RESEARCH ARTICLE

Platelet distribution width, mean platelet volume and haematological parameters in patients with uncomplicated *plasmodium falciparum* and *P. vivax* malaria [version 1; peer review: 1 approved, 2 approved with reservations]

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Abstract

Background: The association between the haematological profile (including abnormal platelets) and malaria is not completely understood. There are few published data on haematological profiles of malaria patients in areas with unstable malaria transmission. The current study was conducted to investigate if the haematological parameters, including platelet indices, were reliable predictors for microscopically-diagnosed malaria infection.

Methods: A case-control study with a total of 324 participants (162 in each arm) was conducted at the out-patient clinic of New Halfa hospital during the rainy and post rainy season (August 2014 through to January 2015). The cases were patients with uncomplicated *Plasmodium falciparum* (107; 66.9%) and *P. vivax* malaria (55, 34.0%) infections. The controls were aparasitemic individuals. The haematological parameters were investigated using an automated hemo-analyser.

Results: There was no significant difference in the mean ($\pm$ SD) age between the study groups; however, compared to the controls, patients with uncomplicated malaria had significantly lower haemoglobin, leucocyte and platelet counts, and significantly higher red cell distribution width (RDW), platelet distribution width (PDW) and mean platelet volume (MPV).

Conclusions: The study revealed that among the haematological indices, PDW and MPV were the main predictors for uncomplicated *P. falciparum* and *P. vivax* malaria infection.

Abbreviations: OR: odds ratio.

Keywords

hematological profile, PDW, MPV, plasmodium falciparum, P. vivax,

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Approval Status

	1	2	3
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Any reports and responses or comments on the article can be found at the end of the article.

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and **Outbreaks** gateway.

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Introduction

In spite of the preventative measures, malaria remains a major public health concern. Malaria is responsible for 781,000 deaths in a year, the majority of which are in Sub-Saharan Africa¹. A correct diagnosis is one of the most important tools in the management of malaria. It has been recommended that all persons with suspected malaria should have a parasitological confirmation of diagnosis¹. Microscopic examination of malaria consists of the identification of parasite species in thin and/or thick blood films, which is the “gold standard” for malaria diagnosis^{1,2}. Microscopy requires trained technicians, and well-maintained microscopes with a perfect quality management system. However, acceptable microscopy services are not widely available for the diagnosis of malaria in some areas where malaria is endemic e.g. in communities in Sub-Saharan Africa¹.

Previously, measurement of haematological blood parameters was unreliable due to intra and inter-method variation. Nowadays, automated analysers have replaced the traditional methods. Automated analysers are available in most settings and can give reliable results within a short period of time. There is a universal trend toward using these to aid the presumptive diagnosis of malaria infection^{2,3}.

Previous studies have reported different results levels of sensitivity and specificity of haematological parameters as predictors of malaria infection⁴⁻⁸. There is no published data on haematological changes in patients infected with malaria parasites in Sudan, where malaria is the major health problem⁹. The current study was conducted in New Halfa, eastern Sudan to investigate the haematological changes observed during malaria infection and to assess the reliability of the haematological parameters used for diagnosis.

Methods

A case-control study was conducted at the out-patient clinic of New Halfa hospital during the rainy and post rainy season (August 2014 through to January 2015). The cases were patients with symptoms and signs of uncomplicated malaria and who were confirmed to be infected with *P. falciparum* or *P. vivax* by microscopic examination of Giemsa stained blood smears during the study¹⁰. The controls were the patients that presented to the same clinic with symptoms of malaria but were found to have negative blood films for malaria. After the participants (or their parents/legal guardians if they were minors) provided written informed consent, a clinical history was gathered using questionnaires. Weight and height were measured and body mass index was expressed as kg/m².

2ml of blood was taken from each participant and placed in a container with EDTA, and a complete hemogram was performed using an automated hematology analyser (Sysmex XN-9000; Hyogo, Japan), following the manufacturers’ instructions as previously described¹¹⁻¹³. The hemogram included measuring the haemoglobin level, leucocyte count and platelet indices, namely platelet count, mean platelet volume (MPV), and platelet distribution width (PDW).

