



Serum Ferritin level among Malaria patients in Sudan

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Abstract

Background: Malaria has been haunting mankind since evolution. It has killed more people than all the wars, has greatly influenced our history and geography and has changed many of our genes.

Objective The study was intended to observe the concentration of serum ferritin level among malaria patients in Sudan.

Materials and Methods: This was across-sectional descriptive study.

During the Sudan a period from September 2016 up to October 2017, a total of 385 blood samples have been collected from 385 individuals suspected with malaria from different malaria endemic stats in Sudan.

Results: Out of 385 examined blood samples, 69 samples were found to be positive for malaria infection. This constituted an overall infection rate of 17.9%. Results also

showed that the serum ferritin level in the malaria positive population ranged in from 40 ng/ml to 180 ng/ml, with a mean value of 67 ng/ml.

Conclusion: This study concluded that Malaria (*Plasmodium falciparum* & *Plasmodium vivax*) infection in the area investigated is still. Malaria presents a diagnostic challenge to laboratories in most countries. Blood film and PCR are more sensitive and specific to diagnose malaria than RDTs. Serum ferritin levels are decreased in malaria positive patients.

INTRODUCTION

In Sub-Saharan African countries, encompassing Sudan, malaria in the course of pregnancy is a major public health threat which results in significant morbidities and mortalities (Nega *et al.*, 2015).

Most of the research and published literature on malaria focuses on *Plasmodium falciparum* and much less on *Plasmodium vivax* (Sina, 2002). This focus is due to the very high burden of mortality attributed to the *falciparum* species in Africa (Hay *et al.*, 2004). However, there is growing evidence that *Plasmodium vivax* is responsible for a significant burden of disease worldwide accounting for half of all malaria cases in Asia and Latin America, will nearly 2.5 billion people at risk of infection (Guerra *et al.*, 2009). All species are transmitted by the bite of an infective female *Anopheles* mosquitoes. Control and management of *vivax* malaria is difficult, and the present particular challenges (Baird, 2009).

Worldwide, microscopy remains the tool of choice for diagnosing malaria. In comparison to analysis of blood by polymerase chain reaction (PCR), microscopy was 85% to 95% sensitive and 95% to 100% specific (Hanscheid, 1999- Humar, 1997). Microscopic examination of peripheral blood stained with Giemsa, Wright's and Field's stains permits detection of 10 to 100 parasites per micro liter of blood, and microscopy permits species identification. Microscopy is, however, time-consuming and requires sufficient operator expertise. Fluorescent microscopy has also been used to identify malaria parasites (Hanscheid T, 2002)

High ferritin levels mainly indicate iron overload without appearance liver damage, as may be noted in the early stages of idiopathic hemochromatosis ferritin levels in serum have also been used to evaluate clinical conditions not related to iron storage, including inflammation, chronic liver disease and malignancy. (Sharma *et al.*, 2014)

Materials and methods

The study area and population

The study was conducted in four Sudanese states (Blue Nile State, White Nile, Sennar state and Khartoum State) among infected with "*Plasmodium falciparum* and *Plasmodium vivax*" Sudanese patients. They were recruited from September 2016 up to October 2017 as a part of a prospective cross-sectional

Hospital based study investigating the adverse consequence of Malaria.

Sample size

The minimum sample size for the study was 385 patients calculated by using the formula

$$n = z^2 * \frac{p * (1 - p)}{e^2}$$

z = is confidence level 95% which equal 1.96.

p = is prevalence of disease equal 14%

e = margin of error equal 5%

n = is sample size (385 sample)

Data collection and analysis

The study participants were interviewed by administration of stander questionnaire to obtain the socio –demographic and economic status information as well as epidemiological risk factors. Laboratory results from the test were entered using the same number as the one on the questionnaires. All the data were entered in to excel spread sheet and the later exported in to SPSS for statistical analysis.

Sample collection

A total of 5 ml of venous blood were collected and divided in to a blood plain container and EDTA anticoagulant and three as Dried Blood Spot (DBS) were spotted on what man card.

Parasitological examination: Thick and thin blood films were prepared from blood, then stained with Giemsa then examined by ×100 oil immersion, all the slides were blindly double-checked.

Molecular technique:

If the suspected malaria patients Dried Blood Spot (DBS) were spotted on whatman card, they dried for 24hr at room temperature then kept in separate clean zipper bag, then DNA extracted by Guanidine chloride method, after amplification of DNA the result reading and documented by gel documentation system.

Serum ferritin:

We used TOSOH AIA-600II to estimate serum ferritin level.

Results

Out of 385 collected blood samples from malaria suspected patients, a total of 69 cases were found malaria positive *Plasmodium falciparuum* and *Plasmodium vivax*. Distribution of malaria cases was observed in all age groups and both the gender.

