According to a report by Bibugn woreda health office (2003/2004 and 2017), malaria is the common presenting complaint at Health facilities in the district. Malaria is among the leading cause of health problem in Bibugn woreda with over 36.6% of the population or over 30 thousand people at risk of malaria. Therefore, this study determines the prevalence of malaria in Bibugn district, East Gojjam Zone, Ethiopia.

The results of this study is considered to generate information that are mandatory for malaria control program to improve malaria control policies and design interventions to prevent malaria. It will help to identify gaps in malaria prevalence and to design appropriate information. The result will also be useful

to evaluate the progress of the district towards achieving the regional and national target to take immediate actions in planning and implementation of prevention and control strategies.

Materials And Methods

Study area

The study was conducted in Bibugn woreda located in East Gojjam Zone North Ethiopia. This woreda is located at 81 km from Deber Markose town. Bibugn woreda is bordered on the South by Sinan, on the West by the West Gojjam Zone Dega Damot district, on the North West by Dega Damot, and on the East and North by Hulet Eju Enese. The agro-climate of the area consists of Wurche, Dega, Weinadega and Kola, though weinadega covers the wider area in the Zone. The total population of the Woreda was estimated to be 82,002, of which 40,190 are males and 41,812 are females. The rural population is estimated at 75,761 of which 37,090 are males and 38,671 are females. The urban population is estimated at 6,241 of which 3,100 are males and 3,141 are females. The largest ethnic group reported in Bibugn was the Amhara (99.9). The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 99.56% reporting that as their religion. Most of the inhabitants practice agriculture based economy, particularly Teffe, maize, potato and wheat are the main products.

Study Design and Sampling methods

Cross-sectional study was carried out among the patients attending the health centers in Woyn Wuha town who came from selected villages. Individual household members, who came to health centers, from the study area, for any kind of health service during the data collection period, were selected randomly. For the study all individual members of the selected households must be included in the study except those who take anti-malaria drugs for the past 2 weeks. Primary data was used for this study. October to December 2017 and March to April 2018 were the seasons for blood sample collection in the most representative three villages in Bibugn district.

Blood Sample Collection and Study participant

Of those visited Woyn Wuha health center from the study area for all services, 822 were selected randomly for parasitological examination.

Specialized laboratory technicians of the district collected blood sample from the list of patients that visited Woyn wuha health center from the study area. Thick and thin blood smears were made, slides properly labeled, air dried and then the thin blood smears were fixed with methanol. The slides were carefully transported to Bibugn district malaria control laboratory for parasitological examination following WHO methods.

Sample size determination

The required sample size was calculated using a formula for a single population proportion at 95% CI level ($Z_{\alpha/2} = 1.96$). However, since there were no previous or pilot malaria studies conducted in the area

and data from the clinic were studied only after the epidemiological study was done, 50%: 50% was assumed for prevalence (P). A minimum of 600 samples (n) was generated using 4% marginal error (d) as shown below.

$n = Z^2 P (1-P)/d^2$ Where n = sample size,

$n = Z^2 \cdot 0.5(0.5) / d^2$ P = average prevalence

$n = (1.96) (1.96) (0.5) (0.5) / (0.04)^2$ Z \cdot 2 = P- value at 95% CI from table,

n = 600 d = worst accepted value/marginal error

Therefore, once the minimum number of sample was obtained, by adding 37% contingency, a total of 822 study subjects were enrolled.

Ethical considerations

The study was conducted after obtaining ethical clearance from Collage of Natural and Computational science, Biology department, Deber Markose University and permission from Bibugn district health office. Positive patients were treated with coartem for *P. falciparum*, and chloroquine for *P.vivax*. They were given written and verbal consent to take part in the study after adequate explanation about the significance of the study. In addition, potential harm and benefit of the study was explained to the respondents. Only volunteer sample populations with informed consent were included in the present study.

Data Analysis

Data collected on blood film examination and associated parasites were entered and analyzed using SPSS version 20.0 statistical software (SPSS Inc., Chicago, IL). malaria prevalence between urban and rural villages and socio demography were compared using Chi-square test. Result were considered to be statistically significant when P-value < 0.05.

Results

Socio-demographic characteristics of the participants

Out of 822 individuals (640 from rural villages and 182 from urban villages) participated in the study. from 822, 482 were males and 340 were females. Table 1 shows the socio-demographic characteristics of the study participants.