Thick and thin blood films were prepared and stained with 10% Giemsa to microscopically confirm which participants were infected. If the slide was positive, the parasite density was measured by counting the number of asexual parasites per 200 leukocytes, and multiplied against the participants own leucocytes number/ μ L. The blood films were considered negative if no parasites were detected in 100 oil immersion fields of a thick blood film.

Statistical analysis

A minimum sample size of 162 participants for each arm of the study was calculated assuming that 10% of participants would have incomplete data. In this way, it would be possible to calculate a significant difference (at $\alpha = 0.05$) in the means of the proposed variables - mainly haemoglobin, red cell distribution width (RDW), leucocytes, platelets counts and PDW - between the cases and the controls, at 80% power.

Statistical analysis was performed using SPSS for Windows, version 20.0 (SPSS Inc., Chicago, IL, USA). Proportions of the studied groups were expressed as percentages and compared using the chi-squared test. Continuous data were checked for normality using the Shapiro-Wilk test. The means ($\pm$ SD) or median (IQR) were used to describe the studied variables, depending if they were normally or non-normally distributed. The t-test (or Mann-Whitney U test if the data were not normally distributed) evaluated the differences between the studied groups. Binary regression was calculated, where malaria was the dependent variable and medical and haematological indices were the independent variables. Diagnostic screening tests were used to determine the diagnostic cut-offs of various parameters (based on test sensitivity and specificity) using the receiver operating characteristic (ROC) curve. $P < 0.05$ was considered statistically significant.

Results

107 (66.9%) and 55 (34.0%) of the uncomplicated malaria cases were infected with *P. falciparum* and *P. vivax*, respectively. There was no significant difference in the age or BMI between the cases and the controls. Patients had significantly higher body temperature than the controls (Table 1). Their ages ranged between 1.1–55 years

Table 1. Comparing the mean ($\pm$ SD) age, BMI and body temperature between patients with malaria and negative controls.

Variables	Patients with malaria (n=162)	Controls (n=162)	P-value
Age, years	20.7(19.6)	20.0 (19.0)	0.738
Body mass index, kg/m ²	19.8(6.2)	19.9(14.3)	0.947
Temperature	38.0 (0.9)	37.6(1.0)	0.002

in the cases and 1.1–42 years in the controls. Around one third of the cases (53, 32.7%) and one third of the controls (49, 30.2%) were children that were under five years old ($p=0.665$). There were 81 (50.0%) vs. 79 (48.8%) males in the cases and controls, respectively ($p=0.912$).

Compared with the controls, patients with uncomplicated malaria had significantly lower haemoglobin levels and lower leucocyte, lymphocyte, neutrophil, and platelet counts, but significantly higher RDW, PDW and MPV (Table 2).

A receiver operating characteristic (ROC) curve was used to determine the cut-offs for haemoglobin levels, RDW, leucocytes and platelet counts, PDW and MPV for prediction of malaria infection. The area under the ROC curve is shown in Table 3 and Figure 1, which failed to confirm predictability of hemoglobin, RDW, leucocytes and platelet count. Poor and fair predictability of PDW and MPV for malaria infection was demonstrated; the areas under the curves were 0.637 and 0.726, respectively.

When the cut-off levels were evaluated using binary regression analysis, PDW ≥ 14.550 % (OR =2.9, 95% CI =1.64–5.43, $P < 0.001$) and MPV ≥ 9.05 fL (OR =2.25, 95% CI =1.12–4.51, $P < 0.001$) were the most important predictors for malaria infection, (Table 4).

There was no significant difference in the hemoglobin, leucocytes, lymphocytes, neutrophils, platelets counts, RDW, PDW, MPV and the parasite count ($P=0.201$) when the cases of *P. falciparum* and *P. vivax* were compared (Table 5).

Dataset 1. Raw data collected as the basis for this study

<http://dx.doi.org/10.5256/f1000research.11767.d164010>

Plasmf = Blood film for *P. falciparum*.

Discussion

According to our present findings, PDW and MPV are the two most important haematological predictors of *P. falciparum* and *P. vivax* malaria infection. This is in line with a recent finding

Table 2. Comparing the median (IQR) of the blood parameters measured in patients with and without malaria. Data is displayed as mean ($\pm$ SD), and the t-test was used because the data was normally distributed.

