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Original Research Article

PREVALENCE OF MALARIA; A CROSS SECTIONAL STUDY AT BAHIR DAR HEALTH CENTER, NORTHWEST-ETHIOPIA

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Abstract: Background: Malaria remains a major public health problem worldwide. It primarily affects low- and lower-middle income countries. Within endemic countries, the poorest and most marginalized communities are the most severely affected, having the highest risks associated with malaria. Updated epidemiological information regarding the prevalence of malaria helps to determine the magnitude of the problem and to design and implement effective prevention and control measures. **Methods and materials**: A cross sectional survey was conducted for four consecutive months from November 2014 to February 2015 at Bahir Dar health center. Socio-demographic data were collected using structured questionnaires. Capillary blood samples were collected for thick and thin blood films, stained with Giemsa stains and examined microscopically for the detection and identification of plasmodium parasites. **Results**: Of 180 patients (age range; 8 months to 63 years) for blood film malaria parasites examinations, 69 (38.3%) were positive for malaria. Most of malaria infected individuals, 26(37.7) were in the age group 19-45 years. The prevalence malaria was high among females (60%) than males (40%). The two most important species of malaria identified were *P. falciparum* in 45(65.2%) patients and *P. vivax* in 24(34.8%). **Conclusions**: Although the numbers of study subjects were quite limited to draw strong conclusions, the observed prevalence calls up concerned stakeholders to undertake sustainable malaria prevention and control measures.

Key words: Malaria, Prevalence, Bahir Dar-Ethiopia.

Introduction: Malaria is an acute infection of the blood caused by protozoa of the genus plasmodium. The four medically important species of plasmodium includes *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale* and *Plasmodium malariae*. Malaria is one of the major public health problems around the world and about half of the world's population is at risk of the disease [1-4].

Globally, an estimated 3.3 billion people are at risk of being infected with malaria and

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developing disease, and 1.2 billion are at high risk (>1 in 1000 chance of getting malaria in a year). According to the latest estimates, 198 million cases of malaria occurred globally in 2013 and the disease led to 584 000 deaths [5]. Africa has the largest number of people living in areas with the high risk of malaria, followed by the South East Asia. More than 90% of clinical cases and death due to malaria occur in Africa [5]. Of those Africans who die from malaria each year, most are children under 5 years of age [6] and pregnant women due to low level of immunity [4].

About 75% of Ethiopian land mass is malaria-endemic, making malaria the leading public health problem in Ethiopia. An estimated 68% of the population of Ethiopia is living in malarious areas. Malaria is seasonal in most parts of Ethiopia with variable transmission and prevalence patterns affected by the large diversity in altitude, rainfall and population movement. Major transmission periods: September to December after main rainy season and the monor one is April to June following small showers of rain in autumn[7]. The unstable malaria transmission patterns make Ethiopia prone to focal and multifocal epidemics that have on occasion caused catastrophic public health emergencies. A malaria indicator survey conducted in Ethiopia in 2011 indicates that *P. falciparum* and *P. vivax* accounted for 58.3% and 41.7% respectively [8].

Ethiopia's fight against Malaria started more than half a century ago. Initially malaria control began as pilot control project in the 1950's and then it was launched as a national eradication campaign in the 60's followed by a control strategy in the 70's [9]. Despite many efforts to control malaria, it remains one of the most important causes of morbidity and mortality. Ethiopia's complex topography and seasonal rainfall largely supports its transmission [8].

Although malaria is among the list of top ten causes of outpatient visits in the study area, there is fluctuation in its position from year to year. Moreover the epidemiological picture of malaria is not yet determined there. Hence, the aim of the present study was to determine the prevalence of malaria at Bahir Dar Health center with convenient parasitological procedures.

Materials and methods: Study area and period: The study was conducted from November 2014 to February 2015 (the first two months are the period with the highest malaria incidence in Ethiopia) at Bahir Dar Heath center. Bahir Dar city, the capital of Amhara regional state, is situated on the Southern shore of Lake *Tana*, the source of Blue Nile (*'Abay'*). The city is approximately 560 Km North-West of Addis Ababa, having an elevation of about 1840 meters above sea level [10]. The city is weight land with annual average temperature of 28.8^{o}C (which is favorable for environment for vector multiplication).

