



## RESEARCH ARTICLE

## EVALUATION OF PLATELET COUNT AND PLATELET INDICES IN PATIENTS WITH ACUTE MALARIA IN SHENDI LOCALITY

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## ABSTRACT

**Background:** Malaria is the commonest cause of morbidity in Africa. This study describes altered platelet count and platelet indices in patients with acute malaria caused by *Plasmodium falciparum*, *Plasmodium vivax* and *plasmodium malariae* and uses these alterations as initial hint for malarial infection and therefore encourage the laboratory physicians for more depth search of the parasite microscopically. **Methods:** Platelet count and platelet indices in (123) patients with acute malaria were evaluated, living in Shendi locality in northern Sudan, an area of malarial holoendemic transmission. **Results:** The results of this study showed that platelet count, mean platelet volume (MPV), and Plateletcrit (PCT) values were exhibited significant decrease, but there was no change in platelet distribution width (PDW). Three sympatric Plasmodium species were recorded during this study with different prevalence of (77.2%) *P.falciparum*, (13.8%) *P.malairae* and (8.9%) *P.vivax* consequently. Mean platelet count decreased with an increase in density of parasitaemia. **Conclusion:** Malaria is associated with different degrees of reduction platelet count and alteration of platelet indices and may be used as probable indicator for malaria in endemic regions and therefore encourage the laboratory physicians for more depth search of the parasite microscopically.

**Keywords:** Malaria, Plasmodium species, Platelets.

## INTRODUCTION:

Malaria is one of the most common infectious diseases in the world, and its history extends into ancient history, no doubt impacting the migration of humans in the world, it is a major health problem in the tropics with high morbidity and mortality. <sup>(1)</sup> According to estimates from the World Health Organization, over (207) million cases and about (627,000) deaths were occurred in 2012. *Plasmodium falciparum* and *Plasmodium vivax* are the most common. *Plasmodium falciparum* is the most deadly. <sup>(2)</sup> Changes in platelet counts during acute malaria are commonly reported in the medical literature, especially in *Plasmodium falciparum* infections; such changes are a major cause of concern to clinicians because such cases are more likely to evolve into serious and complicated disease cases. <sup>(3,4)</sup> However, many recent studies have also found *thrombocytopenia* associated with *P. vivax*. <sup>(5-6)</sup> In general, the underlying mechanisms

of *thrombocytopenia* in malaria are peripheral destruction, excessive sequestration of platelets in spleen, and excessive use of platelets associated with the disseminated intravascular coagulation phenomenon. <sup>(7)</sup> In addition to the reduction in the number of platelets, platelet function is also compromised in these patients; this is generally evidenced by changes in the volume and other features of platelet cells. <sup>(8)</sup> Furthermore, platelet activation alters the morphology of these cells, which can be evaluated on the basis of mean platelet volume (MPV) and platelet distribution width (PDW), Another platelet parameter is plateletcrit (PCT), which is a reliable measurement of platelet biomass because it combines the MPV with the absolute platelet count. <sup>(9)</sup> *Thrombocytopenia* is a common finding in malaria, but its correlation with the type of malaria and prognostic implications in context with severity of the low platelet

count has not been evaluated in large studies in many localities of Sudan such as Shendi locality.

**METHODS:**

This is a cross-sectional descriptive study based on laboratory data of (123) patients with acute malaria either hospitalized or treated on an outpatient basis were included in the study. The investigations were performed on venous blood sample drawn into EDTA tubes for preparation an 'OptiMAL® Rapid Malaria Dipstick Test and the thick and thin smears for malaria parasites and automated determination of platelet count and platelet indices. Platelet count and platelet indices were performed using Mindray Haematology Analyzer (Mindray bc-3000). Blood slide was prepared for each sample that came to the laboratory. Slide had a measured volume of (6 µl) of blood for thick film and (2 µl) for the thin film. (10) % equals (1:9 ml) for (10) minutes fresh, working Giemsa stains was prepared with already prepared stock of Giemsa-staining solution and working Giemsa buffer with PH (7.2). Thin and thick blood smear were stained with Giemsa after fixing the thin smear with absolute methanol. The (10) % Giemsa stain was used to stain the slides to release results by

examining them using 100 oil immersion fields. A positive smear was included with each new batch of working Giemsa stain for quality control.

Parasite densities were assessed as parasite/field.

All slides were double-checked in a blinded manner and only considered negative if no parasites were detected in 100 oil immersion fields.

**Determine the Parasitaemia as follow:**

- 1- 10 parasite\ 100 field (+)
- 1- 10 parasite\ 10 field (++)
- 1- 10 parasite\ 1 field (+++)
- >10 parasite\ 1 field (++++).

