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Original paper

Malaria infection and associated risk factors in pregnant women attending antenatal care clinics in Al Jabalian Locality, White Nile state, Sudan

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ABSTRACT. Pregnant women are more susceptible to malaria which is associated with adverse effects on pregnancy. It is one of the leading causes of maternal mortality in Sudan. The main aim of this study was to determine the prevalence rate of malaria in pregnant women. This cross sectional descriptive study was carried out in Al Jabalian and Kenana hospitals, White Nile State, Sudan. The data of the present study has been collected from 400 Sudanese pregnant women, during a period extending from 16th July 2018 to 25th October 2018. The overall the prevalence of malaria was 38.5% (154), *Plasmodium falciparum* was only malaria parasite observed in all samples. From 154 pregnant women infected with malaria, the third trimester had higher prevalence 53.9% (83), followed by the second trimester 31.8% (49) and the first trimester was 14.3% (22), P<0.0001. The multigravida had high infection with prevalence of 54.5% (84), secondgravida was 24.7% (38) and primigravida was 20.8% (32), P<0.0001. Significant association was noticed between the malaria parasite infection and occupation, ANC attendance and utility of mosquito net, P-value 0.05, 0.0024, 0.0010, respectively. However, no significant association was observed with education level and malaria infection. The study was recommended to promote diagnosis during pregnancy, take anti-malarial medicine as routine care to pregnant women and improve environmental sanitation.

Keywords: prevalence, malaria, pregnant women, antenatal care, risk factors, Sudan

Introduction

Malaria is a life-threatening parasitic disease caused by the *Plasmodium* spp. parasite. Malaria illness still remains a great public health problem. In 2018, it was estimated that 228 million cases of malaria occurred worldwide, with 405,000 deaths. Most malaria infection cases and deaths occurred in Africa, with 99.7% of the infection cases caused by *P. falciparum* [1]. Globally, *P. falciparum* infection during pregnancy is a major or great public health problem, especially in developing countries of Sub-Saharan Africa, which can lead to severe or high maternal mortality and morbidity [1–3].

Above 54 million pregnancies occurred in areas of stable *P. falciparum* malaria transmission, and over 70 million pregnancies occurred in areas of low transmission or areas with only *Plasmodium vivax* malaria [2–4]. Pregnant women are more susceptible to malaria parasites infection, and this susceptibility almost attributed to the immunological changes that occur during pregnancy, and to the sequestration phenomena of *P. falciparum* parasites in the placenta maternal blood spaces [5,6]. Malaria in pregnancy is a main cause of morbidity and mortality, resulting in an estimated 100,000 neonatal deaths and 10,000 maternal deaths every year [6–8]

In endemic area, the prevalence of clinical and asymptomatic malaria is highest in young women and those in their first and second pregnancies. The vulnerability decreases, however, with increasing numbers of pregnancies suggesting that women acquire a gravidity form of immunity, resulting in a decrease in both prevalence and severity of the disease [8–10]. Regardless of pre-pregnancy level of immunity against malaria, the most frequent consequence of malaria during pregnancy is anemia. Several studies have reported malaria infection as primary cause of anemia among pregnant women, and the changes in the immune system associated with pregnancy increasing the susceptibility to anemia [10–13]. In addition *P. falciparum* malaria is a particular danger in pregnancy and can have significant adverse consequences for both the mother and the developing fetus, including abortion, still birth, low birth weight and maternal anemia [14,15]. The combination of tools and methods to combat malaria now includes long-lasting insecticidal nets (LLIN) and artemisinin-based combination therapy (ACT), supported by indoor residual spraying of insecticide (IRS) and intermittent preventive treatment in pregnancy (IPT) [15–17]. Many studies pointed to alarming the prevalence of malaria in pregnant women in several African countries [6,18–23], only a hand full of studies have evaluated such situation in Sudan [13,24–27]. Malaria infection is more associated with adverse effects or influences on pregnancy and the pregnant women are more liable to the infection. It is one of the leading causes of maternal mortality in Sudan. A limited and less information or data have been published or available on the malaria infection among pregnant Sudanese women.

