Insights into Malaria: A Cross-Sectional Survey on Knowledge, Attitudes, and Practices in South-South Nigeria

ABSTRACT

Background: Malaria is a public health concern deeply ingrained within local communities in sub-Saharan Africa. Local beliefs and practices play a critical role in defining the effectiveness of control measures. This study aimed to assess the knowledge, attitudes, and practices regarding malaria in a rural community in South-South Nigeria.

Methods: This cross-sectional study was conducted in Ugunin South-South Nigeria. Data were collected from the participants using an interviewer-administered questionnaire. Data analysis was performed using SPSS and a *P*-value of < 0.05 was considered significant.

Results:This study included 300 participants with a mean age of 51.6 ± 20.9 years. The results showed that 28.3% had good knowledge, 55.7% had a positive attitude, and 44.7% demonstrated good practices regarding malaria. Knowledge scores were associated with the education ($P< 0.012$) and occupation ($P< 0.001$) of participants, while attitude scores were associated with the occupation ($P = 0.002$) and marital status of participants ($P < 0.001$). Age, education, occupation, and marital status were associated with participants' practice scores ($P <0.001$). Civil servants (OR = 4.97; 95% CI: 1.69 - 14.61; $P = 0.004$) and pensioners (OR = 7.26; 95% CI: 1.98-26.61; $P = 0.003$) had higher odds of having good knowledge of malaria than farmers. Married participants (OR = 5.02; 95% CI: 1.51 - 16.66; $P = 0.008$) and those with good knowledge (OR = 1.94; 95% CI: 1.11 - 3.42; $P = 0.021$) had higher odds of exhibiting a positive attitude. Participants with primary (OR = 6.21; 95% CI: 2.59 - 14.86; $P< 0.001$) and secondary (OR = 12.04; 95% CI: 3.89 - 37.31); $P< 0.001$) education had higher odds of adopting good practices than those with informal education.

Conclusion: Although more than half of the participants had a positive attitude towards malaria, the majority showed insufficient knowledge and poor practices related to the disease. This highlights the pressing need for targeted public health educational programs to improve community understanding and promote effective practices for malaria control.

Keywords: Malaria, Knowledge, Attitude, Practice, South-South Nigeria.

1. INTRODUCTION

Malaria is a potentially lethal global health concern that has a major impact on morbidity and mortality worldwide, with a significant impact in developing countries such as sub-Saharan Africa [1]. Fortunately, this condition is preventable and curable. Plasmodium falciparum and Plasmodium vivax represent the greatest threats among the five species of parasites that cause malaria in humans. Plasmodium falciparum is responsible for the majority of malaria-related deaths, particularly in sub-Saharan Africa [1]. Transmission occurs primarily through the bites of infected female Anopheles mosquitoes, but blood transfusion and the use of contaminated needles are also possible routes of transmission [1].

In 2021, the World Health Organization (WHO) stated that almost half of the world's population was at risk of malaria, with 247 million documented cases and 619,000 deaths globally, making malaria the most common infectious disease in tropical and subtropical countries [2]. Malaria has a disproportionately high burden in the WHO African region, accounting for 95% of reported cases and 96% of fatalities in 2021 [2]. Children under five years of age, pregnant women, travelers, and people living with HIV or AIDS are at an increased risk of developing severe malaria [2]. In 2021, four African countries accounted for more than half of all malaria-related deaths globally: Nigeria (31.3%), the Democratic Republic of Congo (12.6%), the United Republic of Tanzania (4.1%), and Niger (3.9%) [1].

Nigeria, in particular, is confronting a significant public health crisis due to malaria, bearing the world's heaviest burden with 68 million cases in 2021 [3]. This represents 27% of the global malaria burden and 28% of the burden in the WHO African region [3]. Severe malaria resulted in 194,000 deaths in Nigeria in 2021, with almost 80% of these deaths affecting children under five years of age, contributing to 31% of global malaria-related deaths and 40% of the deaths in the WHO African region [2,3].

Various malaria control interventions, including the Roll Back Malaria campaign [4], the WHO Global Technical Strategy for Malaria 2016-2030 [5], and the E-2025 program [6] have been implemented. However, the success of these programs depends on factors such as public understanding, attitudes, and regular implementation of preventive measures. Nigeria has a numberof initiatives, including the National Malaria Control Program, National Malaria Elimination Program, National Malaria Strategic Plan, and Nigeria End Malaria Council [7,8]. Despite these measures, the burden of malaria in Nigeria remains high.

Malaria is deeply rooted in African communities, and local beliefs and practices play a critical role in defining responses and the effectiveness of control methods, highlighting the need for culturally appropriate interventions [9–11]. Knowledge gaps in African rural communities demonstrate that studies on knowledge, attitudes, and practice (KAP) are critical for malaria prevention and control [12–14]. Oguntade*et al*. [15] and Singh *et al*. [13]reported generally poor knowledge and practices related to malaria and its control in Nigeria. Studies in Tanzania [12], Ethiopia[16], Uganda [17], and Ghana [18]have reportedcomparable results. These

resultshighlight the importance of assessing the KAP of local communities as a critical step in developing and implementing effective malaria control strategies.

Early malaria diagnosis, treatment, and control are crucial for reducing the prevalence of this disease, preventing death, and reducing transmission rates. Inadequate knowledge of malaria diagnosis, treatment, and control measures can increase the number of cases. Therefore, it is important to understand the perceptions of the population regarding malaria. Despite this need, there is still a research gap regarding malaria KAP in rural communities in South-South Nigeria. Therefore, this study aimed to assess malaria KAP among residents of a rural community in South-South Nigeria.

2. METHODS

2.1 Study design, area, and population

This community-based cross-sectional study was conducted from August 16 to 31, 2023 in Ugun, Igueben Local Government Area (LGA) of Edo State, South-South Nigeria. The Igueben LGA, which covers 380 square kilometers in size, has a population of 70,276 according to the 2006 census, with a current estimate of 103,800 in 2022 [19,20]. Ugun is a rural community that relies heavily on agricultural activities such as farming, trading, and transportation. There are two primary schools, a secondary school, and a primary health care center in the community. The study included participants aged 18 years or older residing in Ugun community.

