

Full Length Research Paper

Prevalence and socio-demographic determinants of malaria among febrile under- five children in Abobo district, Southwest Ethiopia: Cross-sectional study

Mitiku Dubale^{1*} and Obang Obang²

¹Department of Public Health, Faculty of Natural and Computational Sciences, Gambella University, Gambella, Ethiopia.

²Department of Biology, Faculty of Natural and Computational Sciences, Gambella University, Gambella, Ethiopia.

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Malaria ranks among Ethiopia's top ten causes of illness and mortality among children under five. The disease continues to pose a severe public health risk in malaria-endemic regions like the Abobo district. Information on malaria prevalence and its determinants among under-five year's children in the Abobo district is missing. A facility-based cross-sectional study was conducted at Abobo Catholic Health Center in Abobo district, Southwest Ethiopia, from June 2022 to August 2022. A total of 265 febrile children under the age of five were consecutively enrolled in the study. A structured questionnaire was used to collect data on socio-demographic characteristics, parental/caregiver knowledge, and malaria-determining factors. Malaria was diagnosed in the health center using the Malaria Rapid Diagnostic Test and Microscopy to confirm the presence of malaria parasites. Bivariate and multivariate logistic regression analyses were used to identify factors associated with malaria. This study comprised 265 participants, and the response rate was 100%. 36.2% of febrile children under five had malaria. Determinants like the presence of stagnant water (AOR = 0.203, 95% CI: 0.077, 0.537), and garbage heaps close to homes (AOR = 2.45, 95% CI: 1.41-4.26) were all related with an increased risk of contracting malaria. Compared to children who did not sleep under insecticide-treated nets, those who did were more likely to be protected from malaria infection (AOR = 0.238; 95% CI: 0.138-0.411). Malaria in Abobo town and the surrounding area disproportionately affected children under five. The most important determinants for malaria infections were living close to stagnant water, having garbage heaps surrounding the house, poor water drainage systems, and using insecticide-treated nets inadequately. Therefore, it is essential to strengthen community mobilization to improve the implementation of malaria prevention strategies and decrease the prevalence in the study area.

Key words: Children, Ethiopia, malaria, prevalence.

INTRODUCTION

Despite being preventable and treatable, malaria has a devastating impact on people's health and livelihoods

*Corresponding author. E-mail: mitikufast@gmail.com. Tel: (+251) 917164870.

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worldwide. In 2021, it was estimated that there were 247 million malaria cases globally, leading to 619000 deaths. Most of these, 95% of cases and 96% of deaths occurred in the World Health Organization (WHO) African Region. Children under 5 accounted for about 80% of all malaria deaths in the African Region (WHO, 2023).

Malaria remains a major public health issue in many parts of sub-Saharan Africa despite significant investments made in the past few years to decrease incidence rates (Debash et al., 2022), particularly for children under five who continue to be most at risk of frequent and severe malaria episodes with high mortality. Ethiopia, as part of the sub-Saharan region, has a high malaria burden.

Malaria distribution and transmission differ from place to place in Ethiopia. Malaria is the most prevalent in the western lowlands of Oromia, Amhara, Tigray, and nearly the entire Gambella and Benishangul Gumuz regions (Alealign and Dejene, 2018). Previous studies reported malaria prevalence rates in children in different regions of Ethiopia as follows: 3.9% in Benishangul-Gumuz region Western Ethiopia (Ahmed et al., 2021), 8.7% in Wogera district Northwest Ethiopia (Tsegaye et al., 2021), 22.1% in Arba Minch Zuria district South Ethiopia (Abossie et al., 2020), and 24.6% in Ziquala district Northeast Ethiopia (Debash et al., 2022). There is no effective vaccine for the disease and that vaccine studies are ongoing.

Through the use of insecticide-treated nets (ITNs), environmental control, chemoprophylaxis, and rapid case diagnosis followed by prompt case care, the Ethiopian Federal Ministry of Health has been working to minimize malaria morbidity and mortality. Malaria remains among Ethiopia's top ten causes of illness and mortality among children under five, despite several preventive efforts implemented in the past decade (Negatu et al., 2022). Ethiopia's malaria eradication effort aims to eliminate the disease by 2030 (Debash et al., 2022).

