



Malaria-Associated Knowledge, Attitudes, and Practices in Elobied City, Sudan: A Community-Centric Investigation

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Abstract: Malaria is a major public health issue in Sudan, particularly in endemic areas such as Elobied, North Kordofan State. Malaria prevention and control require a community's knowledge, attitudes, and practices (KAP). This study sought to assess KAP for malaria among residents of Elobied, Sudan. A cross-sectional descriptive study was conducted in the community with 638 participants (mean age: 31.8 ± 13.2 years). A standardized predetermined questionnaire was used to collect data on demographics, knowledge, attitudes, and practices pertaining to malaria. The SPSS statistical tests were used to determine significance ($p < 0.05$).

The findings revealed that malaria is well-known, with the majority of participants accurately recognizing it as a parasitic disease (83.7%), transmitted by mosquito bites (93.3%), and a dangerous but treatable disease (85.7% and 90.6%). Regarding malaria prevention, attitudes were overwhelmingly positive, with 74.6% using mosquito nets and 78.1% wanting to learn more about the disease. In terms of practices, 72.4% were educated about malaria in school, while 69.1% were informed through the media. Nonetheless, significant gaps were found: 60.0% of participants did not use mosquito repellents, and only 25.5% identified blood transfusion as a possible method of transmitting malaria. Although headaches and arthralgia were widely accepted, classic symptoms such as fever and chills were not as well received. Finally, residents of Elobied demonstrated good knowledge and positive attitudes toward malaria, but preventive practices were inconsistent, and they perceived non-vector transmission routes to be less severe. As

consequently, it is critical to address these deficiencies through targeted health education initiatives and community-led interventions aimed at improving malaria control strategies.

Keywords: Malaria; Awareness; Malaria Prevention; Community Engagement; Sudan

I. Introduction:

Malaria continues to be one of the most lethal vector-borne diseases in the world, posing a significant threat to human health, especially in tropical and subtropical regions. It is caused by Plasmodium parasites and transmitted through the bite of infected female Anopheles mosquitos (1). Malaria remains a major cause of morbidity and mortality, despite extensive international control efforts, particularly in low- and middle-income countries. According to the World Malaria Report 2023, an estimated 249 million malaria cases and 608,000 deaths were recorded globally in 2022, with the African Region bearing 94% of the total burden (1). Malaria is endemic in Sudan, and it continues to pose a significant public health challenge.

It leads to at least one outpatient and hospitalization (2) and has a negative impact on economic productivity and household welfare. It spreads across most of the country, with prevalence determined by geography, climate, and local ecosystems. For example, in North Kordofan, seasonal transmission coincides with rain-related rainfall, providing an ideal habitat for Anopheles mosquitoes (3). Furthermore, internal migration, inadequate facilities, and insufficient medical conditions contribute to malaria endemicity in many Sudanese towns and cities (4).

For the last 20 years Sudan has introduced malaria control strategies under the overall direction of the National Malaria Control Programme (NMCP). Such measures consist of mass dissemination of insecticide-treated nets (ITNs), indoor residual spraying (IRS), implementation of artemisinin combination therapies (ACTs), as well as enhancements in diagnostics (2). It must be seen that malaria still remains a predominant risk factor for diseases and deaths (5), emphasizing the role of community participation and behavioral changes to sustain malaria control strategies. Community knowledge, attitudes and practices (KAP) on malaria are critical for the efficient prevention and control of the disease. Knowledge regarding transmission, symptoms and prevention of malaria are essential for attitude and behavior toward the control measures. In a number of endemic areas, the misinformation about malaria transmission, e.g., blaming bad air, contaminated food, or solar exposure, persists among the population (6,7). These misunderstandings create in many cases poor preventive habits and delay getting appropriate treatment. Equally important are attitudes towards malaria prevention. Community motivation to adopt preventive measures, including sleeping under ITNs, employing repellents, and ridding stagnant water, largely relies on perceptions about disease severity and efficacy of control measures (8). Positive attitudes are generally associated with superior compliance with preventive strategies, while negligence or fatalistic beliefs tend to derail control efforts. Practices, the behavioral aspect of the KAP model, are the measures of how efficiently individuals apply their knowledge and attitudes to their daily activities. These include the appropriate implementation of mosquito nets, timely diagnosis, and delivery of antimalarial therapies, the use of which are three key factors of malaria prevention and control (9). Yet, limited access to health services, poverty, poor family resources, and traditional medicine are still factors inhibiting effective control of the disease in numerous populations (10). The studies can be performed to design education-focused programs and intervention campaigns with specific population malaria KAP (5), to ascertain the current gap in the knowledge base of populations concerning malaria awareness and behavior, which is necessary to make targeted interventions specific to those populations (5). It is a case that with a few regional studies already being conducted in Sudan, very little data are available to date about the population of Elobied in North Kordofan. Being one of the principal urban centers of western Sudan, this city is susceptible to malaria transmission during and after the rainy season. Nonetheless, with their vast diversity of education level, occupation and lifestyle, the population also presents important opportunity to assess differences in malaria cognitivity and practice. Therefore, this study aimed to get the knowledge, attitudes and practices of malaria among inhabitants of Elobied city, Sudan. More specifically it sought to investigate the community's knowledge on malaria causes, symptoms and prevention, attitude to treatment and preventive measures, and behaviors that could be impactful on malaria transmission in practice. These findings will provide valuable

