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Effect of Asymptomatic Malaria on Haematological Parameters in Children

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ABSTRACT This study was conducted to investigate the effects of asymptomatic malaria on haematological parameters among children in Khana Local Government Area of Rivers State Nigeria. It involved a population of 152 apparently healthy children. Giemsa stained, thick blood films were prepared and then examined microscopically for malaria parasitaemia. The entire prevalence of malaria infection in the studied population was 40.8%. The mean values obtained were Twbc 6.943±1.764 (ul); Hb 10.99±1.168 (g/dl); HCT34.85±3.248 (%); PLT 253.6±92.17 (/ml), for male children with subclinical malaria while Twbc 6.441±1.713 (ul); Hb 11.19±0.9446 (g/dl); HCT35.41±2.920 (%); and PLT 221.0±55.55 (ul) were the values obtained for male children without subclinical malaria respectively. The mean values obtained for female children with subclinical malaria were Twbc7.275±2.171(ul); Hb 11.27±1.276 (g/dl), HCT 35.55±3.606 (%); PLT 226.5±123.1 (ul) while the twbc 6.574±1.911 (ul); Hb 11.24±0.9586 (g/dl); HCT 35.39±2.929 (%); PLT 211.2±68.99 (ul) were the mean values obtained for female without subclinical malaria. A comparison of the difference in mean ± SD using student T- test showed no significant difference ($P>0.05$) for Twbc, Hb, and HCT but significant difference ($P<0.05$) was observed in PLT. In conclusion, diagnosis of malaria and some haematological parameters should be determine together in health institutions and the crucial gaps in the knowledge of subclinical malaria should be the focus of future research towards the growth of much efficient malaria safeguard specific goal.

Keywords: Malaria, haematological, Plasmodium falciparium, thrombocytes, leucocytosis and haematocrit.

Introduction

Malaria is a cosmopolitan disease mostly in developing countries like Africa and Asia. The term malaria can be traced to the Italian word, meaning bad air and the disease was termed ague or mesh fever due to its association with swamps in humid

regions of the world (Cheesbrough, 2000). According to (Joy *et al*., 2003) malaria is an ancient disease that has plagued humans throughout history. One of the world's major infectious diseases is malaria and it is a chaos in economic development. One-half of the world's populations are at risk of the infection, about 250 million people develop clinical infections yearly, which children below five years are mostly affected. The disease is caused by one of the five species of the protozoan; *plasmodium*. Malaria is the leading cause of most of the morbidity and mortality in Nigeria (WHO, 2014). The majority of anti-plasmodial drugs are now severely compromised due to acquired resistance by the parasite, and the development of efficacious vaccines remains a challenge (Agnandji *et al.,* 2012).

It is estimated that 203/1000 children under the age of five years die yearly due to complications of malaria infection (Noland et al., 2014)). Recent world malaria report indicates that Nigeria accounts for a quarter of all malaria cases in the 45 malaria endemic countries in Africa. Nigeria also accounted for 32 percent of the global estimate of 655,000 malaria deaths in 2010 children under the age of five. Furthermore, some other studies has shown that pregnant women are more vulnerable to morbidity and mortality due to malaria infection in Nigeria (WHO,2012 and (http//www.Healthynewbornnetwork.org). Malaria transmission is higher in rural areas than urban settlements in Africa (Hay *et al*., 2005 and Omumbo *et al*., 2005).

In Nigeria, cases of inadequate treatment of malaria is quite large among the rural area, this is because of the high level of self-medication, many of the people use native herbs and plants as their main sources of medicines instead of complementary sources. Though some of these herbs may be efficient, others are not and the implication is that the haematologic parameters could be affected. It therefore becomes absolutely necessary that malaria infection be giving proper attention to ensure proper treatment and eradication. Certain improved environmental factors such as lower vector density, higher human population density, better drainage systems, better quality housing and relative ease of assessing healthcare facilities in urban areas are responsible for the observed lower prevalence of malaria in urban settings (Hay *et al*., 2005 and Lindsay., 1990). It could be said that these variables are virtually not in existence in most rural communities in Nigeria, and this was a motivating factor for carrying out this survey in Khana local government area of Rivers State, Nigeria. Moreover, there has been paucity of information on subclinical malaria among children in Rivers State, Nigeria. Malaria is widely detected by clinical diagnosis. Clinical malaria is known to be sensitive measures of malaria infection but they lack specificity and positive predictive values especially in areas where malaria is less prevalent (Maina *et al.,* 2010) and it may be difficult to distinguish the clinical features of the disease from other viral or bacterial infections (Lathia and Joshi,2004).