Variables	Patients with malaria (n=162)	Controls (n=162)	P-value
Hemoglobin, g/dl*	9.3(2.3)	10.2 (2.0)	0.003
Red cell distribution width,%	16.0(14.2–19.1)	15.1 (13.6–18.3)	0.034
Leucocytes, $\times 10^3/\text{mm}^3$	6.5(5.2–8.4)	8.2 (5.65–10.37)	0.009
Lymphocytes, $\times 10^3/\text{mm}^3$	2.448 (1.668–3.501)	2.53 (1.70–4.03)	0.041
Neutrophils, $\times 10^3/\text{mm}^3$	3.209(2.185–4.686)	4.64 (2.77–6.31)	0.003
Platelet count, $\times 10^3/\text{mm}^3$	121.(78.0–186.5)	280.0 (227.0–350.0)	< 0.001
Platelets distribution width, %	14.7(14.4–15.0)	14.5 (14.3–14.8)	0.003
Mean platelet volume, fL	9.6(9.2–10.0)	8.8 (8.5–9.4)	< 0.001

Table 3. The reliability of haematological indices in predicting malaria.

Variable	Area under the curve	P-value	Sensitivity	Specificity	Cut-off
Hemoglobin, g/dl*	0.365	0.001			
Red cell distribution width, %	0.587	0.039			
Leucocytes, $\times 10^3/\text{mm}^3$	0.396	0.014			
Platelet count, $\times 10^3/\text{mm}^3$	0.143	< 0.001			
Platelets distribution width, %*	0.637	0.001	72.8	56.8	14.550
Mean platelet volume, fL *	0.726	0.000	77.2	60.1	9.05

Key:

*: These were considered because of fair predictability of the area under the curve

Figure 1. Receiver operating characteristic (ROC) curve and the associated reliability of blood parameters in predicting malaria in eastern Sudan.

Table 4. Binary logistic regression analysis of the factors associated with *P. falciparum* and *P. vivax* malaria in eastern Sudan. OR: odds ratio.

Variable	OR	95% CI	P-value
Age	0.99	0.93–1.06	0.986
Male gender	0.93	0.39–2.19	0.870
Body mass index	1.09	0.94–1.26	0.222
Temperature	1.33	0.87–2.03	0.185
Hemoglobin	0.90	0.72–1.13	0.382
Red cell distribution width	1.16	0.99–1.36	0.054
Leucocytes	0.96	0.84–1.10	0.605
Platelets count	0.98	0.98–0.99	0.000
Platelets distribution width ≥ 14.550 %	2.9	1.64–5.43	< 0.001
Mean platelets volume ≥ 9.05 fL	2.25	1.12–4.51	< 0.001

where Al-Salahy *et al.* reported that patients in Hajjah, Northwest Yemen with malaria parasitemia had significantly lower hemoglobin, hematocrit, leucocytes, lymphocytes, and platelet counts compared to healthy subjects¹⁴. Previous studies have shown that patients with complicated malaria had reduced haematological parameters such as platelet, leucocyte, and RBC counts, which provided relatively good predictors for the diagnosis of malaria

Table 5. Comparing the median (IQR) blood parameters in patients with *P. falciparum* and *P. vivax* malaria. Data is displayed as mean ($\pm$ SD), and the t-test was used because the data was normally distributed.

Variables	Patients with <i>P. falciparum</i> malaria (n=107)	Patients with <i>P. vivax</i> malaria (n=55)	P
Hemoglobin, g/dl	9.3(2.3)	10.2 (2.0)	0.003
Red cell distribution width, %	15.5 (14.1–19.0)	17.1(14.1–19.8)	0.225
Leucocytes, $\times 10^3/\text{mm}^3$	6.5 (5.1–8.1)	6.4 (5.1–9.5)	0.504
Lymphocytes, $\times 10^3/\text{mm}^3$	2.454 (1.654–3.373)	2.43 (1.82–3.95)	0.677
Neutrophils, $\times 10^3/\text{mm}^3$	3.090 (1.958–4.389)	3.27 (2.38–5.31)	0.641
Platelet count, $\times 10^3/\text{mm}^3$	115.0 (70.5–183.5)	133.5 (98.7–205.7)	0.168
Platelets distribution width, %	14.8 (14.5–15.0)	14.6 (14.2–14.9)	0.186
Mean platelets volume, fL	9.7 (9.1–10.1)	9.4(9.1–9.9)	0.366

infection^{8,15}. On the other hand, the significant differences observed in the haematological parameters between parasitemic Ugandan patients and non-parasitemic Ugandans were only observed in the monocyte and the platelet count¹⁶. No significant difference was found between the haemoglobin levels, MCV, MCH, neutrophils, lymphocyte counts or MPV¹⁶.