Study design, sample size and sampling technique: A cross sectional survey was conducted on 180 malaria suspected patients who visited Bahir Dar health centre for blood film (BF) examination during the study period. Patients were suspected for malaria if they presented with fever and related clinical symptoms.

Data collection process: Socio-demographic data like patient's age, sex, occupation, residence and educational status were collected using researcher administered structured questionnaire.

Laboratory procedure: Microscopic examination remains the "gold standard" method for laboratory confirmation of malaria in developing nations. Capillary blood samples were collected from each presumptive patient for microscopic examination. The fingertip or heal of the child patient was cleaned with swab moistened with 70% v/v alcohol. After air drying, a sterile lancet was used to prick the finger or heel, and then squeezed gently to obtain the blood [11].

Two blood samples for thick and thin films, were prepared on, clean slides from each participant according to standard WHO

approved protocol. Slides were labeled properly and air dried horizontally on a slide tray. Thin films were fixed with absolute methanol immediately after drying and both thin and thick blood films were stained with 3% Giemsa solution for 30 minutes. Blood slides were read as either negative, *P. falciparum* positive, *P.vivax* positive, or mixed infection. Two hundred fields (the equivalent of 0.5µlof thick blood film) were examined at a magnification of 1000x before identifying a slide as negative. If positive, the thin film was read to determine the species [11, 12].

Data analysis: All data were entered, cleared, and analyzed using Statistical Package for Social Science (SPSS) software *(IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).* Descriptive statistics like proportion and mean was used to present data. Chi-square test was calculated to compare the proportion of blood film results between variables like sex and age of the patients and p value less than 0.05 was considered to indicate statistically significant difference.

Data quality assurance: The standard operation procedure (SOP) for blood film preparation, staining and microscopic examination was strictly followed. Labeled, clean and scratch free microscopic slides were used for detection and identification of malaria parasites. For Giemsa staining solution performance checking, positive and negative control slides were used. During microscopic examination to ensure accuracy, all positive slides and a random sample of 5% of the negative slides were re-examined by a separate laboratory technologist, who was blinded to the diagnosis of the first slide-reader and the degree of accuracy was 100%.

Ethical considerations: Ethical certificate for the study was obtained from Amhara Regional Health Bureau Institutional Review Board (IRB). Written informed consent was obtained from each participant after adequate explanation of the purpose of the study. Positive results were communicated with the health professionals in charge of attending patients for proper management.

Results: Socio-demographic characteristics: A total of 180 study subjects were included in the study. Of these, 106(58.9%), 87 (16.7%) and 112 (62.2) were females, in the age group of 19-45 years and from rural areas, respectively (Table 1). The age range of the study participants was 8 months to 63 years.

Table 1:- Socio-demographic characteristics of presumptive malaria cases at Bahir Dar Health Center, 2015.

Socio-demographic data		Frequency (%)
Residence	Urban	68 (37.8)
	Rural	112 (62.2)
Sex	Female	106(58.9)
	Male	74(41.1)
Age in year	< 5	35(19.4)
	5-18	43(23.9)
	19-45	87(48.3)
	>45	15(8.3)
Marital status	Married	96(53.3)
	Single	62(34.4)
	Divorced	16(8.9)
	Widowed	6(3.3)
Educational status	Illiterate	69(38.3)
	1-8th	59(32.8)
	9-12th	24(13.3)
	College and above	28(15.6)

Prevalence of malaria: From the total of 180 presumptive patients during the study period, the prevalence of malaria was 69 (38.3%). The two most important speciese of malaria identified were *P. falciparum* in 45(65.2%) patients and *P. vivax* in 24(34.8%). There was no report of mixed infection. Females 40(60%) and patients from rural area 41(59.4%) were more affected (Table 2 and Table 3). Moreover, 47 (68.1%) of the cases were identified in the first two months of the study period.

Table 2:- Distribution of plasmodium species by age and sex among the study participants at Bahir Dar Health Center, 2015.