**RESULTS:**

One hundred and twenty three patients with acute malarial infection were included in this study, (95) frequency of *P.falciparum* from total sample, calculated as (77.2%) were infected, (17) frequency of *P.malairae* from total sample, calculated as (13.8%) as infected and (11) frequency of *P.vivax* from total sample, calculated as (8.9%) were infected and there was no case of *P.ovale*. (Table 1)

Table 1: Frequency and percentage of plasmodium species from total sample:

Species	Frequency	Percentage
<i>P.falciparum</i>	95	77.2%
<i>P.vivax</i>	11	8.9%
<i>P.malairae</i>	17	13.8%
<i>P.ovale</i>	0	0 %
<b>Total</b>	123	99,9%

*Thrombocytopenia* is defined as platelet count  $\leq 150 \times 10^3 / \mu\text{l}$  and further defined as severe if the platelet count  $< 50 \times 10^3 / \mu\text{l}$ . In this study *thrombocytopenia* is reported in (83) cases with (67.5%), and the remaining shows normal platelet count. (Table 2)

Table 2: Platelet count in acute malarial infection in association to normal and thrombocytopenic values from the total sample

	Frequency	Percentage
<b>Normal count</b>	40	32.5%
<b>Thrombocytopenia</b>	83	67.5%
<b>Total</b>	123	100.0%

The platelet indices evaluation of all patients showed (12) cases with (9.8) % had normal MPV and (111) cases with (90.2) % had low MPV, (122) cases with (99.2) % had normal PDW and only (1) case with (0.8) % had high PDW and (23) cases with (18.7) % had normal PCT and (100) cases with (81.3) % had low PCT. (Table 3-4-5)

Table 3: Percentage of MPV frequency and the total frequency with acute malarial infection (MPV frequency/ total frequency):

	Frequency (MPV)	Percentage
<b>Normal</b>	12	9.8%
<b>Low</b>	111	90.2%
<b>High</b>	0	0
<b>Total</b>	123	100.0%

Table 4: Percentage of PDW frequency and the total frequency with acute malarial infection (PDW frequency/ total frequency)

	Frequency (PDW)	Percentage
Normal	122	99.2%
Low	0	0 %
High	1	0.8%
Total	123	100.0%

Table (5): Percentage of PCT frequency and the total frequency with acute malarial infection (PCT frequency/ total frequency):

	Frequency (PCT)	Percentage
Normal	23	18.7%
Low	100	81.3%
High	0	0 %
Total	123	100.0%

Effect of *P.falciparum* on platelet count showed (30) cases calculated as (31.6) % with normal platelet count and (65) cases calculated as (68.4) % with *thrombocytopenia* and with mean platelet count (91,000/ $\mu$ l), *P.vivax* showed (5) cases calculated as (45.5) % with normal platelet count and (6) cases calculated as (54.5) % with *thrombocytopenia* and with mean platelet count (84,300/ $\mu$ l) and *P.malairae* showed (5) cases calculated as (29.4) % with normal platelet count and (12) cases calculated as (70.6) % with *thrombocytopenia* and with mean platelet count (103,000/ $\mu$ l). (Table 6-7)

Table 6: Percentage of frequency of normal count of plasmodium species according to the frequency of plasmodium speices carrier:

Plasmodium Species	Frequency of plasmodium carrier	Frequency of normal count	Percentage of normal count
<i>P. falciparum</i>	95	30	31.6%
<i>P. vivax</i>	11	5	45.5%
<i>P. malairae</i>	17	5	29.4%

Table 7: Percentage of frequency of thrombocytopenia of plasmodium species according to the frequency of plasmodium speices carrier

Plasmodium Species	Frequency of plasmodium carrier	Frequency of thrombocytopenia	Percentage of thrombocytopenia
<i>P. falciparum</i>	95	65	68.4%
<i>P. vivax</i>	11	6	54.5%
<i>P. malairae</i>	17	12	70.6%

Table (8): Calculated mean (SPSS) platelet count with plasmodium species:

Species	Mean platelet count/ $\mu$ l
<i>P.falciparum</i>	91,000/ $\mu$ l
<i>P.vivax</i>	84,300/ $\mu$ l
<i>P.malairae</i>	103,000/ $\mu$ l

The parasite density and platelets count were found to be associated with parasitaemia levels ranged as mild, moderate and severe. (24) Cases with (28.9) % were found to be with mild parasitaemia and with mean platelet count (111,000/ $\mu$ l), (42) cases with (50.6) % were found to be with moderate parasitaemia and with mean platelet count (89,600/ $\mu$ l) and (17) cases with (20.5) % were found to be with severe parasitaemia and with mean platelet count (72,200/ $\mu$ l). The mean platelet count showed increased *thrombocytopenia* by increased parasitaemia. (Table 8)  
A common statistical package (SPSS, 16.0) was used to perform all statistical tests.