2.2 Sample Size Estimation and Sampling Technique

The sample size was determined using Fisher's statistical formula ($n=Z^2pq/d^2$). The sample size was calculated using a confidence interval (Z) of 1.96, which corresponds to a confidence level of 95%, tolerable sampling error (d) of 0.05, prevalence (p) of 20% from a previous KAP study [15], and q =1-p, which corresponds to the proportion of the sample population that was not included in this study. Allowing for a 10% risk of attrition, the final minimum sample size (n) was 271. The study site was selected using a multistage sampling technique and participants were recruited sequentially via convenience sampling.

2.3 Inclusion and Exclusion Criteria

All consenting adults aged 18 years or older living in Ugun Village were eligible to participate in the study. Individuals with cognitive disorders, hearing impairment, or those who did not provide consent were excluded.

2.4 Data collection tools

Data were obtained as part of a medical outreach program using an interviewer-administered structured questionnaire derived from previous studies [21,22]. The questionnaire included sociodemographic data and KAP questions related to malaria. A pretest was conducted to determine the reliability of the questionnaire. Trained research assistants, including physicians, medical students, and laboratory scientists, collected data during the medical outreach program to ensure competence and reliability.

Nine multiple-choice questions on different areas of malaria were used to measure knowledge. A correct answer received a score of one (1), whereas an incorrect or uncertain answer received a score of zero (0). The individual knowledge scores were summed, and the participants were classified based on the mean knowledge score (9.2). Individuals with scores equal to or above the mean were considered to have good knowledge, whereas those with scores below the mean were considered to have poor knowledge.

Eleven questions on malaria susceptibility, treatment, prevention, and control were used to examine the participants' attitudes. Each question was scored as “No” = 0, “Maybe” = 1, or “Yes” = 2. The individual attitude scores were summed, and the participants were classified based on the mean attitude score (17.3). Those with scores equal to or above the mean had a positive attitude, while those with scores below the mean had a negative attitude.

Malaria-related practices were assessed using 12 questions on a 3-point Likert scale scored as follows: “never” = 0, “sometimes” = 1, and “always” = 2. The individual practice scores were summed, and the participants were classified based on the mean practice score (9.2). Those whose scores were equal to or above the mean had good practices, whereas those with scores below the mean had poor practices.

2.5 Statistical analysis

Data entry and analysis were performed using IBM SPSS® version 25 for Windows. Continuous variables were summarized as means with standard deviations, and categorical variables were reported as frequencies and percentages. The KAP mean scores were compared across participants’ sociodemographic variables using an independent t-test or one-way analysis of variance (ANOVA), as appropriate. Binary logistic regression analysis was used to identify the predictors of KAP. Statistical significance was set at $p < 0.05$.

3. RESULTS

The study included 300 participantswith a mean age of 51.6 ± 20.9 years. The distribution across age groups was fairly uniform, slightly favoring those under 45 years. There were 221 (73.7%) females and 79(26.3%) males, resulting in a female-to-male ratio of 2.8:1. Ninety-seven (32.3%)

participants had primary school education and 132 (44.0%) were farmers (Table 1). All participants confirmed their awareness of malaria, with television/radio (35.3%), health workers/facilities (26.0%), family/friends (22.7%), and internet/social media (10.3%) as the primary sources of information (Fig. 1).

Table 1: Sociodemographic characteristics of the study population

Characteristics	Frequency	Percent (%)
Age groups (years)		
< 45	104	34.7
45-64	95	31.7
≥ 65	101	33.7
Mean ± SD	51.6 ± 20.9	
Gender		
Male	79	26.3
Female	221	73.7
Level of education		
Informal	74	24.7
Primary	97	32.3
Secondary	82	27.3
Tertiary	47	15.7
Occupation		
Farmer	132	44.0
Trader	56	18.7
Civil servant	23	7.7
Artisan	21	7.0
Pensioner	12	4.0
Student	56	18.7
Marital status		
Single	57	19.0
Married	213	71.0
Widowed	30	10.0