Although typically microscopic slide examination of peripheral blood is time-consuming and requires clinical technical expertise, it remains the most widely used test and it is the gold standard for detecting malaria infection (WHO, 2014). Alterations in haematological parameters are majorly influenced by the disease condition as an endemic disease, affecting human health with various clinical presentations. These changes are some of the most frequent complications of malaria and major cell types are affected such as leucocytes and thrombocytes (Bakhubaira, 2013). Those infected with malaria often have significantly reduced platelets, leuco-

cytes; haemoglobin and haematocrit level (Erhart *et al.,* 2004). This study is aimed at investigating the effects of subclinical malaria on haematological parameters among children in Khana Local Government Area of Rivers State, Nigeria.

Materials and Methods

Study area

The study was a community based cross sectional survey carried out at the Community Primary School 1 Sogho and Community Primary School Lueku, both in Khana Local Government Area of Rivers State, Nigeria.

Study population

A total of 152 apparently healthy children between the ages of 5-12 years were recruited into this study.

Ethical considerations

Clearance was obtained from the head masters of community primary school 1 Akporo, Sogho and community primary school 11 Lueku for their pupils to be used for this survey. Blood sample were collected from only the children who showed cooperation. In order to save time and avoid needle injuries, adhoc staffs that were health works from the Bori health centre were approached and employed to facilitate the collection of the blood samples.

Inclusion criteria

Apparently healthy children who were between the ages of 5-12 years, who showed no sign of sign of fever based on their body temperature, were selected. We ensure that they showed cooperation before collecting their blood samples to avoid needle injuries.

Exclusion criteria

The children excluded from this research were those below 5years and above 12 years of age. Those who did not cooperate during blood collection were also excluded.

Study design

On arrival at the Schools, brief health talk was given to the pupils and their teachers on the prevention of malaria. Afterwards, the distribution of some malaria kits was done .This served as an encourager for the pupils to submit themselves for the blood sample collection.

Sample collection

Blood sample was collected from each child from a prominent vein by venipuncture using 2ml syringe. The sample was immediately transferred into Tri-potassium ethylene di-amine tetra-acetic acid (K3EDTA) anticoagulant bottle and properly mixed to avoid clotting. The collected blood samples were taken to the Laboratory and analyzed within 1 to 2 h of collection. Thick and thin films were smeared on clean dry slides. The slide were air dried, stained with Geimsa stain packed in the rack for ma-

laria parasites examination and identification. The number of parasites was counted against 200 leucocytes and quantification of parasite density was estimated by assuming 8,000 leucocytes/µl blood. Samples were considered negative when no parasite was detected after examining 100 microscopic fields (Mbuh *et al.,* 2003).

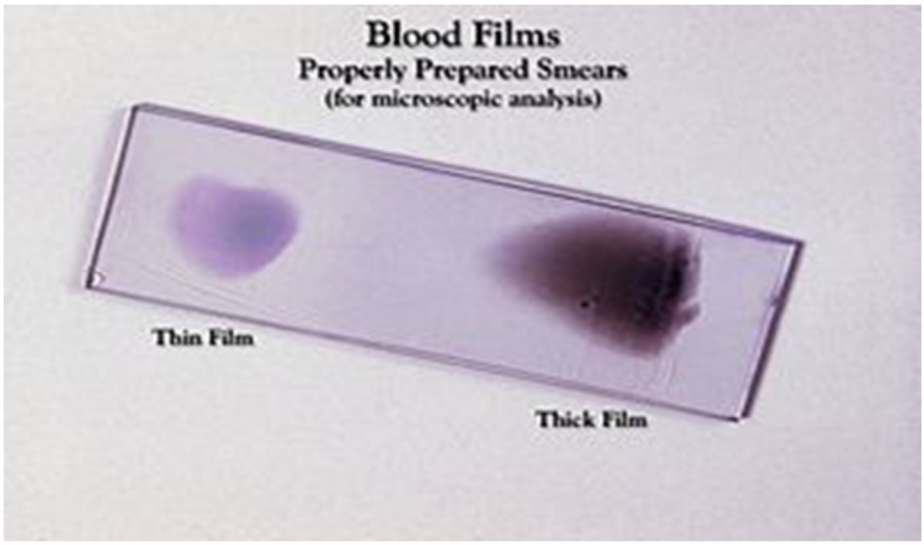

Figure 1: Thick and thin blood films.