In the current study, a PDW $\geq 14.550\%$ and MPV $\geq 9.05\text{fL}$ were the main predictors for malaria (OR =2.9 and 2.3). Previous studies have reported an increased MPV level in malaria^{15,17}. Interestingly, Chandra *et al* reported that an MPV $> 8\text{ fL}$ had a sensitivity and specificity of 70.8% and 50.4% for the diagnosis of malaria, respectively⁸.

The higher PDW and MPV values in malaria could be explained by bone marrow formation of megakaryocytes to compensate for the low absolute platelet count during acute malaria infection^{8,15}. A significantly higher level of the key platelet growth factor (thrombopoietin) has been reported in patients with malaria¹⁸. Furthermore, the parasitized RBCs could increase in platelet sensitivity to adenosine diphosphate (ADP), prompting secretion of dense granules^{19,20}.

Nutritional deficiency and haemoglobinopathies were not investigated in the current study and have to be mentioned as study limitations. Haematological parameters formalaria-infested blood may vary depending on the level of malaria endemicity, presence of haemoglobinopathies and nutritional status^{21,22}. Another limitation of the is that we relied on microscopy only for the malaria diagnosis. Some of negative controls may have had undetected parasitemia (submicroscopic parasitemia). We have previously observed

that the majority of febrile patients who were parasite negative by microscopy had *P. falciparum* infection according to PCR results²³. Lastly, other infections that might have an effect on blood parameters were not ruled out in both the cases and controls. In conclusion, the study revealed that a PDW $\geq 14.550\%$ and MPV $\geq 9.05\text{fL}$ were the main predictors for uncomplicated *P. falciparum* and *P. vivax* malaria infection.

Data availability

Dataset 1: Raw data collected as the basis for this study. Plasmf = Blood film for *P. falciparum*. DOI, [10.5256/f1000research.11767.d164010](https://doi.org/10.5256/f1000research.11767.d164010)²⁴

Consent

The study was approved by the Institutional Review Board of the Medical College, University of Khartoum (3# 2015 1114).

Competing interests

No competing interests were disclosed.

Grant information

The author(s) declared that no grants were involved in supporting this work.

Acknowledgements

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References

- Manual A: **Universal access to malaria diagnostic testing**. 2011; [cited 2017 Mar 5]. [Reference Source](#)
- Jain M, Gupta S, Jain J, *et al.*: **Usefulness of automated cell counter in detection of malaria in a cancer set up—our experience**. *Indian J Pathol Microbiol.* 2012; **55**(4): 467–73. [PubMed Abstract](#) | [Publisher Full Text](#)
- George I, Ewelike-Ezeani C: **Haematological changes in children with malaria infection in Nigeria**. *J Med Med.* 2011; **2**(4): 768–771. [Reference Source](#)
- Maina RN, Walsh D, Gaddy C, *et al.*: **Impact of *Plasmodium falciparum* infection on haematological parameters in children living in Western Kenya**. *Malar J.* 2010; **9**(Suppl 3): S4. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Coelho HC, Lopes SC, Pimentel JP, *et al.*: **Thrombocytopenia in *Plasmodium vivax* malaria is related to platelets phagocytosis**. Carvalho LH, editor. *PLoS One.* 2013; **8**(5): e63410. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Chandra S, Chandra H: **Role of haematological parameters as an indicator of acute malarial infection in uttarakhand state of India**. *Mediterr J Hematol Infect Dis.* 2013; **5**(1): e2013009. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Leal-Santos FA, Silva SB, Crepaldi NP, *et al.*: **Altered platelet indices as potential markers of severe and complicated malaria caused by *Plasmodium vivax*: a cross-sectional descriptive study**. *Malar J.* 2013; **12**: 462. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Chandra S, Chandra H: **Role of haematological parameters as an indicator of acute malarial infection in uttarakhand state of India**. *Mediterr J Hematol Infect Dis.* 2013; **5**(1): e2013009. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Abdalla SI, Malik EM, Ali KM: **The burden of malaria in Sudan: incidence, mortality and disability—adjusted life—years**. *Malar J.* 2007; **6**: 97. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- World Health Organization: **Severe falciparum malaria**. World Health Organization, Communicable Diseases Cluster. *Trans R Soc Trop Med Hyg.* 2000; **94**(Suppl 1): S1–90. [PubMed Abstract](#) | [Publisher Full Text](#)
- Rayis DA, Ahmed MA, Abdel-Moneim H, *et al.*: **Trimester Pattern of Change and Reference Ranges of Hematological Profile Among Sudanese Women with Normal Pregnancy**. *Clin Pract.* 2017; **7**(1): 888. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Abdullahi H, Osman A, Rayis DA, *et al.*: **Red blood cell distribution width is not correlated with preeclampsia among pregnant Sudanese women**. *Diagn Pathol.* 2014; **9**: 29. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Abdelrahman EG, Gasim GI, Musa IR, *et al.*: **Red blood cell distribution width and iron deficiency anemia among pregnant Sudanese women**. *Diagn Pathol.* 2012; **7**: 168. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Al-Salahy M, Shnawa B, Abed G, *et al.*: **Parasitaemia and Its Relation to Hematological Parameters and Liver Function among Patients Malaria in Abs,**