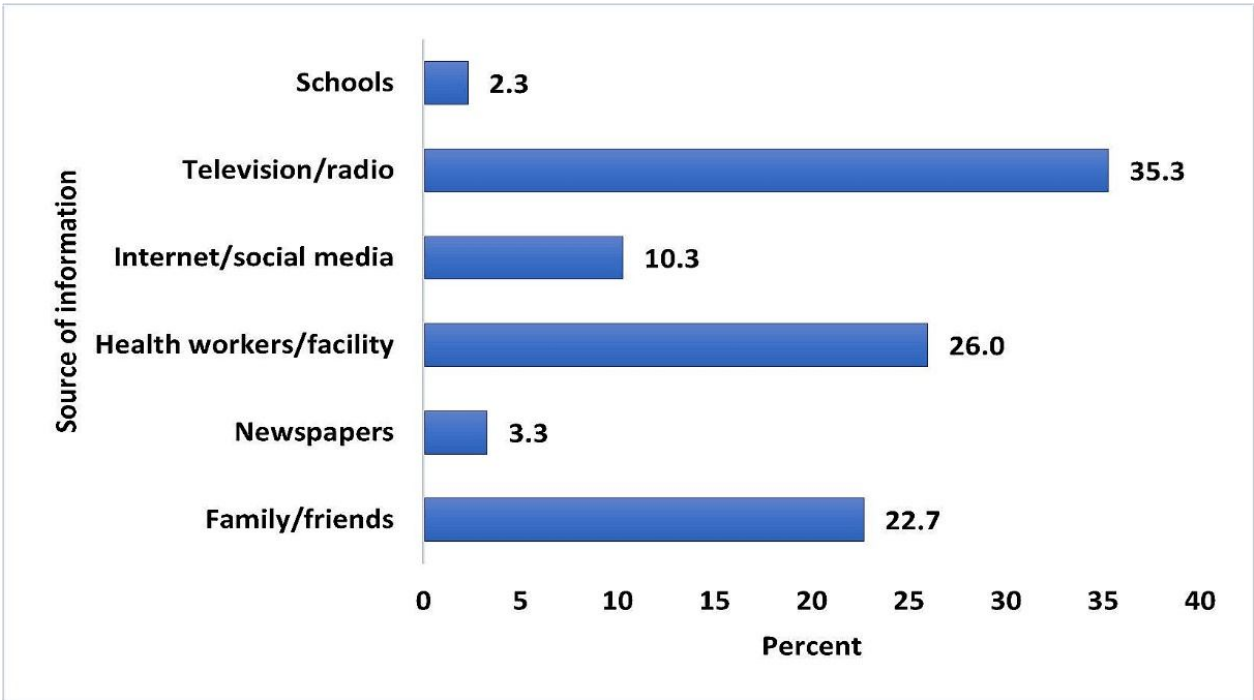

Fig. 1. Sources of information about malaria

The majority of participants correctly identified mosquito bites as the cause (73.0%) and primary mode of transmission (74.7%) of malaria. However, there were misconceptions, such as attributing malaria to witchcraft (8.0%), hard work (25.3%), and drinking contaminated water (29.0%).Different views on transmission routes included drinking contaminated water (27.0%), consuming contaminated food (16.3%), and breathing contaminated air (14.3%). Participants varied in understanding mosquito behavior, with 44.3% believing they can bite anytime and 37.0% mainly at night. The most commonly reported mosquito breeding habitats were ponds/stagnant water (49.7%) and shrubs (47.7%). Commonly reported symptoms included fever (53.3%), cold/chills (41.7%), body aches (40.3%), and headache (13.3%). Regarding vulnerability, 56.3% believed malaria affects all age groups equally, 13.3% mentioned children under five, and 6.3% mentioned pregnant women. Treatment preferences varied, with 31.3% choosing antibiotics, 25.7% herbs, and 22.3% chloroquine. Malaria prevention measures included cleaning of home surroundings (66.7%), bush clearing (28.7%), and insecticide-treated bed nets (ITNs) (22.0%) (Table 2).

The study found that 68.7% of participants believed malaria could be prevented, 87.2% identified it as a serious health issue and 88.7% believed that untreated malaria could lead to death. The majority (80.3%) agreed that seeking treatment at a hospital is crucial for probable malaria cases and 83.0% believed in ITNs' effectiveness for malaria prevention. (Table 3).

Table 2.Participants' responses regarding their knowledge of malaria.

Variable	Frequency	Percent (%)
Cause of Malaria		
Hard work	76	25.3
Mosquito bite	219	73.0
Houseflies	38	12.7
Long exposure to sunlight	51	17.0
Drinking dirty water	87	29.0
Witchcraft	24	8.0
Cold weather	44	14.7
Close contact with a malaria patient	21	7.0
Rat bite	24	8.0
Transmission of malaria		
Mosquito bite	224	74.7
Drinking dirty water	81	27.0
Eating contaminated food	49	16.3
Inhaling polluted air	43	14.3
Contact with a malaria patient	24	8.0
Houseflies	20	6.7
When do mosquitoes mostly bite?		
During the day	52	17.3
At night	111	37.0
Anytime	133	44.3
Do not know	6	2.0
Breeding sites for mosquitoes		
Ponds/stagnant water	149	49.7
Running water	17	5.7
Tall grasses	62	20.7
Bushes	143	47.7
Cattle shed	35	11.7
Along streams and riverbanks	46	15.3
Do not know	10	3.3
Is malaria contagious?		
Yes	89	29.7
No	166	55.3
Not sure	45	15.0
Symptoms of malaria		
Fever	160	53.3

Chills and shivering	125	41.7
Body pain	121	40.3
Joint pain	53	19.3
Headache	105	35.0
Loss of appetite	81	27.0
Nausea and vomiting	44	14.7
Diarrhea	60	20.0
Body weakness	72	24.0
Dizziness	55	18.3
Confusion	26	8.7
Do not know	20	6.7
Most vulnerable group to malaria		
Under five	40	13.3
Pregnant women	19	6.3
Elderly	26	8.7
Equal for all	169	56.3
Do not know	46	15.3
Preferred malaria medication		
Chloroquine	67	22.3
Sulfadoxine-pyrimethamine	21	7.0
Artemisinin combination therapy	43	14.3
Quinine	38	12.7
Amoxicillin	94	31.3
Herbs	77	25.7
Do not know	67	22.3
Preventive measures		
Cleaning household surroundings	200	66.7
Avoid drinking dirty water	80	26.7
Clearing bushes/tall grasses	86	28.7
Avoid contact with malaria sufferers	38	12.7
Drainage of stagnant water	61	20.3
Garlic use	31	10.3
Sleeping under ITNs	66	22.0
Mosquito repellant	38	12.7
Indoor residual spraying of insecticides	38	12.7
Chemoprophylaxis	29	9.7
Doors and window screen	37	12.3
Drinking lots of water	30	10.0
Do not know	26	8.7

ITN: Insecticide-treated net

Table 3: Study participants' responses to attitude statements.

Attitude statements	Frequency (%)		
	Yes	**Maybe**	**No**
Malaria can be prevented	206 (68.7)	39 (13.0)	55 (18.3)
Malaria is a serious or life-threatening health issue	248 (87.2)	2 (0.7)	50 (16.7)
Malaria can lead to death if untreated	266 (88.7)	2 (0.7)	32 (10.7)
Malaria is still a problem in your area	199 (66.3)	19 (6.3)	82 (27.3)
Important to go to a health facility/clinic when you suspect you have malaria	241 (80.3)	12 (4.0)	47 (15.7)
Blood tests are important for malaria diagnosis.	198 (66.0)	24 (8.0)	78 (26.0)
Presence of mosquitoes in your house bothers you	218 (72.7)	16 (5.3)	66 (22.0)
Incomplete or improper use of antimalaria is risky	204 (68.0)	11 (3.7)	85 (28.3)
Use of personal protective items can prevent you from getting malaria.	168 (56.0)	28 (9.3)	104 (34.7)
ITNs are useful in preventing malaria	249 (83.0)	25 (8.3)	26 (8.7)
Orthodox antimalarial drugs are superior to herbal medications.	197 (65.7)	33 (11.0)	70 (23.3)

ITN: Insecticide-treated net; All values are stated in number (percentages) unless otherwise stated.