The prevalence and contributing factors to malaria among at-risk groups should be examined throughout time and in various locations to assess the program's success. Health departments in the current study area indicated that malaria infection was among the most common illnesses reported in children under the age of five at healthcare centers. However, there is a shortage of information regarding the prevalence of malaria and associated factors among febrile, under five children at Abobo Catholic Health Center. Scaling up and developing successful intervention programs require understanding the prevalence and contributing factors of malaria in children under five at health facilities. This study aimed to present up-to-date information on the prevalence of malaria infection and associated socio-demographic determinants at the health center level in an area of Southwest Ethiopia that is endemic for the disease but the researchers could not access any documents published on the study subject at the time of the research.

MATERIALS AND METHODS

Study design, area, and period

The facility-based cross-sectional study was conducted among consecutively recruited under five children visiting Abobo Catholic Health Center Southwest, Ethiopia, between June 2022 and August 2022. Abobo district is located at 811 km from Addis Ababa (the capital city of Ethiopia). Abobo Catholic Health Center is located in Abobo town which was established in 2002 by a group of Italian and Spanish volunteers in collaboration with local Salesian missionaries. It serves approximately 20,000 people living in the area. Provide medical care for those affected by malaria, tuberculosis, HIV/AIDS, and various infections common in the region (<https://missionnewswire.org/ethiopia>).

Study participants

All febrile children aged five years or below visiting the selected health facility during the study period were the source population. The study only included children whose parents/caregivers signed a written consent form.

Sample size estimation

The sample size was estimated using the assumption of 22.1% malaria prevalence from the previous study (Abossie et al., 2020), 95% confidence level, and 5% margin of error. This resulted in a final sample size of 265 participants, using a single population proportion calculation. Using sample size formula, the sample size was calculated as follows:

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

$$n = (1.96^2 * 0.221(1-0.221))/0.05^2 = n = 315.097252 = 265$$

where n=the total sample size, P=prevalence of malaria in Arba Minch Zuria district (22.1%), Z=Za/2 at 95% CI (1.96), d=the desired precision of the estimate/margin of error (5%).

Data collection tools and procedures

A structured questionnaire was used for data collection. The tool contained socio-demographic factors, environmental factors, household factors, and parents/caregiver factors like knowledge about the transmission and prevention of malaria, utilization and coverage of insecticide-treated nets related questions. The questionnaire was initially developed in English and translated into Amharic and local languages for data collection. A face-to-face interview with the parents/guardians of the under-five children was conducted to collect the data. Febrile under five-year-old children who were eligible for the study were seen by clinicians who requested microscopy or malaria rapid diagnostic tests (mRDT) in the laboratory to screen those with positive and negative results, respectively. The parents/caregivers of the children subjected to the test were interviewed by the clinicians using the questionnaire provided as they waited for the children to be tested. The children who tested positive were used to determine the prevalence of malaria in children under the age of five years visiting Abobo Catholic health center. The prevalence was the number of children who tested positive over the total number of children who engaged in the study.

Data quality assurance

Data collectors were trained for two days by the investigators before

the data collection. Each filled questionnaire was checked thoroughly for completeness and consistency, and the necessary feedback was given to data collectors. Recruitment was preceded by obtaining informed written consent from parents/caregivers of the children. To ensure the quality of the microscopic examinations, all positive and randomly selected 5% of the negative slides were checked blindly by another experienced medical laboratory technologist.

Data processing and analysis

After data collection, data were entered using Epi data version 3.1 and then exported to SPSS version 21 for analysis. The correlates of malaria were identified using bivariate and multivariate logistic regression models. Variables with a P-value of <0.2 in the bivariable regression were included in the multivariable logistic regression analysis. A P-value <0.05 was considered to determine statistical significance. Finally, adjusted odds ratios (AOR) with a 95% confidence interval (CI) were used to assess the strength of association of variables.