In this study, we aimed to investigate the malaria prevalence and it is predisposing risk factor during pregnancy.

Materials and Methods

Study area and design

This is a hospital base descriptive cross sectional study was performed in Al Jabalian locality during period 16th July 2018 to 25th October 2018. Al Jabalian locality located in southern of White Nile State. The locality has an area of 6000 km^2 and this area pose (15.1%) from locality area. The population about (177414), the female about (87059) and male about (90355).

Study population

Pregnant women attending to the Al Jabalian antenatal care clinics were recruited to this study. The pregnant women were divided according to age of gestation to the first, second and third trimesters.

Inclusion criteria and exclusion criteria

The samples were collected from pregnant women who attended antennal clinic. Pregnant women who had taken any anti-malarial drugs within the last week and women who live outside the Al Jabalian locality were excluded.

Samples size, collection and examination

In this study, a total of four hundred samples were taken from pregnant women. All samples were collected from capillary blood using 70% alcohol swabs as antiseptic and using sterile lanced. Thin and thick blood films were made for each sample. The thin blood films were fixed immediately after drying in ethyl alcohol and carried in plastic box and then transferred with thick blood films to the laboratory. In the laboratory, the films were stained using 10% Giemsa's stain for 10 minutes, and field stain in coupling gar. The films were examined later using 100x objective, immersion oil lens.

Smearing and staining of blood films

Two types of blood smears for detection of malaria parasite, Thick film and thin film were prepared on the same slide for Giemsa's stain; and separated for fields stain. Slides were labeled with participant number on the frosted area, using a monochrome pencil. Drop of blood was placed (near the frosted side) with circular movement to a size of above 1.5 cm in diameter. The thickness was just possible to see news print through it; holding the narrow side of the non-forced edge between lift thumb and forefinger, with right hand, placed the smooth clean edge of a second "spreader" in front of the blood drop on the middle of the side at a 45 angle, and draw it back against the drop of blood. It did not touch the thick smear, pushing the "spreader" forward with a feathered edge will remind on the side; allowed the blood film to air dry completely and the thin film was fixed by absolute alcohol before staining.

Data analysis

All statistical analysis was carried out using Graph Pad prism 5software. The one-way ANOVA and student t-test were employed for analysis

Table 1. Prevalence of malaria in Al Jabalian locality, White Nile state, Sudan

Area	Positive	Negative
Al Jabalian	21.8% (87)	28.3% (113)
Kenana	16.7% (67)	33.2% (133)
Total	38.5% (154)	61.5% (246)

between group P<0.05 considered significant.

Ethical considerations

Table 2. Malaria prevalence according to the trimester

Trimester	Positive	Negative	P-value
First	14.3% (22)	19.1% (47)	<0.0001
Second	31.8% (49)	32.5% (80)	
Third	53.9% (83)	48.4% (119)	
Total	100% (154)	100% (246)	

Ethical approval was obtained from the institutional Ethics Committee of the Faculty of Medical Laboratory, University of El Imam El Mahdi. Written informed consent was obtained from all participants before conducting any study-related activities. Participants had the option to withdraw from the study at any time.

Results

Four hundred blood samples were collected from pregnant women attending to the clinics of Al Jabalian locality hospitals to determine the prevalence of malaria in pregnant women.

Table 3. Malaria prevalence according to the gravidity

Gravidity	Positive	Negative	P-value
Primigravida	20.8% (32)	26.8% (66)	<0.0001
Secondgravida	24.7% (38)	21.6% (53)	
Multigravida	54.5% (84)	51.6% (127)	
Total	100% (154)	100 % (246)	

The overall prevalence of malaria was 38.5%, *P. falciparum* was only malaria parasite observed in all samples. The malaria prevalence was higher in Al Jabalian 21.8 % (87) than in Kenana 16.7% (67) as shown in table 1.

From 154 pregnant women infected with malaria, the third trimester had higher prevalence 53.9% (83), followed by the second trimester 31.8% (49) and the first trimester 14.3% (22), P<0001 as explained in table 2.