This study found that 151 (50.3%) sought medical care at a health facility when ill, with 90 (30.0%) consistently doing so.Only 14 (4.7%) participants always slept under an (ITN), 52.0% always cleaned and trimmed bushes outside their houses, and 26.7% consistently drained stagnant waters around their homes. Notably, 48.3% sometimes used herbal remedies, and 29.3% always did. Additionally, 62.7% always used over-the-counter antimalarial medication when sick, while 14.0% always used antimalarial medication prescribed by a doctor (Table 4).

Table 4: Participants' responses to malaria practice questions

Practice questions	Frequency (%)		
	Never	**Sometimes**	**Always**
How often do you seek medical care/visit a health facility when you or your family members have malaria symptoms?	59 (19.7)	151 (50.3)	90 (30.0)
How often do you clean the surrounding area and trim the bushes around the house?	25 (8.3)	119 (39.7)	156 (52.0)

How often do you drain stagnant water around the house?	115 (38.3)	105 (35.0)	80 (26.7)
How do you describe your habit of using mosquito-repellent creams on exposed body parts?	201 (67.0)	87 (29.0)	12 (4.0)
How often do you use indoor residual spray with insecticide?	109 (36.3)	162 (54.0)	29 (9.7)
How often do you sleep using an ITN?	188 (62.7)	98 (32.7)	14 (4.7)
How do you describe your habit of using mosquito coils while sleeping at night?	143 (47.7)	111 (37.0)	46 (15.3)
How often do you screen windows and doors	155 (51.7)	116 (38.7)	29 (9.7)
How often do you wear long-sleeved clothes when working in the fields, outside, or at night?	67 (22.3)	196 (65.3)	37 (12.3)
How often do you use antimalarial medication prescribed by a healthcare professional?	109 (36.3)	149 (49.7)	42 (14.0)
How often do you self-medicate with over-the-counter antimalarial medication?	4 (1.3)	108 (36.0)	188 (62.7)
How do you describe your habit of using herbal remedies?	67 (22.3)	145 (48.3)	88 (29.3)

ITN: Insecticide-treated net; All values are stated in number (percentages) unless otherwise stated.

The study found that 71.7% of respondents had poor knowledge and 28.3% had good knowledge of malaria. The mean knowledge score was 9.2 ± 6.6. The mean attitude score was 17.3 ± 4.5, with 43.3% having negative attitudes and 55.7% having positive attitudes. In terms of malaria-related practices, 55.3% adopted poor practices and 44.7% adopted good practices.The mean practice score was 9.2 ± 2.8.

There was no significant gender difference in the knowledge (t = -0.006, $P = 0.900$), attitude (t = 1.479, $P = 0.396$), or practice (t = − 0.071, $P = 0.102$) scores. Participants education level (F = 3.718, $P = 0.012$) and occupation (F = 10.314, $P< 0.001$) were significantly associated with knowledge scores.There was a significant association between participants' mean attitude scores and age groups (F = 3.144, $P = 0.045$), occupation (F = 3.866, $P = 0.002$), and marital status (F = 21.119, $P< 0.001$). Regarding practice, significant differences were found between age groups (F = 9.605, $P< 0.001$), educational level (F = 39.694, $P< 0.001$), occupation (F = 9.526, $P< 0.001$), and marital status (F = 13.566, $P< 0.001$)(Table 5).

Table 5: Association of mean KAP scores with participants' sociodemographic variables using t-tests and ANOVA.

Variable	Knowledge			Attitude			Practice		
	Mean ± SD	**F**	***P*-value**	**Mean ± SD**	**F**	***P*-value**	**Mean ± SD**	**F**	***P*-value**
Age (years)									
< 45	9.4 ± 7.3	2.304	0.102	16.4 ± 5.8	3.144	0.045*	10.1 ± 2.6	9.605	< 0.001*
45-64	10.1 ± 6.5			18.0 ± 3.1			9.0 ± 3.0		
≥ 65	8.2 ± 5.8			17.6 ± 4.1			8.5 ± 2.7		
Gender									
Male	9.2 ± 6.9	-0.006[#]	0.900	17.9 ± 4.5	1.479[#]	0.396	9.2 ± 3.1	-0.071[#]	0.102
Female	9.2 ± 6.5			17.0 ± 4.5			9.2 ± 2.7		
Level of education									
Informal	7.0 ± 3.6	3.718	0.012*	16.1 ± 4.0	2.149	0.094	6.2 ± 2.2	39.694	< 0.001*
Primary	8.9 ± 6.9			16.9 ± 5.4			8.5 ± 2.3		
Secondary	9.0 ± 7.0			17.8 ± 4.7			10.1 ± 2.5		
Tertiary	10.7 ± 6.8			17.9 ± 3.5			10.6 ± 2.4		
Occupation									
Farmer	8.4 ± 5.3	10.314	< 0.001*	17.6 ± 4.4	3.866	0.002*	9.4 ± 2.7	9.526	< 0.001*
Trader	9.6 ± 6.9			18.1 ± 3.6			9.7 ± 2.9		
Civil servant	13.2 ± 8.7			18.4 ± 4.1			7.0 ± 2.8		
Artisan	5.8 ± 2.8			16.3 ± 3.9			6.5 ± 2.4		
Pensioner	19.1 ± 9.8			18.8 ± 3.5			8.8 ± 2.0		
Student	8.3 ± 5.9			15.2 ± 5.5			10.2 ± 2.6		
Marital status									
Single	8.0 ± 6.1	2.612	0.075	14.1 ± 6.2	21.119	< 0.001*	9.2 ± 2.8	13.566	< 0.001*
Married	9.8 ± 6.7			18.2 ± 3.6			10.4 ± 2.4		
Widowed	7.6 ± 5.0			16.9 ± 3.9			7.2 ± 2.8		

[#]t-test; SD: standard deviation; F: variation between sample means; *significant *P*-value; KAP: knowledge, attitude, and practice; ANOVA: Analysis of Variance

Results from binary logistic regression show that civil servants had five times higher odds of having good knowledge (OR = 4.97; 95% CI: 1.69 - 14.61; *P* = 0.004) than farmers. Pensioners also had seven times higher odds of having good knowledge (OR = 7.26; 95% CI: 1.98-26.61; *P* = 0.003) than farmers (Table 6).Married participants were five times more likely to have a positive attitude (OR = 5.02; 95% CI: 1.51 - 16.66; *P* = 0.008) than their single counterparts. In

addition, study participants with good knowledge had 1.9 times higher odds of having positive attitudes (OR = 1.94; 95% CI: 1.11 - 3.42;*P*= 0.021) than those with poor knowledge (Table 7).

