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Magnitude of Malaria Infection in Chalia District, West Shoa Zone, Oromia Reginal State, Ethiopia

Tilahun Bogale Befikadu Asefa
College of Medicine and Health Sciences, Ambo University, P.O. Box 19, Ambo, Ethiopia

Abstract
Malaria is a major public health problem in worldwide and causes high morbidity and mortality. Studying its prevalence is necessary to implement effective control measures. Therefore, the aim of this study was to determine the prevalence of malaria in Gedo Hospital, Chalia District, Ethiopia. A cross sectional study was conducted from July to December, 2013, in Gedo Hospital. A well designed and pretested structured questionnaire and laboratory investigation were used to collect data. Data was processed and analyzed with SPSS version 21.0 (IBM, USA) and also Non-parameter test, Chi-square (X^2) was used to test the significant difference of the prevalence of malaria between the gender group (male and female). A total of 384 patient age ≥ 5 years old clinically suspected to have malaria were examined. Overall prevalence of malaria was 7.55% (29 malaria cases out of 384 patients) of which 19 (65.51%) were positive for *Plasmodium falciparum* and 8(27.58%) for *Plasmodium vivax*; the remaining 2(6.89%) showed mixed infections of *Plasmodium falciparum* and *Plasmodium vivax.* Of the total of 29 positive individuals sex distribution was 21(5.47%) male and 8(2.08%) female; this showed that males were more infected than females. Gender had statistically significant association with malaria infection ($p<0.05$). All age groups were infected but high prevalence observed in age groups 11–20 and 5-10 followed by 21–30 years old. Therefore, health professionals and administrators have to focus on prevention and control of malaria by giving health education, awareness creation at different levels on prevention and control of malaria in the study area and in the country as well.
Keywords: Prevalence, Malaria, Ethiopia.

Introduction

Malaria is a life-threatening infectious disease caused by the protozoan parasite called Plasmodium. The World Health Organization (WHO) estimated 660,000 deaths in 2011 directly attributed to malaria, approximately half of the world's population being at risk of infection [1]. Four main species of malaria infect humans: *Plasmodium falciparum*, *Plamodium vivax, Plasmodium malariae and Plasmodium ovale. Plasmodium falciparum* is the most highly virulent species and is responsible for almost all of the 1.7–2.5 million deaths worldwide caused by malaria [2, 3].

The number of malaria deaths in children aged under 5 years is estimated to have decreased from 723 000 globally in 2000 (range: 563 000–948 000) to 306 000 in 2015 (range: 219 000–421 000). The bulk of this decrease occurred in the WHO African Region, where the estimated number of deaths fell from 694 000 in 2000 (range: 569 000–901 000) to 292 000 in 2015 (range: 212 000–384 000). As a result, malaria is no longer the leading cause of death among children in sub-Saharan Africa. In 2015, malaria was the fourth highest cause of death, accounting for 10% of child deaths in sub-Saharan Africa. Reductions in malaria deaths have contributed substantially to progress towards achieving the MDG 4 target of reducing the under-5 mortality rate by two thirds between 1990 and 2015. Nevertheless, malaria remains a major killer of children, particularly in sub-Saharan Africa, taking the life of a child every 2 minutes (4).

The proportion of children infected with malaria parasites has halved in endemic areas of Africa since 2000. Infection prevalence among children aged 2–10 years is estimated to have declined from 33% in 2000 (uncertainty interval [UI]: 31–35%) to 16% in 2015 (UI: 14–19%), with three quarters of this change occurring after 2005. It is estimated that a cumulative 1.2 billion fewer malaria cases and 6.2 million fewer malaria deaths occurred globally between 2001 and 2015 than would have been the case had incidence and mortality rates remained unchanged since 2000. In sub-Saharan Africa, it is estimated that malaria control interventions accounted for 70% of the 943 million fewer malaria cases occurring between 2001 and 2015, averting 663 million malaria cases (range: 542–753 million). Of the 663 million cases averted due to malaria control interventions, it is estimated that 69% were averted due to use of insecticide-treated mosquito nets (ITNs) (UI: 63–73%), 21% due to artemisininbased combination therapy (ACT) (UI: 17–29%) and 10% due to indoor residual spraying (IRS) (UI: 6–14%) (4).

