A Survey of Malaria Transmission, Knowledge about Malaria Disease, Symptoms and Treatment

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Abstract— A questionnaire was distributed in Elobied, North Kordofan State, Sudan, to collect data on malaria transmission, malaria parasite, knowledge of malaria symptoms, malaria attack and malaria treatment. Analysis of the questionnaire indicated that malaria is an important health problem in Elobied, (88.2%) had malaria. The knowledge about malaria transmission, parasite, symptoms, and treatment is high. More investigation is needed in the area of malaria disease for possible resistance genes to some drugs. There is also a need for future studies to follow up patients with repeated malaria occurrence in less than two weeks.

Index Terms— Elobied, Kordofan, Malaria, *Plasmodium falciparum*, Questionnaire

1 INTRODUCTION

Malaria is a vector-borne infection caused by unicellular parasite of the genus Plasmodium. Plasmodia are obligate intracellular parasites that are able to infect and replicate within the erythrocytes after a clinically silent replication phase in the liver. Four species (*P. falciparum, P. malariae, P. ovale and P. vivax*) are traditionally recognized as responsible for natural infection in human beings but the recent upsurge of *P. knowlesi* malaria in South-East Asia has led clinicians to consider it as the fifth human malaria parasite [1]. In sub-Saharan Africa, which accounts for > 90% of the global prevalence, risk of malaria infection and morbidity are often difficult to estimate accurately due to the interplay of several epidemiological parameters [2]. Even within a single country, there are considerable variations in malaria epidemiology due to differences in climatic condition, ecological and human activities [3]. In 2017, the region was home to 92% of malaria cases and 93% of malaria deaths. Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden. Five countries accounted for nearly half of all malaria cases worldwide: Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%). The 10 highest burden countries in Africa reported increases in cases of malaria in 2017 compared with 2016 [4]. Of these, Nigeria, Madagascar and the Democratic Republic of the Congo had the highest estimated increases, all greater than half a million cases. In contrast, India reported 3 million fewer cases in the same period, a 24% decrease compared with 2016 [5]. Anopheles arabiensis and Anopheles gambiae are the principal vectors of malaria in sub-Saharan Africa, but in some areas, such as the Great Rift Valley in East Africa, A. arabiensis is the predominant malaria vector species [6]. A. arabiensis is better adapted to dry environments than A. gambiae [7]. The diagnosis and management of malaria, especially falciparum malaria, is urgent. As signs and symptoms of malaria are very non-specific, a high index of suspicion is the most important element in the diagnosis of malaria. Malaria should be suspected in any person presenting with any of the symptoms listed below, who has a history of travel to, or residence in, a malaria transmission area. Delayed diagnosis, underassessment of disease severity and inappropriate treatment are associated with significantly increased morbidity and mortality. Classically, malaria presents with fever, rigors, headache and body pains, but the clinical features are non-specific and may be confused with many other diseases, especially influenza. A definitive diagnosis should be made promptly by demonstrating the parasite on microscopy of a blood smear or by using a malaria rapid diagnostic test. Disease severity should be assessed carefully with both clinical and laboratory tests[8]. Antimalarial treatment studies have also contributed insight regarding mixed Plasmodium species infections by revealing

undocumented infection of a second species following successful treatment of a first species [9]Malaria in Sudan is a major public health problem. It leads to an estimated 7.5- 10 million cases and 35000 deaths every year. The burden of the disease on the health system is a reality. Out of total outpatients' attendance, admission and deaths malaria represents 20-40%, 30-50% and 15-20% respectively[10]). Malaria is transmitted exclusively through Anopheles mosquito's bites. The intensity of transmission depends on many factors related to the parasite, the human host, the vector and the environment.

2 MATERIAL AND METHODS

2.1 Parasitological Survey of Plasmodium falciparum

A survey was undertaken in Elobeid city to evaluate whether Plasmodium falciparum was endemic in the area. The study of the parasite and its percentage among the population of the city was determined by distributing a specially designed questionnaire among febrile patients or others with commonly associated malaria symptoms.

2.2 Knowledge about Malaria

The respondents' knowledge about malaria was investigated through specific questions to determine whether they have been stricken by malaria, how often they felt malaria symptoms, when they felt malaria fever symptoms and whether they were aware of the dangers of malaria. Also, the awareness of the population of the study concerning the following factors was investigated: their knowledge of how to keep mosquitoes away and whether they use impregnated nets as a means of prevention from the disease.

2.3 Practices and Management

Environment management practices, community education and participation from the mainstay of some outstanding success in the area.

The present study explored the subjects' knowledge about malaria striking, their reactions when malaria strikes, who decides the treatment, knowledge about the doses of chloroquine for children and adults, the type of malaria treatment they use, whether they use traditional drugs and their efficiency, if malaria reoccurs after treatment, whether they use drugs according to the prescription of the doctor, if they stop using the drugs when the patient improves, when they do when symptoms repeat; whether they go to see a doctor or repeat the drugs.