Table 6. Binary logistic regression of the predictors of good knowledge of malaria

Variable	OR	95% CI		*P*-value
		Lower	Upper	
Level of education				
Informal	1			
Primary	1.93	0.93	3.97	0.076
Secondary	0.63	0.24	1.65	0.346
Tertiary	0.58	0.21	1.65	0.308
Occupation				
Farmer	1			
Trader	1.37	0.63	2.99	0.428
Civil servant	4.97	1.69	14.61	0.004*
Artisan	1.12	0.32	3.89	0.862
Pensioner	7.26	1.98	26.61	0.003*
Student	1.58	0.62	4.02	0.341

OR: odds ratio; CI: confidence interval; *significant *P*-value

Table 7. Binary logistic regression of the determinants of positive attitude towards malaria

Variable	OR	95% CI		*P*-value
		Lower	Upper	
Age group (years)				
< 45	1			
45-64	0.91	0.43	1.92	0.794
≥ 65	1.06	0.47	2.35	0.895
Occupation				
Farmer	1			
Trader	0.66	0.33	1.35	0.254
Civil servant	0.50	0.20	1.28	0.151
Artisans	1.90	0.65	5.56	0.240
Pensioner	0.61	0.17	2.12	0.434
Student	1.78	0.57	5.60	0.323
Marital status				
Single	1			
Married	5.02	1.51	16.66	0.008*
Widowed	2.75	0.68	11.11	0.157
Knowledge level				

Poor	1			
Good	1.94	1.11	3.42	0.021*

OR: odds ratio; CI: confidence interval; *significant *P*-value

Participants with primary education had 6.2 times higher odds of having good practices (OR = 6.21; 95% CI: 2.59 - 14.86; *P*< 0.001) than those with informal education. Participants with secondary education had 12 times higher odds of adopting good practices (OR = 12.04; 95% CI: 3.89 - 37.31; *P*< 0.001) than those with informal education. The odds of adopting good malaria practices were 35% (OR = 0.35; 95% CI: 0.16 - 0.80; *P* = 0.012) lower among traders and 89% practices (OR = 0.11; 95% CI: 0.02 - 0.64; *P* = 0.014) lower among artisans compared to farmers (Table 8).

Table 8. Binary logistic regression of the determinants of good practice regarding malaria

Variable	**OR**	**95% CI**		***P*-value**
		Lower	**Upper**	
Age groups (years)				
< 45	1			
45-64	0.86	0.38	1.94	0.713
≥ 65	1.60	0.62	4.12	0.333
Level of education				
Informal	1			
Primary	6.21	2.59	14.86	< 0.001*
Secondary	12.04	3.89	37.31	< 0.001*
Tertiary	0.68	0.19	2.46	0.560
Occupation				
Farmer	1			
Trader	0.35	0.16	0.80	0.012*
Civil servant	0.34	0.08	1.39	0.132
Artisan	0.11	0.02	0.64	0.014*
Pensioner	1.09	0.28	4.23	0.898
Student	0.71	0.18	2.81	0.630
Marital status				
Single	1			
Married	1.59	0.44	5.74	0.476
Widowed	0.41	0.07	2.27	0.305
Knowledge level				
Poor	1			
Good	0.72	0.39	1.33	0.294
Attitude level				

Negative	1			
Positive	0.58	0.33	1.02	0.058

OR: odds ratio; CI: confidence interval; *significant *P*-value

4. DISCUSSION

Understanding the interplay between KAP is crucial for comprehending the community's approach to malaria prevention and control. This study examined the influence of individual and societal factors on malaria prevention and control. It explored community perspectives and practices, offering scientific insights for evidence-based intervention strategies to effectively combat malaria in communities.

The mean age of participants was 51.6± 20.9 years, and most were under 45 years old, which is consistent with previous studies in Nigeria [13,15] and other sub-Saharan African countries [21,23]. There were more femaleparticipants in this study, similar to previous reports. However, other studies reported more male participants [13,15]. The majority of participants had secondary education or less, a trend observed in previous studies in rural communities in sub-Saharan Africa [18,21,23]. The majority of participants worked as farmers, reflecting the agrarian nature of the community, similar to the findings of previous rural studies [18,24].

All the participants in this study are aware of malaria, which is consistent with the findings of previous studies where over 90% of participants have heard of this disease [13,15].Primary sources of information included family and friends, healthcare professionals, healthcare facilities, and electronic mass media. This pattern is consistent with previous studies in Nigeria [13,24,25]. To sustain malaria prevention initiatives, it is crucial to leverage mass media platforms such as radio and television for a broader reach.

About three-quarters of the respondents attributed the cause and transmission of malaria to mosquito bites, consistent with the findings in previous studies in sub-Saharan Africa [13,18,26] and India [27]. In contrast, a study in the Ethiopian region ofShashogofound that less than one-fourth of the participants associated malaria transmission with mosquito bites [28]. About half of the participants in this study reported common malaria symptoms including fever, cold and chills, myalgia, and headache. A similar pattern was noted in previous studies, however in higher proportions [15,21,22].Difficulties in recognizing key symptoms may be due to factors such as education and limited access to information, which can lead to the misattribution of malaria symptoms to other diseases. Participants in this study reported that mosquitoes often breed in ponds or stagnant water, confirming similar findings from previous studies [21,28].Understanding mosquito behavior is critical for malaria prevention and highlights the need for health education.

Children under five years old and pregnant women are more vulnerable to malaria because of their weakened immune systems. However, only 6.3% and 13.3% of participants accurately

identified these high-risk groups. This contrasts with a study in northwest Ethiopia, where nearly two-thirds correctly identified these vulnerable populations [21]. The study revealed that respondents identified various preventive measures against malaria, including cleaning their home environment (66.7%), clearing bushes (28.7%), using ITNs (22.0%), and draining standing water (20.3%). Previous studies have shown a similar pattern but with higherpercentages [13,21,29,30.]This study revealed low awareness and use of ITNs for malaria prevention, with a utilization rate of 37.4%, which is comparable with the findings of Singh et al. [13] in Northern Nigeria. This rate is lower than that reported in previous studies [21,22,30]but higher than the 2% utilization rate reported in South Africa [31]. Factors contributing to these discrepancies include income, market availability, distribution, discomfort, and awareness [13,15]. These findings reveal the need for continued public education to promote behavioral change and underscore the benefits of ITNs and potential government subsidies.