Table 1
Socio-Demographic Characteristics of the Study
Participants

| Variables | | Study participants | % |
|-----------|--------|--------------------|--------|
| Sex | Male | 482 | 58.64% |
| | Female | 340 | 41.36% |
| Residence | Rural | 640 | 77.86% |
| | Urban | 182 | 22.14% |
| Age | < 5 | 122 | 14.84% |
| | 5–14 | 306 | 37.23% |
| | ≥ 15 | 394 | 47.93% |
| Total | | 822 | 100% |

The Prevalence of Malaria

Out of 822 blood films examined, the total malaria positivity was 46 (5.6%). There was statistical significant variation between malaria infection and age ($\chi^2 = 12.2$ df = 2, $P = 0.002$). The greatest prevalence was in the 15 and above age-group (8.38%) compared to less than 5 years (4.92%) and in the age group between 5 to 14 (2.29%). On the other hand, there was no statistical significant variation in malaria prevalence between place of residence and sex of study participants (Table 2). More males (58.64%) were examined for malaria than females (41.36%), and 6.43% of males and 4.41% of females examined were positive for malaria. Prevalence in rural villages (6.25%) was greater than in urban areas (3.29%), but there was no statistically significant difference ($P > 0.05$).

Table 2
malaria prevalence based on the socio demography

| Variables | | Number examined | Malaria infection | | χ^2 | P –value |
|------------------|-----------|-----------------|-------------------|----------|----------|----------|
| | | | Positive | Negative | | |
| Sex | Male | 482 | 31 | 451 | 1.54 | 0.251 |
| | Female | 340 | 15 | 325 | 2.34 | 0.126 |
| Residence | Rural | 640 | 40 | 600 | 12.208 | 0.002 |
| | Urban | 182 | 6 | 176 | | |
| Age | < 5 | 122 | 6 | 116 | | |
| | 5–14 | 306 | 7 | 299 | | |
| | ≥ 15 | 394 | 33 | 361 | | |
| Total | | 822 | 46 | 776 | | |

A total of 46 parasite positive slides were found in all study sites, 6(13.04%) in Ameba village, 32 (69.56%) in Woyn wuha village and 8 (17.39%) in Moseba. Out of 31 (6.43%) infected males 0.83% were in Ameba village, 4.56% were in Woyn wuha village and 1.04% in Moseba village. Out of 15(4.41%) infected females 0.59% were in Ameba, 2.94% in Woyn wuha village and 0.88% in Moseba village. Overall malaria infection prevalence in Woyn wuha village (6.37%) was significantly ($P < 0.05$) higher than the prevalence in Moseba and Ameba village respectively (5.71% and 3.33%) as shown in Table 3.

Table 3
Overall malaria infection prevalence in three villages

| Villages | Sex | No. examined | No. positive | % |
|------------------|--------|--------------|--------------|-------|
| Ameba | Male | 102 | 4 | 3.93% |
| | Female | 78 | 2 | 2.56% |
| Woyn wuha | Male | 294 | 22 | 7.48% |
| | Female | 208 | 10 | 4.81% |
| Moseba | Male | 86 | 5 | 5.81% |
| | Female | 54 | 3 | 5.55% |
| Total | | 822 | 46 | 5.6% |

P. vivax 28(60.87%) and *P. falciparum* 18 (39.13%) are two the *Plasmodium* species identified in the study site. The result showed that *P. vivax* species was the most prevalent malaria parasite in the district as shown in Fig. 1. There is no significant difference between sexes and residence in the prevalence of *P. falciparum* species But, there is significant difference in *P. vivax* as indicated in (Table 4).

Table 4
Prevalence of *Plasmodium* species

| Variables | | Total examine | Presence of <i>Plasmodium</i> species | | | χ^2 | p-value |
|-----------|--------|---------------|---------------------------------------|--------------|------------|----------|---------|
| | | | <i>falciparum</i> | <i>Vivax</i> | Total | | |
| Sex | Male | 482 | 12 (26.09%) | 19(41.30%) | 31(67.39%) | 0.007 | 0.933 |
| | Female | 340 | 6 (13.04%) | 9(19.57%) | 15(32.61%) | | |
| Residence | Rural | 640 | 16 (34.78%) | 24(52.17%) | 40(86.95%) | 0.097 | 0.755 |
| | Urban | 182 | 2 (4.35%) | 4(8.7%) | 6(13.04%) | | |
| Age | < 5 | 122 | 4 (8.7%) | 2(4.35%) | 6(13.04%) | 6.924 | 0.031 |
| | 5–14 | 306 | 5 (10.86%) | 2(4.35%) | 7(15.21) | | |
| | ≥ 15 | 394 | 9 (19.57%) | 24(52.17%) | 33(71.74) | | |
| | | 822 | 18 (39.13%) | 28(60.57%) | 46(100%) | | |