guidance for health authorities and decision-makers regarding malaria education, preventive methods, and community-based interventions in accordance with community-level needs.

II. Methodology.

Study Design:

A cross-sectional descriptive study was done to determine the KAP (knowledge, attitudes, and practices) about malaria prevention and control from Elobied city, Sudan during study period from June 2024 to February 2025.

Study Area and Population:

The research was conducted in Elobied City, an endemic malaria area and recruited from the Kordofan area. The target population were residents in the Elobied City who had lived in the area for at least 6 months. Nonparticipants or individuals unwilling or unable to provide informed consent were excluded.

Sample Size and Participants:

A total of 638 participants participated in the study, of whom a mean age of 31.8 ± 13.2 years was recorded. Both males and females were equally represented in the respondents and both formed around 50 per cent of the study population. The majority of responders (582, 91.2%) were inhabitants of Elobied city and 56 subjects (8.8%) of the vicinity. Participants were all from the Kordofan region.

Sampling Technique and Health-center-based recruitment:

Participants were recruited using a simple random sampling method. Eligible individuals attending selected primary health care centers in Elobied City during the study period were listed daily, and participants were randomly selected from the list and invited to participate after providing informed consent.

Data Collection Tool:

A structured questionnaire was developed, aligned with WHO malaria KAP protocol and literature, comprising four sub-items:

1. Socio-demographic data (age, sex, home, origin, education, occupation)
2. Common knowledge regarding malaria transmission, symptoms, and prevention
3. Attitude on prevention and treatment among malaria patients
4. Practices in prevention of malaria such as use of insecticide-treated nets, indoor spraying, and seeking medical care

The questionnaire was pre-tested with participants from a neighboring community to make sure its content was clear, appropriate, and reliable. **Data Collection Procedure:** Data were obtained through face-to-face interviews with trained field workers. Participants were informed about the goals of the study and their confidentiality before giving verbal or written consent.

Data Management and Analysis:

All completed questionnaires were checked for completeness and coded prior to entry into [software, e.g. SPSS, STATA]. Descriptive statistics, such as frequencies, percentages, means, and standard deviations were used to describe socio-demographic characteristics and KAP scores. Knowledge, attitude, and practice scores were computed and participants were classified as having “adequate” or “inadequate” knowledge/practice according to cut off point. Statistical inferences between socio-demographic features and KAP variables were made by chi-square tests or logistic regression, and $p < 0.05$ was considered statistically significant.

Ethical Considerations:

All ethical approval was sought and received from the [name of the ethical review board]. Informed consent was obtained from all participants and participation was voluntary. Confidentiality and anonymity were adhered to throughout the entire study.

III. Result:

Socio-demographics

638 participants were included with mean age of 31.8 +/- 13.2 years. Males and females were equally represented in this study. Majority of the respondents were residing inside Elobied city (582, 91.4%) and originally from Kordofan region (504, 79.0%). Half of the participants had university education (307, 48.1%). Regarding their marital status (314, 49.2%) were single. Most of the participants had no chronic illnesses (521, 81.7%), however; among those who had chronic illness diabetes was the commonest. (Table 1)

Perceptions toward malaria

Regarding malaria causes and transmission the study showed that 83.7%, 93.3% and 92.9% of the participants very highly significantly agreed with malaria being caused by parasite, it is transmitted through mosquito bites and mosquitoes help in malaria transmission. Also, 85.7% agreed that malaria is a dangerous disease. Regarding malaria treatment, 90.6% and 79.6% significantly agreed that malaria could be treated and anti-malarial doses should be accomplished. However, 57.7% and 52.2% significantly disagreed with taking anti-malarial without seeking medical services and using of herbs as a treatment for malaria. With regard to malaria prevention, 74.6% and 78.1% significantly agreed with that they do not sleep without mosquito net and they advise their fellows not to sleep without mosquito net. Finally, 78.1% significantly agreed with being interested to know more about malaria. (Table 2)