Ethical consideration

Ethical clearance (protocol number 006/FNCS/022) was obtained from the ethical review board committee of the Faculty of Natural and Computational Sciences at Gambella University, Ethiopia. A letter of support to conduct the study was obtained from the research directorate office of Gambella University, Ethiopia. The parents/caregivers were given detailed explanations about the study's objectives, procedures, and potential risks and benefits, and written consent was obtained following that. The interview of each study participant took place in a separate room, and sent the children to the laboratory for malaria examination. Appropriate Anti-malarial treatment was given to children who tested positive as per the national protocol..

RESULTS

Socio-demographic characteristics of parents/caretakers of the children

Two hundred sixty-five respondents participated in the current study, making the response rate 100%. More than half of the respondents, (75.5%) were married. Of most respondents, (40%) had only primary education, and (59.6%) had lived near a swampy areas. (63.8%) of the respondents lived in rural areas, as shown in Table 1. The majority of respondents, 176 (66.4%), were female. (47.5%) were between the ages of 25 and 34.

Magnitude of malaria infections

In this study, 265 febrile under-five children who came to the Abobo Catholic Health Center from various parts of the district throughout the study period underwent both mRDT and microscopy-based diagnostic tests for malaria. (36.2%) of the 265 children tested positive and (63.8%) tested negative.

Knowledge and perception about malaria among parents/caregivers

Most respondents 94.7% knew that a mosquito bite spreads malaria; however, the remaining 5.3% had misconceptions about the mode of transmission. When asked about ways to prevent malaria, 98.5% of respondents said sleeping insecticide-treated nets (ITNs), 88.3% said wearing long sleeves, 95.5% said spraying insecticide inside the house, 97.4% said draining mosquito breeding sites, 91.3% said closing windows early, 94.7% said using mosquito repellents, and 97.0% said clearing bushes around the house. Although 89.8% of respondents said mosquitoes only bite at night, 8.7% said they bite day and night. Malaria symptoms that were often stated included fever 98.5%, headache 98.9%, fatigue 97.7%, vomiting 99.6%, and chills 92.5%. Regarding treatment behavior, 39.2% of respondents sought treatment for ill children within a couple of days, whereas 33.2%, 15.1%, and 12.5% of respondents did so within four to seven days, more than seven and one days, respectively (Table 2).

Household and environmental factors for malaria prevalence

The majority 66.4% of the respondents' homes built unburned bricks and mud, 20.0% burnt bricks and cement, and 13.6% grass thatched with mud and poles. 78.5% of respondents stated that fewer than six persons lived in the family, while only 21.5% said that more than six individuals lived in the household. Regarding about time to go to bed, 54.7% of respondents said that under five-year-olds children went to bed between the hours of 8 and 9.00 p.m., 41.9% of children should sleep between the hours of 6 and 7 p.m., and 3.4% children should sleep between the hours of 10 p.m. and above.

Concerning households' current ITNs (75.1%) of respondents had possessed ITNs, whereas 24.9% did not possess ITNs due to lack of access. Of the respondents who owned ITNs, 48.7% of the household members slept under ITNs every night during the study period, while 51.3% of the respondents who possessed ITNs did not sleep under ITNs; when asked why they did not sleep under ITNs, the respondents who owned ITNs mentioned that ITNs produce bedbug insects that suck blood from the body. Most respondents 87.5% stated that their homes lack effective water drainage systems. In addition, as shown in Table 3, 84.5% of respondents had stagnant water adjacent to their homes, 63.8% had surrounding bushes, and 62.3% had garbage heaps.

Factors associated with malaria infection among febrile children

In bi-variable logistic regression, the following variables

Table 1. Demographic characteristics of parents/caretakers of children aged under- five years, in Abobo district, Southwest Ethiopia.