Determination of haematological parameters

The Sysmex Kx-21 was used for the determination of haematological parameters (White blood cell count, Haemoglobin, haematocrit and platelets. This method is based the movement of blood samples through a thin tube (probe) where the blood cells passes by one at a time. Using the electrical impedance or Lasers in the equipment, the characters of the different cells are measured. At the end of the analysis the buzor gave a beep sound and the screen display the result for each parameter.

Normal ranges

TWBC – Total white blood cells (5.3-11.5 X 103/uL)
Hb – Haemoglobin (10.5 - 13.3 g/dl)
HCT – Haematocrit (31.7 – 39.6%)
PLT – Platelets (150,000-450,000/mL)

Statistical Analysis

Data of the subjects were entered into a computer and analyzed using SPSS (statistical program for social sciences) version 21. Data are presented as mean and standard deviation. Also, the student t-test was used to compare mean of parameters between the groups with malaria and groups without malaria. The variations between the groups were considered significant at $p<0.05$.

Results

A total of 152 children comprising of 74 (48.68%) males and 78 (51.31%) females were examined in this study. Sixty two (62) children were positive for malaria which represents a prevalence of 40.8% (table 1). This prevalence rate is categorized into mild malaria (+ parasitaemia =36.84%), moderate malaria (++ parasitaemia = 3.28%) and severe malaria (+++ parasitaemia = 0.65%) (table 2). This is also shown in fig. 2.

The haematocrit (HCT) of the male children who were positive for malaria were lower than those who were negative. Total white blood cell count mean values were higher in malaria positive male children than in the malaria negative males. Values of haemoglobin in the negative male children are slightly higher though these differences were not significant ($p > 0.05$) (table 3).

The mean values of total white blood cell count of the malaria positive female children were higher than in the negative ones. Also, the values of haematocrit were higher in the malaria positive female children than in the negative ones although these differences were also not significant ($p > 0.05$) (table 4). However, in both the male and female children, there observed significant difference ($p<0.05$) in the mean of platelets.

Table 5 represents the mean ±SD of the effect of subclinical malaria on the haematological parameters in the study population that falls below and within normal range and their percentages.

Table 1: Prevalence of malaria among school children

Subjects	**Total number of children**	**Percentage (%)**
No of children with malaria	62	40.8
No of children without malaria	90	59.2
Total number of children	152	100

Table 2: Categories of prevalence of malaria amongst the school children

Categories of malaria	No. of positive malaria cases	Percentage of positive malaria cases (%)
Mild (+)	56	36.84
Moderate (++)	5	3.28
Severe (+++)	1	0.65
Total	62	40.8%

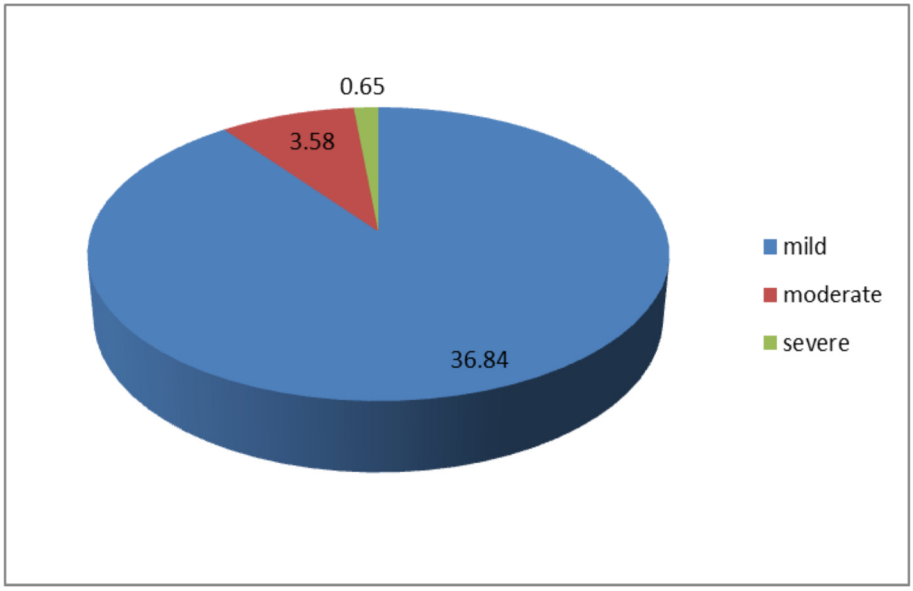

Fig. 2: Percentage categorization of the prevalence of malaria amongst the school children