Malaria practice

In 72.4% schools were providing them with awareness about malaria, 69.1% found the information about malaria in media and 75.1% had family history of malaria. On the other hand, 69.4% mentioned that they do not work or live near stagnant water and 60.0% did not use any mosquito repellent. (Table 3)

Identification of clinical remarks:

Headache, arthralgia and loss of appetite were the most commonly identified symptoms, 90.6%, 70.7% and 67.2%, respectively. While, shivering, fever and diarrhea were the least identified features, 49.2%, 40.0% and 33.9%, respectively. (Table 3)

It is worth noting that, 71.8% of the participants mentioned that they know the severe complications of malaria and 73.8% know the types of malaria. However, only 25.5% identified the role of blood transfusion in disease transmission. Most of the participants 55.8% do not have health insurance. (Table 3)

Table 1. Shows the sociodemographic characteristics among the participants:

		n	%
Age (years)	31.8 +/- 13.2		
Gender	male	287	45.0
	female	351	55.0
Residence	Inside Elobeid	582	91.4
	Outside Elobeid	55	8.6
Origin	From Kordofan	504	79.0
	From outside Kordofan	134	21.0
Education	Illiterate	132	20.7
	Primary/Secondary	199	31.2
	University	307	48.1
Marital Status	married	308	48.3

	Single	314	49.2
	widow	14	2.2
	divorce	2	.3
Chronic illness	Diabetes Mellitus	84	13.2
	Chronic Kidney Disease	18	2.8
	Cardiovascular disease	15	2.4
	No chronic illness	521	81.7

Table 2. shows the perceptions of the participants toward malaria

	N (%)			Mean +/- SD	R value	p-value
	Agree	Disagree	I don't know			
malaria caused by parasite	534 (83.7)	34 (5.3)	70 (11.0)	1.27 ± 0.6	-28.398	<0.001
malaria transmitted through mosquitoes' bite	595 (93.3)	30 (4.7)	13 (2.0)	1.09 ± 0.3	-66.237	<0.001
mosquitoes help in malaria transmission	593 (92.9)	34 (5.3)	11 (1.7)	1.09 ± 0.3	-68.025	<0.001
malaria is dangerous disease	547 (85.7)	71 (11.1)	20 (3.1)	1.17 ± 0.5	-45.888	<0.001
malaria can be treated	578 (90.6)	55 (8.6)	5 (0.8)	1.10 ± 0.3	-69.240	<0.001
use of antimalarial drug without seeking medical services	265 (41.5)	368 (57.7)	5 (0.8)	1.59 ± 0.5	-20.284	<0.001
accomplish malaria dose	508 (79.6)	130 (20.4)	0 (0.0)	1.20 ± 0.4	-49.892	<0.001
use of herbal as treatment	297 (46.6)	337 (52.8)	4 (0.6)	1.54 ± 0.5	-22.693	<0.001
I don't sleep without mosquito net	435 (68.2)	195 (30.6)	8 (1.3)	1.33 ± 0.5	-34.028	<0.001
I advise my fellows not to sleep without mosquito net	478 (74.6)	134 (21.0)	28 (4.4)	1.30 ± 0.5	-32.526	<0.001
I am interested to know more about malaria	498 (78.1)	104 (16.3)	36 (5.6)	1.28 ± 0.6	-32.688	<0.001

Table 3: Shows the practice and the identification of clinical remarks of malaria among the participants

	Yes	No	I don't Know
<i>Practice</i>			
school provides us awareness about malaria	462 (72.4)	138 (21.3)	40 (6.3)
found information about malaria in media	441 (69.1)	96 (15.0)	101 (15.8)
malaria in family	479 (75.1)	159 (24.9)	-
live or work near stagnant water	195 (30.6)	443 (69.4)	-
did you use any type of mosquito repellent creams	255 (40.0)	383 (60.0)	-
<i>Clinical remarks</i>			
fever	255 (40.0)	383 (60.0)	-
chills	372 (58.3)	266 (41.7)	-
headache	578 (90.6)	60 (9.4)	-
malaise	379 (59.2)	260 (40.8)	-
myalgia	394 (61.8)	244 (38.2)	-
arthralgia	451 (70.7)	187 (29.3)	-