As shown in table-4, the distribution of plasmodium species by sex, out of the total malaria positives the majority 31 (67.39%) were males and 15 (32.61%) were females. From these, 19 (61.29%) males were positive for *P. vivax* and 12(38.71%) were positive for *P. falciparum*, whereas 9 (60%) females were positive for *P. vivax* and 6(40%) were positive for *P. falciparum*.

The highest prevalence of malaria was seen in the age group of ≥ 15 years, which is 33 (8.38%) of 394 individuals. The least positivity was seen in the age group of 5–14 years which is 2.29% of the total of examined 306 individuals. In the majority of the age group the dominant *Plasmodium* species is *P. vivax*.

Discussion

This study was conducted primarily to determine the prevalence of malaria and associated parasites in the study area, malaria transmission, and to map out areas of high malaria risk.

In the current study, out of the total 46 positive cases 28 (60.87%) were *P. vivax* and 18(39.13%) were *P. falciparum*. So this result is quite different from the national prevalence of *P. falciparum* and *P. vivax* which is 60% and 40% respectively. The present study contradicts with the study conducted in Jimma zone at Assendabo health center, which reported prevalence of *P. vivax* 48 (45.7%) and *P. falciparum* 57 (54.3%) from total of 365 study population (Ghebreyesus, *et al.* 2000).

However, this study partly in line with the study finding reported from Southern Ethiopia health and health related indicator in 1992 in which out of 61,079 positive cases 47.2% were *P. falciparum* and 50.9% were

P. vivax indicating the lower number of *P. falciparum* in the region. The other study performed in Assendabo health center showed that 75% were positive for *P. vivax* and 32.5% were positive for *P. falciparum* which also parts confirmed with findings of the present study (Ghebreyesus, et al .2000). In addition to this the current study is also related with the study conducted at Aleta wondo in 2007 on 185 study subjects which indicates that 68 (66%) were *Plasmodium vivax* and 35 (34%) *Plasmodium falciparum* infection from (55.7%) 103 positive cases (Milikit, et al. 2007). The present study is also related with the survey conducted around Butajira, southern Ethiopia, where the prevalence of *P. falciparum* and *P. vivax* were shown to be 12.4% and 86.5%, respectively (Aynalem A, 2008). These three results indicate the lower number of *P. falciparum* in the region.

Moreover, the result of this study agree with the study conducted in Akaki in 1995 on 2136 sample were 78 (5.7%) positive cases found mainly account to *P. vivax* 54(69%) and 24(31%) were due to *P. falciparum* (Woyessa, T. et al.2004). In addition to these result of this agree with the study conducted in Hallaba Health Center, Southern Ethiopia in 2014 on 204 study population 169(82.84%) were found positive for plasmodium species, of which 119(70.41%) were due to *P. vivax* and 39(23.08%) were due to *P. falciparum* (Girum, T. 2014). Prevalence of *P. vivax* was also higher in males than females. The reason behind to this result should be, males are movable to different malaria risk area of Ethiopia for daily labor and might be caught (positive) there and relapse when they came to this study area due to the relapsing behavior of *P. vivax*.

In contrast to the established convention that infection among children less than 5 years old in stable communities implies autochthonous malaria transmission (Giha, et al. 2000), the finding in Bibugn district, where the highest prevalence was in the age group 15 years and above, does not fit into the conventional characterization of malaria epidemiology based on age stratification.

The total prevalence of malaria within the present study was 5.6%. This shows that the malaria prevalence was high compared to the findings of the National Malaria Indicator Survey (4%) (MoH, 2007), in Oromia and Southern Nations, Nationalities, and Peoples' Region (SNNPR) regions (2.4%), and Amhara Regional state (4.6%) (Estifanos, et al. 2008 and Tekola, et al. 2008). However, this was lower than the prevalence (10.5%) among the population in South West Ethiopia (WHO 2011). The variation of those result is may be environmental variation, sample size, nature of population and method of diagnosis.

The local variation in malaria prevalence in Ethiopia is further complicated by the local variation documented in this study where by the prevalence was significantly higher in the rural Kebeles compared to urban. The higher transmission of malaria occurs during October and November (the main rainy season) in the study area which is correlated with the study conducted by Hay, et al. 2000. Therefore, the relatively high transmission occurs in October and November, following the heavy rains, was to be expected in the study area.