- Hajjah, Northwest Yemen.** *Interdiscip Perspect Infect Dis.* Hindawi Publishing Corporation; 2016; **2016**: 5954394.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
15. Maina RN, Walsh D, Gaddy C, *et al.*: **Impact of *Plasmodium falciparum* infection on haematological parameters in children living in Western Kenya.** *Malar J.* 2010; **9**(Suppl 3): S4.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 16. Muwonge H, Kikomeko S, Sembajwe LF, *et al.*: **Uncomplicated *Plasmodium falciparum* Malaria in an Endemic.** 2014; 1–9.
 17. Ladhani S, Lowe B, Cole AO, *et al.*: **Changes in white blood cells and platelets in children with falciparum malaria: relationship to disease outcome.** *Br J Haematol.* 2002; **119**(3): 839–47.
[PubMed Abstract](#) | [Publisher Full Text](#)
 18. Kreil A, Wenisch C, Brittenham G, *et al.*: **Thrombopoietin in *Plasmodium falciparum* malaria.** *Br J Haematol.* 2000; **109**: 534–6.
[PubMed Abstract](#) | [Publisher Full Text](#)
 19. Wickramasinghe SN, Abdalla SH: **Blood and bone marrow changes in malaria.** *Baillieres Best Pract Res Clin Haematol.* 2000; **13**(2): 277–99.
[PubMed Abstract](#) | [Publisher Full Text](#)
 20. Prasad R, Das BK, Pengoria R, *et al.*: **Coagulation status and platelet functions in children with severe falciparum malaria and their correlation of outcome.** *J Trop Pediatr.* 2009; **55**(6): 374–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
 21. Price RN, Simpson JA, Nosten F, *et al.*: **Factors contributing to anemia after uncomplicated falciparum malaria.** *Am J Trop Med Hyg.* 2001; **65**(5): 614–22.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 22. Erhart LM, Yingyuen K, Chuanak N, *et al.*: **Hematologic and clinical indices of malaria in a semi-immune population of western Thailand.** *Am J Trop Med Hyg.* 2004; **70**(1): 8–14.
[PubMed Abstract](#)
 23. Giha HA, A-Elbasit IE, A-Elgadir TM, *et al.*: **Cerebral malaria is frequently associated with latent parasitemia among the semi-immune population of eastern Sudan.** *Microbes Infect.* 2005; **7**(11–12): 1196–203.
[PubMed Abstract](#) | [Publisher Full Text](#)
 24. Ali EA, Abdalla TM, Adam I: **Dataset 1 in: Platelet distribution width, mean platelet volume and haematological parameters in patients with uncomplicated *plasmodium falciparum* and *P. vivax* malaria.** *F1000Research.* 2017.
[Data Source](#)

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Walter R.J. Taylor

Mahidol Oxford Tropical Medicine Research Unit, Bangkok, Thailand

This is a nice academic paper that deals with haematological parameters in malaria. Using a case control approach, the authors have identified a mean platelet distribution width and mean platelet volume as possible markers of acute symptomatic malaria in their setting.