nausea	401 (62.9)	237 (37.1)	-
vomiting	349 (54.7)	289 (45.3)	-
diarrhea	216 (33.9)	422 (66.1)	-
Loss of appetite	429 (67.2)	209 (32.8)	-
shivering	314 (49.2)	324 (50.8)	-
Do you know the severe complications of Malaria	458 (71.8)	180 (28.2)	-
Blood transfusion	163 (25.5)	475 (74.5)	-
Types of Malaria	471 (73.8)	167 (26.2)	-
insurance	281 (44.1)	356 (55.8)	-

IV. Discussion:

This study examined the knowledge, attitudes, and practices of residents in Elobied city, North Kordofan, Sudan regarding malaria. There were overall good knowledge and overall positive attitudes toward malaria, but significant gaps were identified in preventive activities and knowledge of different transmission pathways. Most participants accurately classified malaria as a parasitic disease that is transmitted by mosquito bites. This is also in keeping with the observations made in other malaria-endemic settings, notably in Sudan and sub-Saharan Africa, where better public health messaging and school-based public education helped boost community knowledge (10,11). Similar knowledge levels were found in Ethiopia and Nigeria, implying that ongoing malaria education campaigns can make a significant difference in people's knowledge of the transmission of the disease (12). But, a minority with little or no knowledge has remained in place, showing that misconceptions are not fully eradicated, as we have seen in research in rural and peri-urban contexts in the past (13). Participants held largely positive attitudes towards malaria. Nearly all respondents considered malaria a dangerous but treatable disease, and highlighted that completing antimalarial treatment courses was crucial. These results are consistent with research from other endemic geographical areas, in which positive attitudes were found to be significantly linked to early treatment taking and treatment compliance (14,15). Conversely, studies based in more remote or conflict-affected regions have reported fatalistic beliefs and a lack of confidence in modern treatment that were less present in the current study population (16). Prevalent knowledge and favourable attitude notwithstanding, preventive measures were not uniform in effectiveness. While most people reported to have used the mosquito net, a significant number did not apply mosquito repellents. The disparity in knowledge and practice has been extensively explored in malaria KAP studies, which generally attribute this to economic constraints, access and discomfort regarding preventive instrumentation (17,18). In urban Sudanese settings, there have also been similar discrepancies, with knowledge transfer having not always resulted in persistent protective behavior (19). There was considerable knowledge of malaria symptoms across the study. Although headache and arthralgia were well documented, classical symptoms such as fever and chills were considered less often. This finding is to the contrary of those from other African countries that reported fever as the most frequently-recognized symptom (20). Failure to recognize cardinal symptoms can prolong diagnosis and predispose to complications. Furthermore, among participants, only some recognized blood transfusion as a route of malaria transmission—similar to previous studies which showed limited knowledge of non-vector transmission routes in communities (21). These findings therefore highlight the necessity of targeted health education intervention that focuses on translating knowledge into practice and on improving symptom recognition, thereby addressing under-recognized transmission routes. However, reinforcing behavior change communication alongside the existing malaria control strategies will also enhance community engagement and enable sustainable reductions in malaria in Elobied city.

V. Conclusion

The results show that, in general, Elobied city residents here, Sudan, are highly knowledgeable and generally good in their attitude towards malaria in terms of its transmission, severity and treatability. Most of the participants correctly ascribed mosquito bites to be the most dominant mode of transmission and realized that it is important to take antimalarial course. Their results seem to indicate that community awareness increased positively from ongoing malaria control programs and health education efforts. This knowledge and awareness level was promising, yet

significant limitations for malaria prevention and full knowledge of malaria were reported. Inconsistent use of mosquito repellents, a low recognition of classical malaria signs such as fever and chills, and a limited knowledge of non-vector transmission routes and particularly blood transfusion highlight areas that need to be addressed. Such gaps can lead to delayed diagnosis, poor prevention, and further transmission in the community. In general, the results underscore that knowledge may not automatically lead to the best preventive action. Strengthening communication about behavior change, increasing the access to preventative measures, and developing practical malaria prevention strategies are necessary. Focused interventions in community-based contexts and at the site level should be the focus to improve the control of malaria and eliminate the burden of disease in Elobied city and related endemic settings in Sudan.

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Data Availability: Entire datasets supplied and analyzed during the study are included in the manuscript.

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