Variable	Category	Frequency	Percent
Gender	Male	89	33.6
	Female	176	66.4
	Total	265	100
Age	15-24	31	11.7
	25-34	126	47.5
	35-44	95	35.8
	≥45	13	4.9
	Total	265	100
Marital status	Single	29	10.9
	Married	200	75.5
	Divorced	30	11.3
	Widowed	6	2.3
	Total	265	100
Level of Education	None	27	10.2
	Primary	106	40.0
	Secondary	99	37.4
	Higher education	33	12.5
	Total	265	100
Location	Close to a swamp	158	59.6
	Not close to a swamp	107	40.4
	Total	265	100
Residence	Rural	169	63.8
	Urban	96	36.2
	Total	265	100

were chosen because of p-value <0.2 and entered into the forward stepwise multivariable logistic regression model: Under-five children sleeping under ITNs regularly; presence of a good water drainage system around the house; presence of stagnant water near the house; presence of garbage heaps near the house.

In the final adjusted model, children who regularly slept under ITNs had a lower risk of contracting malaria than children who did not (AOR = 0.238; 95% CI: 0.138-0.411). Children who lived in homes with nearby stagnant water had 0.2 times higher risks of contracting malaria than children who did not (AOR = 0.203, 95% CI: 0.077, 0.537). Children who lived near dumps of garbage had a 2.45 times higher risk of developing malaria infection than children who did not live in those homes (AOR = 2.45, 95% CI: 1.41-4.26) (Table 4).

DISCUSSION

In the present study, we estimated the prevalence of

malaria among febrile under-five children in the malaria endemic area and its determinant factors, and the results showed that the malaria prevalence in under-five children were 36.2%, which is in line with the study conducted in rural areas of central Malawi, where the prevalence of malaria in under-five children was identified to be 35.4% (Chilanga et al., 2020).

The current findings were lower than those of other studies, which reported prevalence rates of 64.5% in Tanzania (Sumari et al., 2017) and 49.4% in Haro Limmu Woreda, East Wollega Zone, Western Ethiopia (Bidu and Babure, 2016). This might be because the methodologies and geographic variance differed, and the study locations had additional malaria control and prevention systems. The prevalence found in this study, however, revealed a greater prevalence of malaria than other studies carried out in Rwanda (14.0%), Arba Minch Zuria District South Ethiopia (21.1%), and Ziquala District, Northeast Ethiopia (24.6%), respectively (Habyarimana and Ramroop, 2020; Aboessie et al., 2020; Debash et al., 2022). The studies were done during the peak transmission season in the

Table 2. Knowledge and perception about malaria among parents/caregivers of under five children in Abobo districts.

Variable	Category	Frequency	Percent
Knowledge about the disease and health seeking behaviors			
Have you ever heard about malaria?	Yes	258	97.4
	No	7	2.6
Malaria is transmitted by	Dog	1	0.4
	Mosquito	251	94.7
	Fly	6	2.3
	I don't know	7	2.6
How can we prevent and control malaria?			
Sleeping under ITNs	Yes	261	98.5
	No	4	1.5
Wearing long sleeved clothes	Yes	234	88.3
	No	31	11.7
Spraying with insecticide	Yes	253	95.5
	No	12	4.5
Destroying mosquito's breeding sites	Yes	258	97.4
	No	7	2.6
Closing windows early	Yes	242	91.3
	No	23	8.7
Using mosquito's repellants	Yes	251	94.7
	No	14	5.3
Clearing bushes	Yes	257	97.0
	No	8	3.0
When do mosquitoes bite?	Day time	4	1.5
	Night time	238	89.8
	Both day and night	23	8.7
What are the most common signs and symptoms of malaria infection seen in children?			
Fever	Yes	261	98.5
	No	4	1.5
Loss of energy	Yes	259	97.7
	No	6	2.3
Vomiting	Yes	264	99.6
	No	1	0.4
Headache	Yes	262	98.9
	No	3	1.1
Chills	Yes	245	92.5
	No	20	7.5

Table 2. Contd.

Treatment seeking behaviors			
Do you usually take any child who has fallen sick due to malaria to health care facility?	Yes	244	92.1
	No	21	7.9
How soon after suspecting malaria would you seek for treatment? (days)	1	33	12.5
	2-3	104	39.2
	4-6	88	33.2
	7	40	15.1

ITNs= Insecticide treated bed nets

Table 3. Household and environmental factors for malaria prevalence among under 5 children in Abobo districts.