Most participants in this study perceived malaria as a potentially life-threatening illness and largely emphasized the importance of seeking medical attention at healthcare facilities when malaria symptoms occur. This finding is consistent with the report from previous studies in sub-Saharan Africa [18,21,30,32]. This mindset has the potential to play a significant role in malaria control efforts. Despite participants expressing a preference for malaria treatment in health facilities, there was a discrepancy between this preference and actual practice, with only 30% consistently seeking treatment in a health facility. This contrasted with previous Ethiopian studies, where a higher percentage of participants opted for health facility-based treatment facilities [21,30,32,33]. The suboptimal treatment-seeking behavior observed in this study aligns with the findings of previous studies [13,18,34].

Abouttwo-thirds of the respondents used over-the-counter antimalarials from local drug retailers for self-medication, while fewer than one-third used herbal remedies. This reliance on self-medication, particularly herbal remedies, can lead to delayed medical treatment, worsened malaria outcomes, noncompliance with treatment recommendations, and drug resistance. Factors such as financial limitations, educational background, and religious and sociocultural beliefs further contribute to this preference. Similar patterns have been observed in studies conducted in Nigeria [13,25,35], Ghana [34], Uganda [36], and Ethiopia [32]. These local drug stores serve as primary treatment facilities, particularly in areas with limited access to medical facilities. Despite concerns about their knowledge and ability to provide curative treatment, a significant portion of the population in rural communities seek initial treatment for suspected malaria at these local stores [37]. Implementing education programs for these local shopkeepers regarding malaria symptoms, treatment, and proper medication use could be an effective strategy to combat malaria. These interventions successfully change treatment-seeking behavior and help prevent drug resistance by regulating the use of antimalarial drugs [38].

The KAP regarding malaria assessed in this study was observed to be generally low. This study revealed that most participants (71.7%) had poor knowledge of malaria, which is consistent with

the findings of previous studies conducted in Nigeria [13,15] and Uganda [17]. Studies in Southern Ethiopia [28], Cameroun [39],and EasternGhana [18]have reported a higher proportion of participants with good malaria knowledge. Inadequate knowledge is associated with poor prevention practices, potentially increasing the risk of malaria transmission [15,40]. More than half (55.7%) of the participants in this study had positive attitudes, which is consistent with the findings of previous studies in Nigeria [15] and Ethiopia [30]. However, studies in Karachi [41] and the Amhara region of Ethiopia [30] reported even greater percentages of positive attitudes. Differences in attitudes are probably influenced by community demographics, socioeconomics, education, and culture, and limited access to accurate malaria information may impact knowledge and attitudes toward the disease [18,34].This study revealed that more than half of the participants (55.3%) had poor practices, whereas 44.7% had good practices. Comparable findings have been reported in previous studies [16,18,22]. However, studies in northwest Ethiopia [21], Cameroon [42], and Karachi [41]recorded a higher proportion of respondents with good practices, whereas the proportion in Laos was only 5.7% [43]. Differences in sociodemographic characteristics, community awareness, and attitudes toward malaria prevention may contribute to different levels of practice.

Socio-demographic factors with a significant relationship with knowledge score from this study were formal education and occupation that are attributed to formal education (being a civil servant and pensioner). Higher education levels were associated with better knowledge, consistent with findings in Nepal [22], Uganda [17], and Myanmar [44]. Occupations such as civil servants and pensioners were found to be predictors of knowledge, with five to seven times higher odds of having good knowledge compared to farmers. Public servants may have a better education and access to information and learning opportunities, particularly in rural areas.

In this study, participants' attitudes were significantly influenced by age, occupation, and marital status. However, being married was found to be a predictor of positive attitudes, with five-fold greater odds than single people. Our study also revealed that good knowledge is a predictor of positive attitudes, which is consistent with the findings of a previous study in Ethiopia [30].Good malaria-related practices were significantly associated with age, education, occupation, and marital status. Higher practice scores were associated with higher education levels, consistent with the findings of previous studies in Nepal [22] and Ethiopia [21,45]. Married individuals took greater responsibility for health and adopted more effective malaria prevention measures, consistent with the findings of a previous Nigerian study [15].

This study showed that education and occupation were predictors of good malaria practices. Participants with formal education had higher odds of adopting good practices than those with informal education. Comparable results were reported in a study conducted in southern Ethiopia [28]. Participants' knowledge and attitudes did not predict good practices in this study unlike the study in Ethiopia which found that participants with positive attitudes had higher odds of adopting good malaria practices [30].This may be a deviation from the assumed dynamic in

public health, where positive attitudes are reinforced by sound knowledge, which in turn contributes to better practices.

In this study, misconceptions about malaria KAP were noted, including attributing malaria to witchcraft, unconventional transmission routes such as drinking contaminated water and food, as well as misconceptions about preventive measures, like avoiding contact with people with malaria. These results align with findings from previous African studies [16,18,30,46]. This highlights the need for culturally sensitive educational messages and community mobilization programs to reduce the burden of malaria. Monitoring the effectiveness of these strategies and identifying the key factors influencing protective behavior are critical for effective intervention.

This study has some limitations, including its cross-sectional design, focus on a single study area, and reliance on quantitative measurements, which limits the in-depth analysis of community perceptions. Additionally, there is a potential for recall bias in self-reported actions.

5. CONCLUSION

This study provides valuable insights into the KAP regarding malaria in a rural community in South-South Nigeria. While a majority of participants exhibited a positive attitude towards malaria, their knowledge, and practices related to the disease were largely inadequate. This study highlights widespread misconceptions regarding malaria among the population and underscores the urgent need for focused interventions to improve knowledge and practices. Malaria control efforts can be enhanced through targeted public health campaigns, educational activities, and community engagement programs that address identified determinants.