In Ethiopia malaria is a leading public health problem where an estimated 68% of the population lives in malarious areas and three quarters of the total land mass is regarded as malarious [5]. This makes malaria the number one health problem in Ethiopia with an average of 5 million cases per year [6]. The disease causes 70,000 deaths each year and accounts for 17% of outpatient visits to health institutions [7]. In 2009 there was 29% of outpatient visits to health facilities during high transmission years for malaria. The incidence of malaria is likely to be underestimated because only ≈30% of the population accessed health facilities at that time [8]

About half of the total population living between altitudes of 1,500 and 2,500 m above sea level (masl) is at risk of malaria and the areas experience epidemics in Ethiopia [9]. Recent studies from high-altitude areas identified age, nearness of houses to breeding places, sharing of houses with animals, presence of windows and open eaves as malaria risk factors [10-15]. Moreover, malaria is associated with environmental factors such as altitude, rainfall, and temperature [16]. In Ethiopia, malaria is unstable and commonly occurs as intraannual and interannual epidemics. Transmission is associated with altitude, temperature, and rainfall, generally peaking twice a year, after the 2 rainy seasons (March–May and July–September) [9*]*. Cases are caused by *Plasmodium falciparum* and *P. vivax*. *Anopheles arabiensis* mosquitoes are the main vector for both species. Although malaria is the most common communicable disease in Ethiopia [10], few longitudinal case data has been published [11].

Understanding the epidemiology of highland malaria, which is considered as at high epidemic risk is vital in improving malaria control efforts, and furthermore successfully eliminate malaria. A recent study described prevalence of malaria influenced by altitudinal location of households, survey season and age of participants [17]. Prevalence increased from high to low altitude that also revealed differences at varying age categories. In addition, this study confirmed seasonality of malaria. Malaria endemic areas that show a large variation from one year to another in the number of malaria cases considered as high epidemic risk. Thus, a present study area is considered as at high risk of epidemic malaria. A study was aimed at estimating malaria prevalence using longitudinal data illustrated seasonal variation of malaria infection. Moreover, prevalence of malaria differed by about 20-fold between villages of low prevalence and high prevalence. More interestingly, prevalence varied with different age categories along three altitudinal strata [17].

2. MATERIAL AND METHODS

2.1 Study Area

The study was conducted in Chalia District, Oromia Regional State, Ethiopia, which is at distance of 170Km to West of the capital city Addis Ababa. According to Central Statistical Agency (2005), the human population of the district is 240,055, of whom 122,182 are men and 117,873 are women; 26,619 or 11.09% of its population are urban dwellers. Religion wise 68.2% Orthodocs, 15.8% Protestant, 11.67% practiced traditional beliefs, and 3.99% were Muslim [18]

2.2 Study Design and Study Participants

A cross-sectional study was conducted during period from July to December 2013 at Gedo Hospital. A total of 384 patients with typical symptoms of the disease, such as fever (>37.8^{O}C), headache, back and joint pain consistent with malaria was included in this study. According to population-based survey evaluation of light microscopy and rapid diagnosis test (RDT) suggested that blood slide microscopy found to be the best option for population-based prevalence survey of malaria parasitaemia [19]. So that, we used simultaneously RDT, thin and thick blood film microscopically examinations.

- A blood sample was collected by taking finger-prick blood from participants for malaria rapid diagnostic test (RDT). The test is capable of detecting both *Plasmodium falciparum* and other *Plasmodium species*. Participants with positive rapid tests were immediately offered treatment according to National guidelines.
- From RDT negative participants, we collected two millilitres of venous blood samples into an Ethylene diamine tetra acetic acid (EDTA) containing bottles for the study, using vein puncture technique [20].
- Blood, laboratory analysis was carried out after thin and thick blood films prepared according to technique out lined and examined microscopically for malaria parasites under the microscope [20].

2.3 Ethical clearance

This study was reviewed and approved by the Institutional Ethics Review Committee of Ambo University. Participants of the study were informed about the purpose of the study and their issues were reserved confidentially.