Table 3: Mean ± SD of haematological parameters of male children with and without subclinical malaria

Haematological Parameters	Males With Subclinical Malaria	Males Without Subclinical Malaria	P Value	Remark
TWBC	6.94±1.76	6.44±1.713	0.231	NS
Hb	10.99±1.17	11.19±0.945	0.614	NS
HCT	34.85±3.25	35.41±2.92	0.539	NS
PLT	253.6±92.17	221.0±55.55	0.0252	***

NS = no significant difference ($p<0.05$)
*** = significant difference ($p>0.05$)

Table 4: Mean ± SD of haematological parameters of female children with and without subclinical malaria

Haematological Parameters	females With Subclinical Malaria	females Without Subclinical Malaria	P Value	Remark
TWBC	7.275±2.171	6.574±1.911	0.1360	NS
Hb	11.27±1.276	11.24±0.9586	0.9139	NS
HCT	35.55±3.606	35.39±2.929	0.8344	NS
PLT	226.5±123.1	211.2±68.99	0.0483	***

NS = no significant difference ($p>0.05$)
*** = Significant difference ($p<0.05$)

Table 5: Effect of subclinical malaria on haematological parameters

Parameters	**Mean Below Normal Range**	**Mean Within Normal Range**		
	Male	Female	Males	Females
TWBC	4.38±0.409 (19.23%)	4.38±0.614 (15.6%)	7.61±1.51 (80.77%)	7.811±1.911 (84%)
Hb	9.240±1.29 (20%)	9.57±0.706 (18.8%)	11.52±0.674 (80%)	11.66±1.031 (81.25%)
HCT	27.70±3.51 (11.5%)	30.13±0.15 (12.5%)	35.98±2.030 (88%)	36.32±3.154 (88%)
PLT	113.0±00 (3.8%)	128.7±4.62 (9.4%)	278.3±76.76 (96%)	272.8±82.27 (90.63%)

Discussion

The study showed that the overall prevalence of *Plasmodium* parasite was 40.8% (n=62). In a related study by Awupeju and Yaguo-Ide (2017), in Port Harcourt, a prevalence rate of 70.84% was obtained. The findings in our study is, therefore, lower and at variance with the results of this study and other related findings (Nankabirwa *et al*., 2013; Olasehinde *et al*., 2010). Although the overall prevalence

in this study is relatively lower than previous results, yet it can be said that the prevalence is still high because malaria is a disease with high death rates especially in children as often reported in the rural areas. Moreover these relatively lower results could also be associated to the fact that the subjects were those who showed no symptoms of malaria before their blood samples were collected. Malaria infection is gotten wherever there are human hosts carrying the parasites and sufficient *Anopheles* mosquitoes in combination with conditions of humidity and temperature that favor the growth of parasites in the mosquitoes.

There was no observation of sex difference in the malaria infection pattern in this study. Thus, the findings in this study is in agreement with the report of Mbanugo and Ejim (2000) who reported that sex did not affect the prevalence of malaria. Developing immunity either (innate or adaptive) has significant outcome on the transmission of the morbidity by decreasing the amount of parasitaemia after infective bites which causes an increment of ten (10) folds in the amount of clearance of parasitaemia (Ademowo, 1995).

Analysis of prevalence of malaria parasite in this study shows that many of the infected children had mild malaria infection (90%). This indicates that malaria occurrence among children in the studied population was asymptomatic. However, this observation is not in agreement with the findings of Awopeju and Yaguo-Ide (2017), who worked within the same environment. Alterations in haematological parameters have been connected with malaria infection and it has been reported to include leukocytes, haemoglobin, haematocrit and thrombocytes (Layla *et al*., 2002; Maina *et al.,* 2010; Imoru *et al.*, 2013). In this study, variations in haematological parameters such as total white cells, haemoglobin and haematocrit was not observed except in platelet counts in both male and female children. Therefore, there was no significant difference ($p>0.05$) in the levels of haematological parameters (WBC, Hb and HCT) between the children with subclinical malaria and those without subclinical malaria in both male and female.

Conclusion

The prevalence of malaria in this study shows that the fight against malaria in Nigeria has gradually gone a long way, even into the rural communities**.** The presence of sub-malaria was established in the study population, although its impact on the haematological parameters was not significant. However, as a result of the devastating effect of malaria, the diagnosis of malaria and some haematological parameters should be determined together in health care institutions and the gaps in the knowledge of subclinical malaria should be included in future malaria research geared towards effective and efficient malaria control and management.

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