4 STATISTICAL ANALYSIS

Data were collected through a standardized questionnaire and checked for errors and completeness. The data were double entered in Microsoft Excel data sheet, cross checked and transferred, and analyzed using SPSS for Windows version 14. Descriptive statistics were carried out to measure relative frequencies, percentages; correlation and what? Were used to further determine the statistical significance and differences of relative frequencies.

5 RESULTS:

5.1 Knowledge and practices about malaria disease

Data revealing the awareness of malaria transmission, its symptoms and treatment were shown in table (1). The majority of the respondents had heard about malaria disease. Most of them believed that the disease was transmissible. When asked about attack of malaria, 88.2% of the respondents reported that had malaria, out of these, 26.4% had malaria repeated after a week, 20% had malaria repeated after two weeks, 20% had malaria after one month of its first strike and 32% had malaria after more than a month of its first occurrence. 93.5% of the respondents said that they had adequate knowledge that malaria is a dangerous disease, with a high significance of $(x^2 =128.84,$ P-Value=0.000). Moreover, 86.4% of the respondents had adequate knowledge that malaria worry them, with odds ratio = 0.3 and confidence interval $(x^2 =90.44,$ P. Value = 0.000). The respondents with good knowledge that malaria causes death were 84.7% of the population, with

odds ratio 0.3 ($x = 81.9$, P. Value = 0.000). Table (1) shows the source of information on various aspects of malaria disease.

TABLE 1 KNOWLEDGE ABOUT MALARIA DISEASE:

Characteristics	Total	Mean	Std-Deviation	Test	P. Value
Attack with malaria disease					
Yes	150(88.2%)	1.12	0.32	$x^2 = 99.41$	> 0.000
No	20(11.7%)				
Feeling with malaria sign again					
Week	45(26.4%)				
Month	35(20.5%)	2.59	1.19	$x^2 = 7.45$	> 0.059
Two weeks	34(20%)				
More	56(32%)				
Malaria dangerous disease					
Yes	159(93.5%)	1.06	0.24	$x^2 = 128.84$	> 0.000
No	11(6.4%)				
Malaria worry you					
Yes	147(86.4%)	1.14	0.34	$x^2 = 90.44$	> 0.000
No	23(13.5%)				
Malaria cases death					
Yes	144(84.7%)	1.15	0.36	$x^2 = 81.90$	> 0.000
No	26(15.2%)				
Malaria is curable disease					
Yes	152(90.5%)	1.09	0.29	$x^2 = 112.02$	> 0.000
No	16(9.4%)				
Children attack during this year					
Yes	116(68.2%)	1.31	0.46	$x^2 = 23.48$	> 0.000
No	53(31.1%)				
Attack repeat during					
One month	82(48.2				
Twice	42(24.7)	1.79	0.84	$x^2 = 17.12$	> 0.000
More	46(27%)				

5.2 Knowing About the Symptoms of Malaria

There was similar knowledge about the symptoms of malaria in children and adults. 50% of the respondents said that fever was the first symptom of malaria in children while 41.7% believed that it was the first symptom in adults. 26.4% of the study participants reported that the signs of malaria in children were fever, chills, vomiting and diarrhea. Details about the common symptoms of malaria in children and adults are presented in table (2).

TABLE 2 KNOWING ABOUT THE SYMPTOMS OF MALARIA

Characteristics	Percentage	Mean	Std- deviation	Test	P. Value
Sign of malaria in children					
Fever	86(50.5%)				
Chills	8(4.7%)				
Vomiting	8(4.7%)				
Diarrhea	7(4.1%)	3.30	2.65	$x^2 = 231.8$	> 0.000
Others	4(2.3%)				
I do not know	12(7%)				
Fe.Chi.Vo.Dia	45(26.4)				
Sign of malaria in adult					
Fever	71(41.7%)				
Chills	16(9.4%)				
Vomiting	6(3.5%)				
Diarrhea	2(1.1%)	3.69	2.65	$x^2 = 194.24$	> 0.000
Others	9(5.2%)				
I do not know	8(4.7%)				
Fe.Chi.Vo.Dia	58(34.1%)				

5.3 Knowledge about malaria attack and malaria treatment

The majority of the surveyed patients (70%) said that they would go to the doctor when attacked by malaria, about two thirds of them (65.2%) sought treatment at health institutions as first resort. 19.2% were home treated with Paracetamol prior to visiting health centers. 11.1% went to labs, 7% used chloroquine tablets, 0.5% went to traditional healers and 0.5% used paracetamol plus chloroquine in addition to visiting a traditional healer. About 82.9% of the respondents knew about malaria treatment and 95.2% believed that the doctor was the person who decides treatment. 56.4% stated that they knew about the dose of chloroquine taken by children compared to 66.4% who knew the dose of chloroquine for adults. Overall, the percentage of patients who used injection for the treatment of malaria was (52.3%) which was higher than those who use tablets; however, 10% of them used both tablets and injection while only 1.7% used traditional drugs. 64.1% of the respondents said that malaria occurred repeatedly after treatment and most of them used the drugs according to the prescription of the doctor (92.3%). Whether they used to terminate the use of the drugs after a child's relative improvement, the majority of the respondent (61.7%) answered with no; with 62.3% of the them visited the doctor on the same day, whereas 25.2% on the second day and 12% on the third day, as shown in Table (3).