2.4 Statistical Analysis

Data were statistically analyzed with one-way analysis of variance by using SPSS version 21 (IBM, USA). The presence or absence of association between malaria positive and risk factors assessed and also Non-parameter test, Chi-square (X^2) was used to test the significant difference of the prevalence of malaria between the gender group (male and female).

3. Result

A total of 384 patients clinically suspected to have malaria in Gedo Hospital were participated, of these, 231(61.15%) were males and 153 (39.84%) were females (Table1).

Table: Socio demographic characteristics of study participants (n=384)

Variables	Frequency (percent)
Male	231(61.15%)
Female	153 (39.84%)
Age	
5-10	33(8.59%)
11- 20	98(25.52%)
21- 30	187(48.69%)
31-40	48(12.5%)
≥41	18(4.68%)

The overall prevalence of malaria was 7.55% (29 malaria cases out of 384 patients) of which 19 (65.51%) were positive for *Plasmodium falciparum* and 8(27.58%) for *Plasmodium vivax*; the remaining 2(6.89%) showed mixed infections of *Plasmodium falciparum* and *Plasmodium vivax* (Table 2).

Table 2: Prevalence of malaria parasite among study participants

Malaria parasite	Frequency	Percent (%)
Plasmodium falciparum	19	65.51
Plasmodium vivax	8	27.58
Mixed infections (*Plasmodium falciparum* and *Plasmodium vivax*)	2	6.89

Male and female positivity was 21(5.47%) male and 8(2.08%) female. This study showed that male was more infected than females. Gender had statistically significant association with malaria infection ($p<0.001$) (Table 3).

Table 3: Prevalence of malaria parasite in relation to sex among study Participants

Sex	Number of examined	Number of positive	Percentage (%)	X^2
Male	231	21	5.47	**10.08***
Female	153	8	2.08	
Total	**384**	**29**	**7.55**	

In this study, all age groups were infected but high prevalence was observed in age groups 11- 20 and 5–10 followed by 21–30 years old (Table 4).

Table 4: Prevalence of malaria parasite in relation to age groups among study participants

Age	Number of examined	Number of infected	Percent (%) infected
5-10	33	7	1.82
11- 20	98	11	2.86
21- 30	187	5	1.3
31-40	48	4	1.04
≥41	18	2	0.52
Total	**384**	**29**	**7.55**

4. Discussion

Malaria is a major public health problem in Ethiopia. Over the past years, the disease has been consistently reported as the first leading cause of outpatient visits, hospitalization, and death in health facilities across the country [8]. In this study the overall prevalence rate of malaria was 29 (7.55%). This result was in line with similar studies done in the country [9, 10]. But it is higher than study conducted in other areas of the country [12]. This difference might be due to altitude variation and climate differences that may contribute to a great role for breeding of Anopheles mosquitoes. The predominant Plasmodium species detected was *Plasmodium falciparum,* followed by *Plasmodium vivax*. This was in agreement with other previous studies [13, 21]. But other studies reported that the most prevalent species was *Plasmodium vivax, followed by Plasmodium falciparum* [22, 23]. Males were more infected than females, which was statistically hilly significant ($p < 0.001$). This result is in consonance with the other previous studies [9, 24, 21]. The higher prevalence rate might be due to the fact that males engage in activities which make them more prone to infective mosquito bites as compared to female counterparts which are mostly at home and protected from such infective bites. In all age groups, malaria was reported in the study area. However, significantly affected age groups were 15–19 years old, followed by 20–29 years old. This might be associated with their daily activities. Agricultural activities are extensive in Chalia District. So that farmers are engaged day and night, especially at night during the time at which mosquito bite is

common. This may expose them to the infection of malaria. The prevalence of malaria depends on adequate rainfall and temperature. In areas with low temperate, transmission and incidence of malaria is commonly limited [25].

5. Conclusion

This study showed that there is high prevalence of malaria. Malaria has statistically significant association with sex and age. Therefore, health planners and administrators need to give intensive health education for the community on prevention and control of malaria.

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7. Competing Interest

I have declared that there is no any relevant competing interest to disclose in this research.

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