Table 9: Correlation of thrombocytopenia with density of parasitaemia:

Severity	Frequency	Percentage	Mean platelet count/ $\mu$ l
Mild	24	28.9%	111,000/ $\mu$ l
Moderate	42	50.6%	89,600/ $\mu$ l
Heavy	17	20.5%	72,200/ $\mu$ l

P. value = 0.002 (less than 0.02) significant variation.

#### DISCUSSION:

In the present study, the analysis of the platelet count and platelet indices in (123) patients with acute malaria revealed a high frequency of *thrombocytopenia* and changes in *MPV* and *PCT*. Platelet abnormalities in malaria are both qualitative and quantitative. In this study, platelet counts were significantly reduced in malarial infected subjects. *Thrombocytopenia* occurred in (67.5) % of malarial cases in comparison to study done in Pakistan which had high percent (85.5) %. The platelet indices in this study showed (90.2) % had low *MPV* and (81.3) % had low *PCT*. In the present study the prevalence of plasmodium species as follows; *P.falciparum* was (68.4) %, *P.vivax* was (8.9) % and *P.malairae* was (13.8) % in comparison to study done in south Sudan which showed a prevalence of (94.4) %, (5) % and (0.7) % respectively.<sup>(10)</sup> Effect of *P.falciparum* on platelet count showed (68.4) % were *thrombocytopenia* with mean of platelet count of (91,000/ $\mu$ l), *P.vivax* (54.5) % were *thrombocytopenia* with mean of platelet count of (84,300/ $\mu$ l) in comparison to study achieved in India showed the mean of platelet count in *P.falciparum* infection was (100,900/ $\mu$ l) and in *P.vivax* was (115,390/ $\mu$ l) and *P.malairae* (70.6) % were *thrombocytopenia* with mean of platelet count of (103,000/ $\mu$ l).<sup>(11)</sup> The trend of decreasing platelet count with increasing levels of parasitaemia observed in this study has been previously noted for malaria (Eze Evelyn M et al. 2012).<sup>(12)</sup>

#### CONCLUSION:

Three species of malaria parasite are in circulation in the study area. This study showed that platelet count and platelet indices were altered during acute and symptomatic infection.

#### REFERENCE:

- John W. Ridley, parasitology for medical and clinical laboratory professionals. 2012 Delmar, Cengage Learning, www.cengage.com/highered.
- www.who.int/mediacentre/factsheets/fs094/en/.
- Gérardin P, Rogier C, Ka AS, Jouvencel P, Brousse V, Imbert P: Prognostic value of thrombocytopenia in African children with falciparum malaria. Am J Trop Med Hyg 2002, 66:686–69.
- Maina RN, Walsh D, Gaddy C, Hongo G, Waitumbi J, Otieno L, Jones D, Ogutu BR: Impact of Plasmodium falciparum infection on haematological parameters in children living in western Kenya.
- Malar J 2010, 9 (Suppl 3):S4.
- Rodríguez-Morales AJ, Sánchez E, Vargas M, Piccolo C, Colina R, Arria M: Anemia and thrombocytopenia in children with Plasmodium vivax malaria. J Trop Pediatr 2006, 52:49–51.
- Rizvi I, Tripathi DK, Chughtai AM, Beg M, Zaman S, Zaidi N: Complications associated with Plasmodium vivax malaria: a retrospective study from a tertiary care hospital based in western Uttar Pradesh, India. Ann Afr Med 2013, 12:155–159. doi:10.4103/1596-3519.117624.
- Gupta NK, Bansal SB, Jain UC, Sahare K: Study of thrombocytopenia in patients of malaria. Trop Parasitol 2013, 3:58–61. doi:10.4103/2229-5070.113914.
- Greisenegger S, Endler G, Hsieh K, Tentschert S, Mannhalter C, Lalouschek W: Is elevated mean platelet volume associated with a worse outcome in patients with acute ischemic cerebrovascular events? Stroke 2004, 35:1688–1691.
- Akpinar L, Sayin MR, Gursoy YC, Karabag T, Kucuk E, Buyukuysal MC, Aydin M, Haznedaroglu IC: Plateletcrit: a platelet marker associated with saphenous vein graft disease. Herz 2013: . Epub ahead of print, doi: 10.1007/s00059-013-3798-y.
- Margaret B Eyobo, Adwok C Awur, Gregory Wani, Ahmed I Julla, Constantino D Remijo, Bakhit Sebit, Robert Azairwe, Othwonh Thabo, Edward Bepo, Richard L Lako, Lul Riek and Emmanuel Chanda. emmanuel\_chanda@yahoo.co.uk. Wwww.malariajournal.com/content/13/1/45. Malaria Journal 2014, 13:45 doi: 10.1186/1475-2875-13-45.
- UM Jadhav, VS Patkar, NN Kadam. ©JAPI • VOL. 52 • AUGUST 2004. www.japi.org.
- Eze Evelyn M, F. C. Ezeiruaku, & D. C. Ukaji. Global Journal of Health Science; Vol. 4, No. 4; 2012. doi:10.5539/gjhs.v4n4p139, RL: http://dx.doi.org/10.5539/gjhs.v4n4p13