TABLE 3: KNOWLEDGE ABOUT MALARIA STRICKEN AND MALARIA TREATMENT

Characteristics	Percentage	Mean	Std-deviation	Test	P. Value
Who decide that you are attack with malaria					
Go to doctor	119(70%)	1.30	0.46	2 x =27.20	> 0.000
By symptoms	51(29.4%)				
Attack with malaria what do you do					
Use paracetamol	26(15.2%)	2.76	0.90	2 x =306.61	> 0.000
Use chloroquine	12(7%)				
Go to hospital	111(65.2%)				
Go to lab	19(11.1%)				
Go to traditional healer	1(0.5%)				
Par.Ch.Tra	1(0.5%)				
Decide the treatment					
Doctor	162(95.2%)	1.07	0.33	2 x =293.69	> 0.000
Alone	4(2.3%)				
Others	4(2.3%)				
Knowing about malaria treatment					
Yes	141(82.9%)	1.17	0.37	2 x =73.78	> 0.000

No	29(17%)				
Knowing the dose of chloroqine in children					
Yes	96(56.4%)	1.44	0.49	2	>
No	74(43.5%)			x =2.84	0.000
Knowing the dose of chloroqine in adult					
Yes	113(66.4%)	1.34	0.47	2	>
No	57(33.5%)			x =18.44	0.000
Type of treatment you use					
Tablet	61(35.8%)	1.86	0.87	2	>
Injection	89(52.3%)			x =110.94	0.000
Traditional treatment	3(1.7%)				
Tab.Inj	17(10%)				
Using the traditional treatment					
Yes	64(37.6%)	1.62	0.48	2	>
No	106(62.3%)			x =10.37	0.001
Efficient of traditional drugs					
Yes	71(41.7%)	1.58	0.49	2	>
No	99(58.2%)			x =4.61	0.032
Malaria repeated after treatment					
Yes	109(64.1%)	1.36	0.48	2	>
No	61(35.8%)			x =13.55	0.000
Use the drugs according to prescribe of doctor					
Yes	117(92.3%)	1.08	0.26	2	>
No	13(7.6%)			x =121.97	0.000
Stop using the drugs when the child improved					
Yes	65(28.2%)	1.62	0.48	2	>
No	105(61.7%)			x =9.41	0.002
When you go to doctor					
In the same day	106(62.3%)	1.50	0.70	2	>
In the second	43(25.2)			x =68.69	0.000
In the third	21(12%)				

6 DISCUSSION

The findings of this study indicate that malaria is an important public health problem in Sudan and that the community knowledge about its transmission, signs and symptoms, treatment and prevention is high. This result also indicates that the members of displaced population are familiar with the disease and have better understanding of malaria causes, and symptoms, treatment and preventive measures. Most of the respondents have a better understanding about the attack of malaria if the symptoms are repeated again. The findings have also shown that Plasmodium falciparum is responsible for all the infections in the Elobeid. However, when recently the laboratories began to use ICT for detection of malaria parasite, mixed infections of Plasmodium falciparum with Plasmodium vivax were discovered. Nevertheless, up to now, the main parasite in the area is still P. falciparum. The symptoms of malaria are always the same: fever, chills, vomiting, diarrhea and headaches; but some people in the town feel fatigue and tiredness throughout the entire body without any fever. This may indicate the emergence of new types of malaria in the town. The repeated malaria transmission in less than two weeks with the same symptoms of malaria leads to speculations about the immunity of the people, the inefficiency of drugs used to combat malaria parasite; but no one considered drug resistance of the parasite to some drugs. The study also found out

that health facilities were sufficient for the treatment of malaria in the area. The findings of the survey confirm other similar studies, particularly, the case in Tanzania [11].

Measuring malaria mortality is very difficult since, in many parts of African rural areas, as many as 90% of deaths toll from malaria disease occur at home and are not reported. The majority of the surveyed patients (70%) said that they would see a doctor when they were attacked by malaria, most of them (65.2%) sought treatment at health centres. This is probably due to good knowledge about the disease, good level of education and belief in treatment provided in health centres. The majority of the respondents (92.3%) used drugs according to medical prescription and most of them (62.3%) said that they would go to see the doctor on the same day they felt malaria symptoms. However, the finding showed that more than 12% of the patients delayed seeking treatment. This could be attributed to financial inability, and in this case they refuged to traditional drugs. The practices of self-medication in the present study is probably related to cultural beliefs and the unattainable cost of medical services; similar findings had been reported previously [12]. A recent study reported that the most significant factor for the delay of cure was taking drugs prior to coming to health facilities [13].

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