ETHICS APPROVAL AND CONSENT

Approval was obtained from the Health Research Ethics Committee of Irrua Specialist Teaching Hospital. The procedures used in this study adhere to the tenets of the 1964 Declaration of Helsinki and its subsequent amendments. All the participants provided written informed consent and had the option to withdraw from the study at any time. All the data were anonymized for data protection.

DATA AVAILABILITY

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

REFERENCES

1. World Health Organization. Fact sheet about malaria. 2023. Accessed 14 October 2023.Available: https://www.who.int/news-room/fact-sheets/detail/malaria.

2. World Health Organisation. World Malaria Report 2022. 2022. Accessed 14 October 2023. Available: https://www.who.int/publications-detail-redirect/9789240064898.

3. Report on malaria in Nigeria 2022. WHO | Regional Office for Africa. 2023. Accessed 15 October 2023. Available: https://www.afro.who.int/sites/default/files/2023-08/WEB_7784%20WMR%20-%20Nigeria%202022_2408.pdf.

4. White NJ, Day NPJ, Ashley EA, Smithuis FM, Nosten FH. Have we really failed to roll back malaria? Lancet. 2022;399(10327):799–800

5. World Health Organization. Global technical strategy for malaria 2016-2030, 2021 update. 2021. Accessed 14 October2023. Available: https://www.who.int/publications-detail-redirect/9789240031357.

6. World Health Organization. Zeroing in on malaria elimination: Final report of the E-2020 initiative. 2021. Accessed 21 October 2023. Available: https://iris.who.int/bitstream/handle/10665/340881/9789240024359-eng.pdf?sequence=1.

7. Sokunbi TO, Omojuyigbe JO, Bakenne HA, Adebisi YA. Nigeria End Malaria Council: What to expect. Ann Med Surg. 2022;82:104690.

8. Maduka O. End malaria for good: a review of current strategies and future novelties for malaria elimination in Nigeria. Malar World J. 2018;9(1):1-4.

9. Awasthi KR, Jancey J, Clements ACA, Leavy JE. A qualitative study of knowledge, attitudes, and perceptions towards malaria prevention among people living in rural upper river valleys of Nepal. PLoS One. 2022;17(3):e0265561.

10. Ezihe EK, Egbuche CM, Ukonze CB, Nwangwu UC, Onwude CO, Amakiri P, et al. The Impact of Human and Socio-cultural behavior on Outdoor malaria transmission in a rural community of Nigeria: The Nyumagbagh Experience. N Y Sci J. 2020;13(2):86–99.

11. Awasthi KR, Adefemi K, Awasthi MS, Chalise B. Public Health Interventions for Control of Malaria in the Population Living in the Terai Region of Nepal. J Nepal Health Res Counc. 2018;15(3):202–7.

12. Mazigo HD, Obasy E, Mauka W, Manyiri P, Zinga M, Kweka EJ, et al. Knowledge, Attitudes, and Practices about Malaria and Its Control in Rural Northwest Tanzania. Malar Res Treat. 2010;2010:794261.

13. Singh R, Musa J, Singh S, Ebere UV. Knowledge, attitude, and practices on malaria among the rural communities in Aliero, Northern Nigeria. J Fam Med Prim Care. 2014;3(1):39-44.

14. Uzochukwu BSC, Ossai EN, Okeke CC, Ndu AC, Onwujekwe OE. Malaria Knowledge and Treatment Practices in Enugu State, Nigeria: A Qualitative Study. Int J Health Policy Manag. 2018;7(9):859–66.

15. Oguntade ES, Shohaimi S, Nallapan M, Lamidi-Sarumoh AA. Factors Influencing Malaria Knowledge, Attitude and Practice in Gwagwalada. Int J Sci Healthc Res. 2018;3(3):168-78.

16. Aderaw Z, Gedefaw M. Knowledge, Attitude and Practice of the Community towards Malaria Prevention and Control Options in Anti-Malaria Association Intervention Zones of Amahara National Regional State, Ethiopia. J Trop Dis. 2013;1(3):100118.

17. Musoke D, Karani G, Ssempebwa JC, Etajak S, Guwatudde D, Musoke MB. Knowledge and practices on malaria prevention in two rural communities in Wakiso District, Uganda. Afr Health Sci. 2015;15(2):401–12.

18. Lopez AR, Brown CA. Knowledge, attitudes and practices regarding malaria prevention and control in communities in the Eastern Region, Ghana, 2020. PLoS One. 2023;18(8):e0290822.

19. FGN. Federal Republic of Nigeria Official Gazette, Abuja. 2009. Accessed 26 October 2023. Available: https://gazettes.africa/archive/ng/2009/ng-government-gazette-dated-2009-02-02-no-2.pdf.

20. Igueben (Local Government Area, Nigeria) - Population Statistics, Charts, Map and Location.Accessed 30 October 2023. Available: https://www.citypopulation.de/en/nigeria/admin/edo/NGA012010__igueben/.

21. Flatie BT, Munshea A. Knowledge, Attitude, and Practice towards Malaria among People Attending Mekaneeyesus Primary Hospital, South Gondar, Northwestern Ethiopia: A Cross-Sectional Study. J Parasitol Res. 2021;2021:5580715.

22. Karki R, Bartoula N, Kaphle M, Shah SK. Knowledge, and practice of malaria prevention among residents of Ratuwamai Municipality, Nepal. One Health Bull. 2023;3(1):6.

23. Diema Konlan K, Amu H, Konlan KD, Japiong M. Awareness and Malaria Prevention Practices in a Rural Community in the Ho Municipality, Ghana. InterdiscipPerspect Infect Dis. 2019;2019:9365823.

24. Ekeleme NC, Ijioma CE, Unachukwu NA, Ejikem PI, Areh JE, Ogwu CI, et al. Attitudes and Practices of Insecticide Treated Bed Nets Usage among Rural Dwellers in Oyo State, Nigeria. Int J Trop Dis Health. 2023;44(15):43–58.

25. Fatugase O, Amoran O, Fatugase O. The Impact of Health Education Intervention on Perception and Treatment Seeking Behaviour About Childhood Infections among Caregivers in Rural Communities in Western Nigeria. Br J Med Med Res. 2013;3(4):1331–43.

26. Koroma JM, Wang Y, Guo X, Zhang X, Ngobeh JJK, Gabir AMEA, et al. A Cross-Sectional Survey on the Malaria Control and Prevention Knowledge, Attitudes, and Practices of Caregivers of Children Under-5 in the Western Area of Sierra Leone. Trop Med Infect Dis. 2022;7(7):120.