Out of 69 malaria positive samples 66.6 % were *Plasmodium falciparum* positive, and 33.4% were *Plasmodium vivax* positive . About 91.9% of malaria positive is symptomatic patients and 8.1% with mild symptoms.

Serum ferritin levels in malaria positive population arranged between 23 to 180 ng/ml with main value 47 ng/ml. Serum ferritin levels in malaria positive population was decrease when compared with control group. 56.5% of malaria positive showed result below 50 ng/ml.

Table (1) Overall prevalence rate of *Plasmodium falciparum* & *plasmodium vivax*

Species of malaria	Total	Positivecases	Percent	
<i>P.falciparum</i>	385	46	66.6%	
<i>p.vivax</i>	385	23	33.3%	p.value 0.01

Table (2) Comparison between BFFM, PCR results

Technique	Positive cases	Percent	Negative cases	Percent
PCR	73	(18.9%)	312	81%
BFFM	69	(17.9%)	316	82%

Table (3) :The results of serum ferritin in study group and control ,show Serum ferritin levels in malaria positive population was decrease when compare with control group 57.5% of malaria positive show result below 50 ng/ml

Serum ferritin level	Malaria positive(73)		Control (35)	
	Number of samples	Percent	Number of samples	percent
Below 50ng/ml	42	57.5%	11	31.4%
51 - 100	21	28.7%	4	11.4%
101 -150	3	4.5%	4	11.4%
Above 150 ng/ml	7	10.1%	16	45.8%

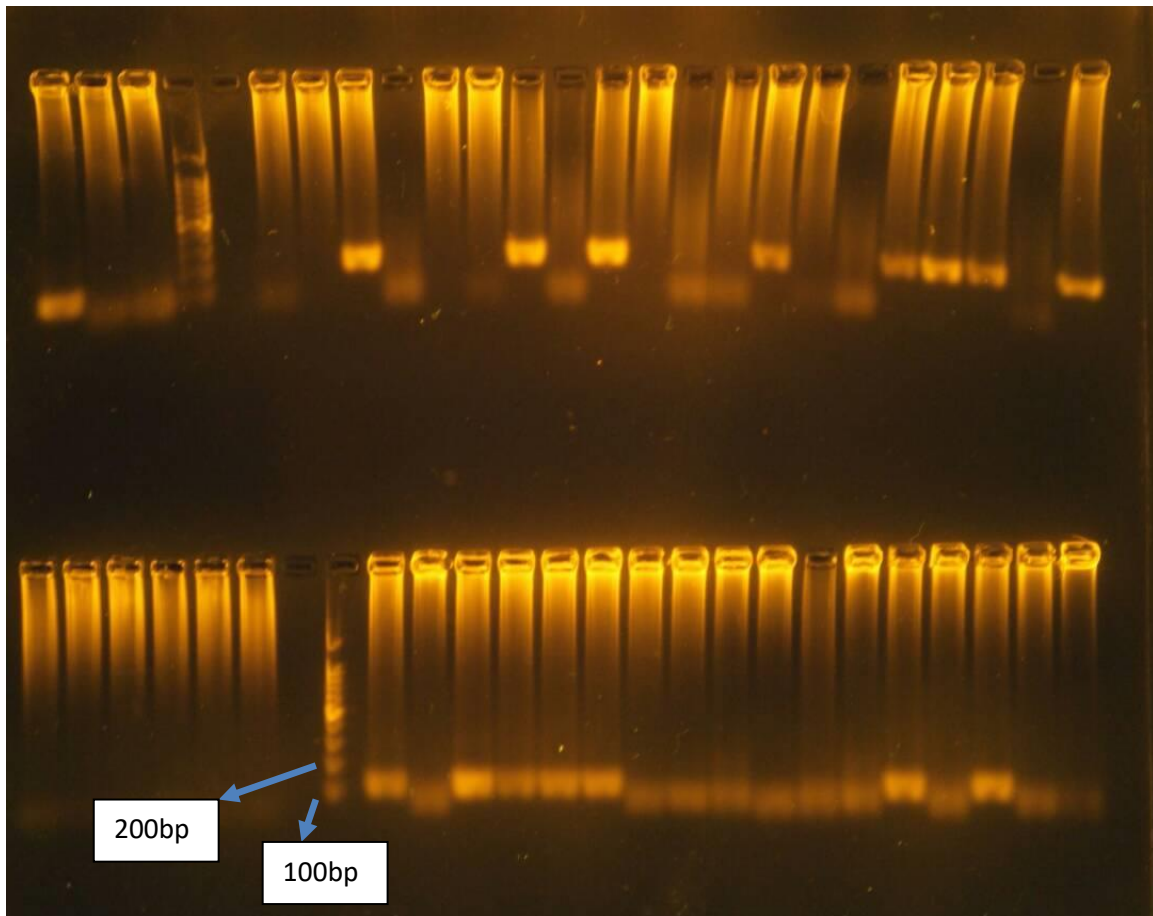


Figure (1) Amplification of malaria parasite in study groups ,Lane 4 ,33 DNAmwt markers (size TM-100) (*Plasmodium falciparum* with band 205 bp)