Age	Total BF examined	Positive BF N (%)	Female N (%)		Males N (%)	
			P.f	*P.v*	*P.f*	*P.v*
<5	35(19.4)	11(15.9)	3(11.5)	2(14.3)	4(21.1)	2(20)
5-18	43 (23.9)	18(26.1)	7(26.9)	2(14.3)	7(36.8)	2 (20)
19-45	87 (48.3)	29(42.0)	11(42.3)	7 (50)	6(31.6)	5(50)
>45	15 (8.3)	11(15.9)	5(3.8)	3(21.4)	2 (10.5)	1(10)
Total	180	69	26	14	19	10

P.f = Plasmodium falciparum, P.v = Plasmodium vivax

Table 3:- Prevalence of malaria parasites by residence and educational status presumptive malaria cases at Bahir Dar Health Center, 2015

	Nº examined (%)	**Nº positive (%)**	**Nº Negative (%)**	***X²*, *P* value**
Residence				
Urban	68 (37.8)	28 (41.2)	40 (58.8)	0.4, > 0.05
Rural	112 (62.2)	41 (36.6)	71(65.4)	
Educational status				
No formal education	69 (38.3)	24 (34.8)	45(65.2)	
1-8th	59 (32.8)	15 (25.4)	44 (74.6)	15.46, < 0.05
9-12th	24 (13.3)	11 (45.8)	13 (54.2)	
College	28 (15.6)	19 (67.9)	9 (32.1)	

Discussion

The African continent continues to bear the greatest burden of malaria and the greatest diversity of parasites, mosquito vectors, and human victims [13]. In Ethiopia, malaria usually occurs at altitudes < 2,000m above sea level. Occasionally, transmission of malaria occurs in areas previously free of malaria, including areas > 2,000m above sea level [14].

The present study area is one of potentially malarious region in Ethiopia. The overall prevalence of malaria was 38.3%, which was higher than 14.8% in Gondar [15] and 25.6% in Negele borena.[16], Ethiopia. This might be due to Ethiopia's complex topography and variation in seasonal rainfall which supports largely seasonal short term transmission and malaria is generally unstable since the population remains non-immune. Additionally, about 68.1% of positive malaria cases were identified in the month November and December where there is good environment for vectors that make the incidence of malaria at the peak level in most malarious areas of Ethiopia. Similar finding was also reported by Yewhalaw *et al.* study in the country [17].

The prevalence of malaria in this study was relatively higher among females (60%) than males (40%) although it was not found significantly associated (p>0.05). However, this finding is in line with reports of 2010 world malaria report in which prevalence of malaria

was 62.4% among female and 37.5% in males [18]. This difference may be related with their relative low immune status and in addition, the number of female participants in the present study was greater than males.

The present study as well showed that the disease affected patients in the age range of 8 months to 63 years however; relatively more cases, 29(42.0%) were documented among the age group of 19-45 years. Similarly, significant numbers of children (16%) under the age of five were also affected. It was also found that age was an important predictor of malaria (X^2= 5.19, p value < 0.05). Almost similar reports were stated by other studies in the country [8, 16]. Occupational exposure of the adults and low immune position of children might prone them for high chance of contacting malaria.

The two most important causes of malaria identified during the study period were *P. falciparum* and *P. vivax* that accounts 65.2% and 34.8%, respectively. This result was comparable with the national prevalence study where about 57% and 43% of malaria cases in Ethiopia are account to *P. falciparum* and *P .vivax,* respectively [1]. Comparable finding was also demonstrated by another study in Southwest Ethiopia [15, 17]**.** Furthermore, different literatures stated that *P. falciparum* is in charge for the most form of malaria in Ethiopia [8, 19]. According to WHO malaria report of the year 2014 [5], *P. falciparum* is most prevalent on the African continent, and is responsible for most deaths from malaria. The report also indicated that *P. vivax* accounts for about 38% of reported cases in Eritrea and Ethiopia which is in agreement with our finding.

The study was carried out for just four month period in which the authors are unable to show the seasonal picture of malaria and its prevalence on a year basis. Similarly, this study lacks enough sample size and additional data that might affect the study to draw strong conclusions. It would be also useful to know the percentage of people infected who are not presenting at the health center with suspected malaria.

Conclusion and recommendations

The present study revealed high prevalence, 38%, of malaria in the study area over the four months period. The predominant identified species was *P. falciparum*. More proportion of women were affected. Consequently, concerned stakeholders should put sustainable malaria prevention and control measures to curb the problem.

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