In the present study, malaria prevalence in males is higher than in females in all study seasons in the study area. This result may be due to the fact that, in Bibugn district males spend the first part of the night working in their farms where they might be easily infected by mosquito which is active at the hours

of darkness, whereas most females do not have such risk as they normally are engaged in indoor household chores.

The present study indicates that *P. falciparum* and *P. vivax* were the two plasmodium species that infect humans occurred within the Bibugn district especially within the selected three villages. But different studies indicate that in Ethiopia four and three species are present in many places respectively (MoH, 2002 and MoH, 2006), and five Plasmodium species in the world (WHO.2011). Due to this in the present study, the prevalence of Plasmodium species within the study area become low.

Conclusion

This study was an initial step for the understanding of malaria prevalence in Bibugn district especially in the selected three villages. Based on the finding of the study, two plasmodium species cause malaria were *p. falciparum* and *p. vivax*. From the two species *P. vivax* was higher in prevalence than *P. falciparum* in the study area. The study revealed that there is association between age group and prevalence of malaria. Highest prevalence of malaria was seen for age groups ≥ 15 . Significantly higher prevalence of malaria was observed in Woyn wuha village as compared to the other villages in Bibugn district. Generally, from the result of this study it can be concluded that the prevalence of *P. vivax* and *P. falciparum* is different from the national figure.

Declarations

Consent for publication

If you allow, I am happy to publish in malaria journal. Because I need to be a member of this journal.

Availability of data and material

I get the data from published and unpublished material. I use primary and secondary information after publication articles are made available to subscribers as well as developing countries and patient groups through our universal access programs.

Competing interests

I have no Competing interests.

Funding

The fund which is required to do this study covered by the authors. There is no any organization which support by finance during in study design; in the collection, analysis and interpretation of data; in the writing of the report except in the decision to submit the article for publication.

Authors Contributions

My contribution on this study are data collection, organizing, identifying the parasite and prevalence of malaria. Almost all activity done by the author except blood sample collection, staining and comments