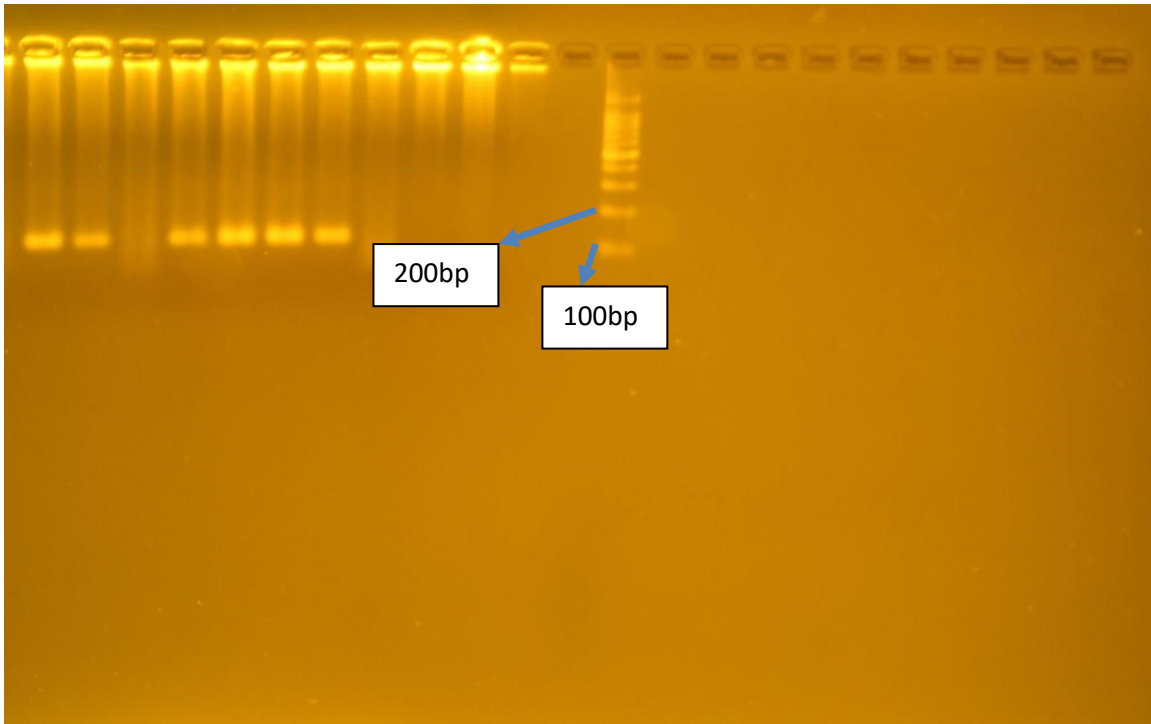


Figure (2) Amplification of malaria parasite in study groups ,Lane 13 DNAmwt markers (size TM-100) (*Plasmodium vivax* with band 120 bp)

Discussion

This study was attempt to compare the infection rate of *plasmodium* among Sudanese by using various techniques include blood film and PCR technique. The result revealed significant variation of prevalence rate and intensity of infection .the study subjects were categorized according to age, gender, previous history of infection by plasmodium and who received or didn't receive treatment.

Overall prevalence rate of *Plasmodium falciparium*(66.6%) is more than *plasmodium vivax* (33.4%)in the study groups, the result was similar to Thu Zar Han &Indar 2017 "comparison of microscopy and PCR for detection of human plasmodium species and plasmodium know lesi in southern Myanmar " which the percentage of infection is (67.8%) and (30.5%)as *Plasmodium falciparium*,*plasmodium vivax* respectively .

In this study, it was seen that the serum ferritin levels were decreased in malaria positive patients when compared to healthy controls as same as result of (jitendra Sharma *et al*,2014 - serum ferritin and hematological parameter among malaria patients in assam)

Conclusion

This study concluded that Malaria (*Plasmodium falciparum* & *Plasmodium vivax*) infection in the area investigated is still.

Malaria presents a diagnostic challenge to laboratories in most countries. Blood film and PCR are more sensitive and specific to diagnose malaria than RDTs.

Serum ferritin levels are decreased in malaria positive patients.

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