This is interesting but of limited practical application. Therefore, this paper should emphasise the academic aspects of their findings.

I think this paper can be accepted but with major revisions in two areas, in particular.

Sample size calculation – this has been determined using continuous variables yet we do not see any examples. This must be addressed.

Discussion – this should be more thorough comparing and contrasting the current data with previously published data. Moreover, readers will want to know important causes of increased RDW, PDW and MPV and where in haematological practice these parameters play an important role.

The authors should let us know if their research has led to any new research questions and future avenues of research.

Minor comments

- The number of malaria related deaths are higher than those reported by the WHO. The authors should obtain the latest data.
- No mention of the role of malaria rapid diagnostic tests
- The second line of the Discussion does not follow. Did the Yemeni study report PDW and MPV ?

- Page 6 left hand column penultimate paragraph:

Remove 'in' in this sentence:

Furthermore, the parasitized RBCs could increase in platelet sensitivity to adenosine diphosphate (ADP), prompting secretion of dense granules.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Malaria and tropical medicine

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 11 July 2017

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Alberto Tobón-Castaño

Malaria Group, Faculty of Medicine, University of Antioquia, Medellín, Colombia

1. The objective of the study should be re-examined in the introduction. The terms "reliability" and "validity" should be differentiated. Reliability refers to the degree to which the

measurement procedure can be reproduced.

2. Thus, if the objective is to study the validity of the hematological parameters to make a diagnosis, the methodology must be revised since these studies require a sample size that considers the prevalence and the expected sensitivity. Since this is a case-control study the objective should be consistent with this methodology.
3. It must be specified what a case is; What are the signs and symptoms of uncomplicated malaria?
4. It should be explained why 100 oil immersion fields were used as criteria to consider a thick blood film as negative. This does not correspond to international recommendations.
5. The calculation of the sample should be presented with the elements of a case-control study i.e. case-control relation, expected O.R., frequency of outcomes in exposed and unexposed.
6. RESULTS. If the clinical history is available, the time of evolution of the disease could be compared, which may lead to differences in hematological profiles.
7. The results presented in the Tables 2 and 5 are confusing. It is not clear whether the averages or medians are compared and what was the statistical test of comparison. It is not explicitly stated which variables presented normal distribution.
8. The presumptive diagnosis of malaria with haematological analyzers does not seem to be the appropriate way of solving malaria diagnosis problems in endemic areas. In this sense, it is not clear whether the study intends to contribute to the malaria diagnosis using a method that would be non-specific.

The study contributes to show hematological differences between cases and controls and this should serve to identify early lesions, but clearly is not a useful method for malaria diagnosis.

There is no relevant discussion about the findings. The reference values of the hematological parameters according to age and sex are not presented; the comparisons must take into account this variation.

Some aspects related to platelet changes are analyzed but superficially. Leukocyte count and cell line analysis are neglected; no mention is made of the significance of alterations, monocytes and eosinophils are neglected. There are no correlations with parasitemias which is also a variable that can contribute significantly to the hematological alterations as a function of the greater or lesser inflammatory response.

REFERENCES.

Reference 1. Who are the authors?

Ref 6 and 8 are the same.

Ref. 16. The title is incomplete? The journal name?

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Malaria, clinical and epidemiological studies

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 07 July 2017

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Mr Ali and colleagues present a study that revealed the mean platelet volume and platelet distribution width as good parameters to predict uncomplicated malaria parasite infection. The manuscript is well written and presented. The analysis of the results is adequate and correct. Some minor points should be reviewed:

1. As the authors used several statistical tests to compare the results between cases and controls, it is important to make these tests explicit for each p-value presented in the tables, as a footnote.

2. The title of Table 5 is not clear. In fact, Table 5 compares means (SD), and non-median (IQR).

3. In the last paragraph of the Discussion section the sentence "...parameters formalaria-infested blood..." should be changed by "... for malaria-infected blood...".

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

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