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Figures

Prevalence of *Plasmodium* species

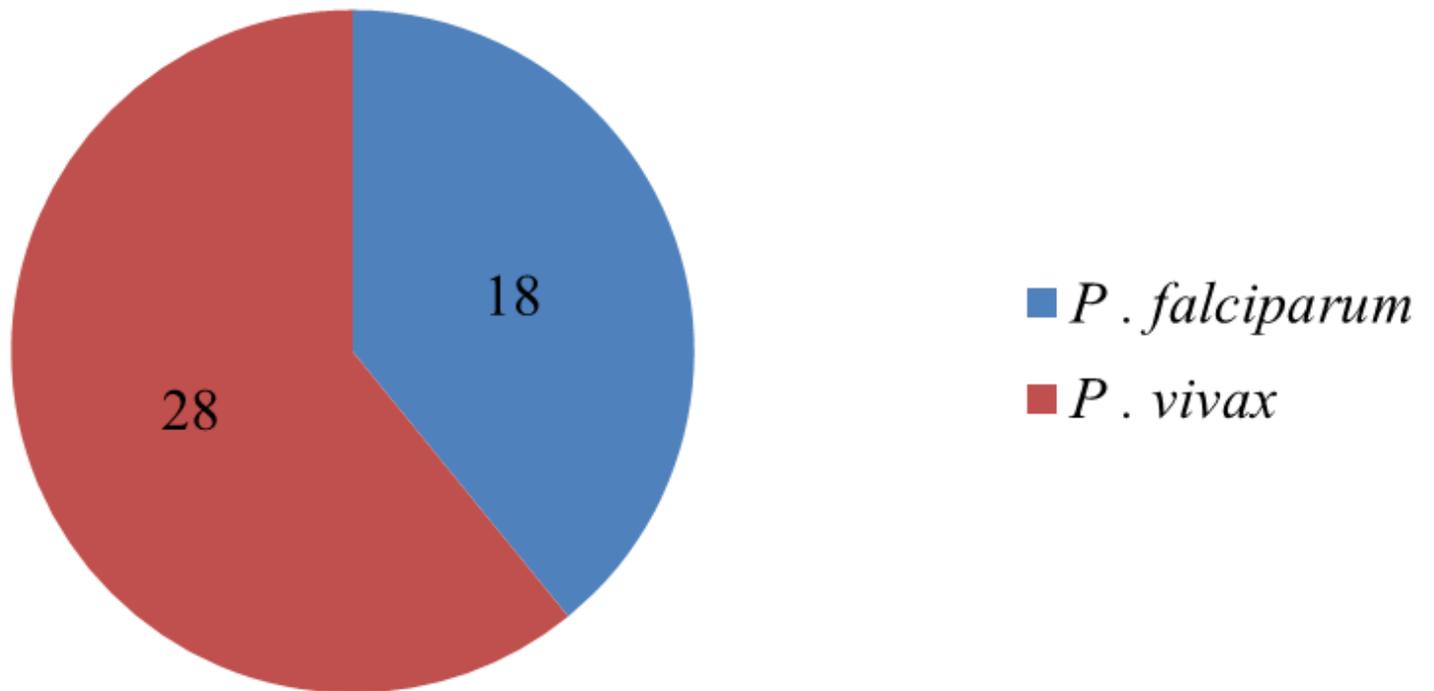


Figure 1

prevalence of plasmodium species

Prevalence of *Plasmodium* species

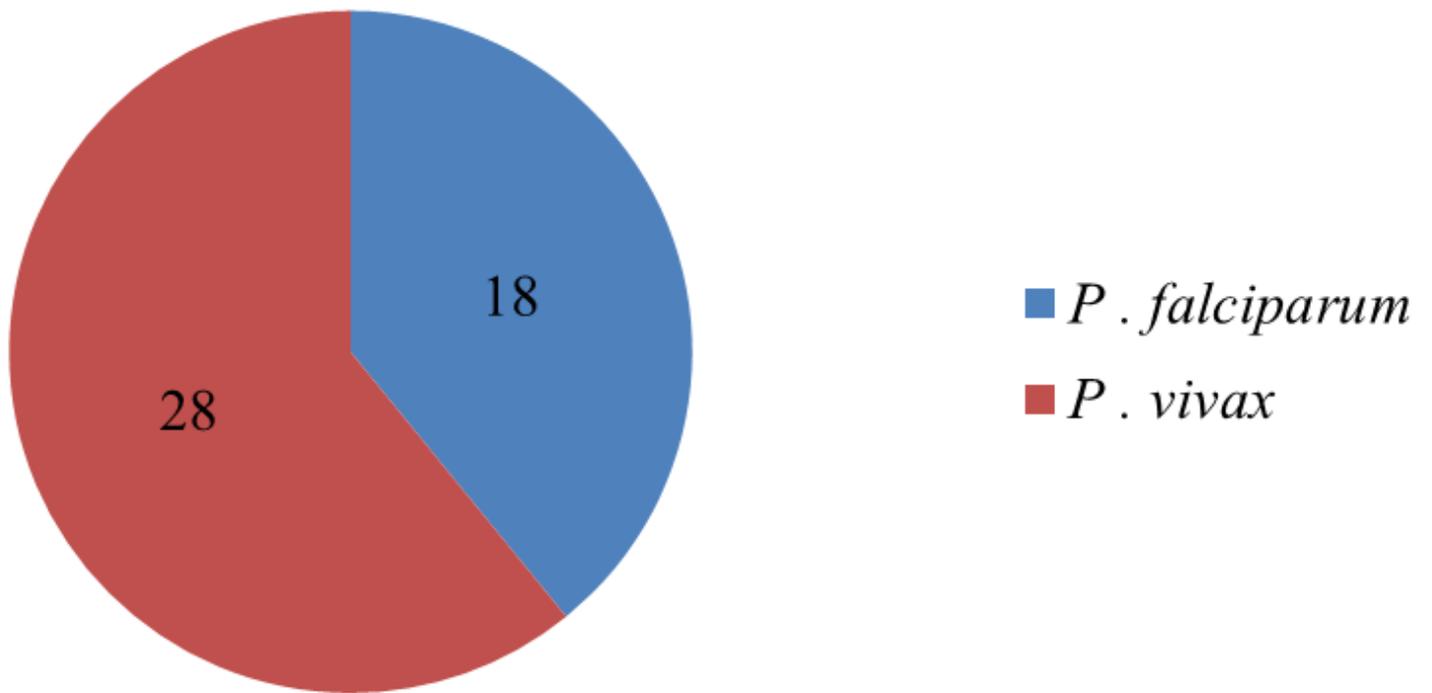


Figure 1

prevalence of plasmodium species