Variable	Category	Frequency	Percent
Household factors			
What type of house do you sleep in?	Burn bricks with cement	53	20.0
	Un burnt bricks, mud poles	176	66.4
	Grass thatched with mud and poles	36	13.6
How many people live in your household? (people)	≤ 6	208	78.5
	> 6	57	21.5
What time do children under five go to bed?	6.00-7.00 pm	111	41.9
	8.00-9.00 pm	145	54.7
	10.00 & above	9	3.4
Does your household possess ITNs?	Yes	199	75.1
	No	66	24.9
Did you and your household members sleep under ITNs?	Yes	129	48.7
	No	136	51.3
Environmental factors			
Do you have good water drainage system around your house?	Yes	33	12.5
	No	232	87.5
Do you have stagnant water near to house?	Yes	224	84.5
	No	41	15.5
Do you have bushes around your house?	Yes	169	63.8
	No	96	36.2
Do you have garbage heaps very close to your home?	Yes	165	62.3
	No	100	37.7

study sites, which may account for this.

Regularly sleeping under ITNs was discovered to be protective against contracting malaria. Other research undertaken in East Shewa (Haji et al., 2016), Dilla (Molla and Ayele, 2015), Ethiopia (Aychiluhm et al., 2020),

Ghana (Nyarko and Cobblah, 2014), and Uganda (Roberts and Matthews, 2016) provide support to this evidence. It was clear that properly using ITNs reduced mosquito bites, which reducing malaria infection (Belete and Roro, 2016).

Table 4. Factors associated with malaria infection in under-five children, in Abobo district, Southwest Ethiopia.

Variable	No.	Positive (%)	Negative (%)	COR (95% CI)	P-Value	AOR (95% CI)	P-value
Under five children sleeping under ITNs regularly?							
Yes	129	26	103	0.379 (0.154-0.930)	0.000	0.238 (0.138-0.411)	0.034
No	136	70	66	1		1	
Presence of good water drainage system around the house?							
Yes	33	3	30	0.370 (0.061-2.247)	0.002	0.149 (0.044-0.504)	0.280
No	232	93	139	1		1	
Presence of stagnant water near to the house?							
Yes	41	5	36	0.641 (0.137-3.005)	0.001	0.203 (0.077-0.537)	0.573
No	224	91	133	1		1	
Presence of garbage heaps near to the house?							
Yes	165	72	93	1.654 (0.661-4.140)	0.001	2.452 (1.411-4.260)	0.283
No	100	24	76	1		1	

In comparison to children who live in areas free of stagnant water, bushes, and garbage heaps nearby to their homes, those who do so are more likely to contract malaria. This finding is consistent with previous Dembia (Agegnehu et al., 2018) and Southern Ethiopia (Belete and Roro, 2016) studies. This can be explained by the fact that they are more likely to get bitten by mosquitoes because the areas around their homes are ideal for mosquito breeding (WHO, 2023).

Limitations of the study

Data was collected in the healthcare facility, making it difficult to generalize to all Woreda respondents. The study's cross-sectional study design prevented us from determining whether cause or effect came first. In addition to these, there was no detail about the children immunization status, presence of malnutrition and previous disease histories were collected.

CONCLUSION AND RECOMMENDATIONS

The prevalence of malaria in under-five children attending the selected health facility in the Abobo district was high. The most significant predictors of malaria in the study site were the presence of bushes, garbage dumps, and stagnant water close to their homes. The government and other stakeholders should strengthen malaria control strategies such as eradicating mosquito breeding sites, ensuring access to ITNs for all under-five children living in malaria-endemic areas, and increasing awareness regarding malaria transmission and its preventative methods in the study area to mitigate the burden of malaria.

ABBREVIATIONS

AOR, Adjusted odds ratio; **CI**, confidence interval; **ITNs**, insecticide treated nets; **AIDS**, acquired immune deficiency syndrome; **HIV**, human

immune virus; **SNNPR**, Southern Nation Nationalities and People Region; **mRDT**, malaria rapid diagnostic test; **SPSS**, Statistical Package for the Social Science.

CONFLICT OF INTERESTS

All the authors declared that there is no any conflict of interests.

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