According to the gravidity, the multigravida had high infection with prevalence of 54.5% (84), secondgravida was 24.7% (38) and primigravida was 20.8%(32), P<0.0001 as shown in table 3.

The results of personal questionnaire were used to determine possible risk factors for malaria parasite infection in pregnant women. Significant association was noticed between the malaria parasite infection and occupation, ANC attendance, using of mosquito net, P-value 0.05, 0.0024, 0.0010, respectively. However, no significant association was observed with education level and malaria infection, as explained in table 4.

Table 4. Association of the risk factors with the prevalence of malaria

Risk factor		Positive	Negative	P-value
Education level	Not educated	32.5% (50)	36.9% (91)	0.6301
	Primary	27.3% (42)	25.6% (63)	
	Secondary	26.6% (41)	21.9% (54)	
	Tertiary	13.6% (21)	15.4% (38)	
Occupation	House wife	90.3% (139)	95.1% (234)	0.05
	Employed	9.7% (15)	4.9% (12)	
ANC attendance	Yes	45.5% (70)	60.9% (150)	0.0024
	No	54.5% (84)	39.1% (96)	
Using of mosquito net	Yes	64.3% (99)	79.3% (195)	0.0010
	No	357% (55)	20.7% (51)	

Discussion

Malaria is a life-threatening parasitic disease caused by the *Plasmodium* spp. parasite, and *P. falciparum* infection during pregnancy considered a major or great public health problem, especially in developing countries of Sub-Saharan Africa, which can lead to severe or high maternal mortality and morbidity. In the current research we aimed to investigate and to determine prevalence rate of malaria infection among pregnant women attending to the antenatal clinics of Al Jabalian and Kenana hospitals during the period extend for (16th July 2018 to 25th October 2018).

The overall prevalence of malaria was 38.5% with higher prevalence in Al Jabalian area 43.5% than Kenana area 33.5%. The finding of this study is lower compared with result obtained by Georgian et al. [22] in Ebonyi state, Nigeria, which revealed that the prevalence of malaria among pregnant women was 41%. Similar and near results obtained Kwala et al. [12] in Adamawa state, Nigeria, 36.74%. The variations in the prevalence rates reported may be related to the fact that malaria transmission is more influenced by numerous environmental factors such as season, water sources and the nature of living homes that provide enough breedings areas of mosquitoes, and sanitation [28–31]. The degree of environmental sanitation and the infrastructural improvement or development may differ between the different study areas, therefore, leading to the variations in the level or the degree in malaria transmissions and infections [12,31]. Additionally, the variations in the prevalence rates may be attributed to the laboratory personnel skills and experiences which involved in the laboratory diagnosis of malaria [30,31].

Our study found the trimesters of the pregnancy associated with malaria infection. Third trimester had higher malaria infection 53.9%. This observation is in agreement with reports from Ebonyi state, Nigeria [22,32]. In this study, the gravidity times of women also strongly correlated with malaria infection. The multigravida appears more affected 54.5% than the primigravida 20.8% and secondgravida 24.7%. The correlation of gravidity times with malaria infection also reported in other studies from logos, Nigeria [10,22]. However, it is documented that immunosuppression is obvious while the second and third trimester of pregnancy, and this related to the presence of high levels of adrenal steroid, fetoprotein, and chorionic gonadotrophin in the blood. Additionally, there may be a depression in the activity of lymphocyte. This may have explained the higher malaria susceptibility to pregnant women in their third trimester of pregnancy, as registered in most of the researches including our study.

In our study, the occupation, ANC attendance and the utility of the mosquito net significantly associated malaria infection in pregnant women. Similar observation also obtained from Luanda, Angola [10,33]. Education level of pregnant women shows no significance with malaria. This observation is in agreement with reports from Lagos, Nigeria [10,32,33]. This may be related to the enormous campaigns of television and radio on the prevention and control strategies and the availability of malaria treatment in White Nile State localities. In conclusion, our study recommended that to promote diagnosis during pregnancy, take anti- malarial medicine as routine care to pregnant women and improve environmental sanitation.

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