27. Gupta R, Raina S, Shora T, Jan R, Sharma R, Hussain S. A household survey to assess community knowledge, attitude, and practices on malaria in a rural population of Northern India. J Fam Med Prim Care. 2016;5(1):101-7.

28. Fuge TG, Ayanto SY, Gurmamo FL. Assessment of knowledge, attitude, and practice about malaria and ITNs utilization among pregnant women in Shashogo District, Southern Ethiopia. Malar J. 2015;14:235.

29. Abate A, Degarege A, Erko B. Community knowledge, attitude, and practice about malaria in a low endemic setting of Shewa Robit Town, northeastern Ethiopia. BMC Public Health. 2013;13(1):312.

30. Kebede DL, Hibstu DT, Birhanu BE, Bekele FB. Knowledge, Attitude and Practice Towards Malaria and Associated Factors in Areka Town, Southern Ethiopia: Community-Based Cross-Sectional Study. J Trop Dis. 2017;5(3):243.

31. Manana PN, Kuonza L, Musekiwa A, Mpangane HD, Koekemoer LL. Knowledge, attitudes, and practices on malaria transmission in Mamfene, KwaZulu-Natal Province, South Africa 2015. BMC Public Health. 2018;18(1):41.

32. Karunamoorthi K, Kumera A. Knowledge and health-seeking behavior for malaria among the local inhabitants in an endemic area of Ethiopia: implications for control. Health. 2010;2(6):575–81.

33. Deressa W, Ali A, Enquoselassie F. Knowledge, Attitude and Practice About Malaria, the Mosquito and Antimalarial Drugs in a Rural Community. Ethiop J Health Dev. 2004;17(2):99–104.

34. Awuah RB, Asante PY, Sakyi L, Biney AAE, Kushitor MK, Agyei F, et al. Factors associated with treatment-seeking for malaria in urban poor communities in Accra, Ghana. Malar J. 2018;17(1):168.

35. Idowu OA, Mafiana CF, Luwoye IJ, Adehanloye O. Perceptions and home management practices of malaria in some rural communities in Abeokuta, Nigeria. Travel Med Infect Dis. 2008;6(4):210–4.

36. Ndyomugyenyi R, Magnussen P, Clarke S. Malaria treatment-seeking behavior and drug prescription practices in an area of low transmission in Uganda: implications for prevention and control. Trans R Soc Trop Med Hyg. 2007;101(3):209–15.

37. Ahmed SM, Hossain MA. Knowledge and practice of unqualified and semi-qualified allopathic providers in rural Bangladesh: implications for the HRH problem. Health Policy. 2007;84(2–3):332–43.

38. Abuya TO, Mutemi W, Karisa B, Ochola SA, Fegan G, Marsh V. Use of over-the-counter malaria medicines in children and adults in three districts in Kenya: implications for private medicine retailer interventions. Malar J. 2007;6:57.

39. Talipouo A, Ngadjeu CS, Doumbe-Belisse P, Djamouko-Djonkam L, Sonhafouo-Chiana N, Kopya E, et al. Malaria prevention in the city of Yaoundé: knowledge and practices of urban dwellers. Malar J. 2019;18(1):167.

40. Dhimal M, Aryal KK, Dhimal ML, Gautam I, Singh SP, Bhusal CL, et al. Knowledge, Attitude and Practice Regarding Dengue Fever among the Healthy Population of Highland and Lowland Communities in Central Nepal. PLoS One. 2014;9(7):e102028.

41. Bilal A, Siddiqui A, Mansuri F. Knowledge, Attitude and Practice (KAP) About Malaria Among Inhabitants of a Slum Area of Karachi. Ann Abbasi Shaheed Hosp Karachi Med Dent Coll. 2013;18(2):79–85.

42. Djoufounna J, Bamou R, Mayi MPA, Kala-Chouakeu NA, Tabue R, Awono-Ambene P, et al. Population knowledge, attitudes, and practices towards malaria prevention in the locality of Makenene, Centre-Cameroon. Malar J. 2022;21(1):234.

43. Thanabouasy C, Pumpaibool T, Kanchanakhan N. Assessment of Knowledge, Attitude and Practice Regarding Malaria Prevention towards Population in Paksong District Champasack Province, Lao PDR. J Health Res. 2009;23(Suppl):11–5.

44. Aung PL, Pumpaibool T, Soe TN, Kyaw MP. Knowledge, attitude, and practice levels regarding malaria among people living in the malaria endemic area of Myanmar. J Health Res. 2020;34(1):22–30.

45. Beyene HB, Telele NF, Mekuria AH. Knowledge, Attitude and Practice on Malaria and Associated Factors Among Residents in Pawe District, North West Ethiopia: A Cross-Sectional Study. Sci J Public Health. 2015;3(3):303-9.

46. Chirevbu E, Chimbari MJ, Ngwenya B. Knowledge and practices on malaria in Tubu village, in a malaria-endemic area in northern Botswana: implications for interventions. Malar World J. 2013;4(15):1–8.

Cyril UA, Elizabeth OU, Darlington O, David A, Stephen AE, Goodluck SB, Meshach OI, Jeremy OA, Precious AJ. Malaria Prevalence in Toddlers: A Retrospective Study. J. Adv. Med. Med. Res. [Internet]. 2024 Feb. 1 [cited 2024 May 22];36(1):93-104. Available from: https://www.journaljammr.com/index.php/JAMMR/article/view/5354

Nwalozie R, Onosakponome OE, Hanson AH, Nyebuchi J. Malaria and HIV Co-infection among COVID-19 Cohort in Selected Healthcare Facilities in Rivers State, Nigeria. J. Adv. Med. Pharm. Sci. [Internet]. 2022 Jul. 28 [cited 2024 May 22];24(6):42-8. Available from: https://journaljamps.com/index.php/JAMPS/article/view/562

Forero DA, Chaparro PE, Vallejo AF, Benavides Y, Gutiérrez JB, Arévalo-Herrera M, Herrera S. Knowledge, attitudes and practices of malaria in Colombia. Malaria journal. 2014 Dec;13:1-0.