



Gender Based Variations of Haematological Parameters of Patients with Asymptomatic Malaria in Akure, Ondo State, Nigeria

**Emmanuel Ifeanyi Obeagu^{1*}, Ayomiposi Ibiroinke Busari²,
Getrude Uzoma Obeagu³, Chukwuma J. Okafor⁴, Pat Uzo Okpala⁵,
Chikaodili Nwando Obi-Ezeani⁶, O. M. T. B. Ochiabuto⁷,
Amaechi Chukwudi Ofodile⁷, Vivian Chinenye Ezeor⁷
and Linda Nnenna Ogbonna⁸**

¹Department of Medical Laboratory Science, Imo State University, Owerri, Nigeria.

²Department of Medical Laboratory Science, Achievers University, Owo, Ondo State, Nigeria.

³Department of Nursing Science, Ebonyi State University, Abakaliki, Nigeria.

⁴Department of Pathology and Biochemistry, State University of Zanzibar, Tanzania.

⁵Department of Nursing Science, Evangel University, Akaeze, Ebonyi State, Nigeria.

⁶Department of Chemical Pathology, Chukwuemeka Odumegwu Ojukwu University, Awka Campus, Anambra State, Nigeria.

⁷Department of Medical Laboratory Science, Nnamdi Azikiwe University, Nnewi Campus, Nnewi, Anambra State, Nigeria.

⁸Department of Haematology, Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Authors EIO and AIB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GUO, CJO, PUO and CNOE managed the analyses of the study. Authors OMTBO, ACO, VCE and LNO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The study was done to evaluate the variations of haematological parameters of patients with asymptomatic malaria based on gender. The study is a cross-sectional study among asymptomatic malaria patients and patients who are apparently healthy individuals. The subjects were selected

*Corresponding author: E-mail: emmanuelobeagu@yahoo.com;

using a well-structured questionnaire who were age and sex matched. This study was conducted on asymptomatic malaria patients and apparently healthy individuals in the Oda Road area of Akure, Ondo State. Two hundred (200) asymptomatic malaria patients, 100 subjects each for males and females were recruited for this study. 5ml of venous blood was collected from each participant into an EDTA bottle which was then used for the determination of full blood count and Malaria. The results showed increase in PCV ($p=0.000$), RBC ($p=0.000$), Hb ($p=0.000$) and no significant difference in WBC ($p=0.180$), LYM ($p=0.841$), GRAN ($p=0.986$), MID ($p=0.395$), MCV ($p=0.111$), MCH ($p=0.191$), MCHC ($p=0.791$), Plt ($p=0.959$) when compared between male and female respectively. The study showed increase in packed cell volume, haemoglobin and red blood cells of male compared to females of asymptomatic malaria patients. There were no variations in other haematological parameters studied. The changes in the red cell line may be associated to bone marrow activity difference in the patients and effects of hormonal difference on the males and females.

Keywords: Gender; haematological parameters; asymptomatic malaria.

1. INTRODUCTION

Malaria is a life-threatening infectious disease of widespread burden. Globally, in 2017, 219 million people were stricken with malaria, which was an increase of 2 million cases as compared to the previous year; of these, approximately 435,000 died due to related complications [1]. Malaria remains a leading communicable disease in the developing countries of the world. It occurs mostly in the tropical and subtropical regions and accounts for considerable morbidity and death. It causes the death of more than one million in Africa every year, and is responsible for fifteen percent (15%) of clinical illnesses in the tropical regions of the continent [2]. Malaria is widespread in tropical and subtropical regions because of the significant amounts of rainfall and consistent high temperatures and high humidity, along with stagnant waters which provide mosquitoes the environment needed for continuous breeding [3,4,5].

It has been documented that asymptomatic malaria parasitaemia (ASMP) serves as reservoir for malaria due to gametocyte transmission [6] and represents, perhaps, one step in the heterogeneous set of the disease pathways [6]. Asymptomatic malaria is prevalent in highly endemic areas of Africa, with only a small percentage of individuals exhibiting clinical symptoms [7]. The clinical consequence of asymptomatic malaria is not fully understood. Some researchers are of the view that asymptomatic parasitaemia is involved in the development of partial immunity and may protect against clinical disease from new infections [7]. The asymptomatic parasitaemics are healthy carriers of malaria parasites and serve as reservoir of infection. The symptomatic people

can be treated during their clinical manifestation but the asymptomatics remain unnoticed posing public health danger to the population as long as there is high mosquito vector density to transmit the parasites [8]. So-called "asymptomatic" malaria infections have been recognized for many years, and result from partial immunity (sometimes referred to as premonition, which controls but does not completely eliminate the infection. Although there is no standard definition for "asymptomatic" malaria infections, it is generally accepted to be malarial parasitaemia of any density, in the absence of fever or other acute symptoms, in individuals who have not received recent antimalarial treatment [9]. At any given time, the vast majority of individuals with detectable malaria parasitemia can be categorized as asymptomatic based on this definition, regardless of the level of malaria transmission (Ingrid et al. 2016). This definition includes early detection of rising parasitaemia that has yet to reach the pyrogenic threshold (i.e., the density of parasitized erythrocytes that is sufficient to trigger innate immune responses and fever) [10], infections that are intermittently symptomatic but not severe enough to cause the person to seek health care, and long-standing infections imperfectly controlled by the immune response.

Changes in haematological parameters are likely to be influenced by any disease condition which affects the haemopoetic physiology at any level [11,12,13]. This is likely to happen with an endemic disease such as malaria that affects the host homeostasis at various fronts resulting in a myriad of clinical presentation. Typically, microscopic slide examination of peripheral blood remains the most widely used test and is the gold standard for detecting malaria infection [14].

However, it requires technical expertise and is time-consuming in smear examinations. Moreover, the World Health Organization (WHO) recommends the use of antimalarial drugs based on a definitive demonstration of parasites in the peripheral blood film [15].

Haematological changes are some of the most common complications in malaria and they play a major role in malaria pathology. These changes involve the major cell lines such as red blood cells, leucocytes and thrombocytes [16]. The haematologic picture, however, varies from person to person and largely depends on nutritional status (parameters are severely depleted in malnourished as compared to well-nourished children), intensity of malaria transmission, age, and co-morbidities, such as helminthiasis [17]. Also, Malaria infected patients tend to have significantly lower platelets, WBCs, lymphocytes, eosinophils, RBCs and Hb level, while monocyte and neutrophil counts were significantly higher in comparison to non-malaria infected patients [18]. The most common complication during malaria infection is thrombocytopenia. The most significantly altered parameters are haemoglobin and packed cell volume [19]. To foster the knowledge of haematological parameters, the study was aimed at evaluating the variations of haematological parameters of patients with asymptomatic malaria based on gender in Akure, Ondo State, Nigeria.

2. MATERIALS AND METHODS

2.1 Research Design

The study is a cross-sectional study among asymptomatic malaria patients and patients who are apparently healthy individuals. The subjects were selected using a well-structured questionnaire who were age and sex matched.

2.2 Study Area

This study was conducted on asymptomatic malaria patients and apparently healthy individuals in the Oda Road area of Akure, Ondo State.

2.3 Target Population

Two hundred (200) asymptomatic malaria patients, 100 subjects each for males and females and 100 subjects apparently healthy

individuals as the control were recruited for this study.

2.4 Blood Collection

5ml of venous blood was collected from each participant into an Ethylene Diamine Tetra-acetic Acid (EDTA) bottle which was then used for the determination of full blood count and Malaria.

2.5 Methods of the Test

Screening for Malaria parasite was carried out using Rapid Diagnostic Test. A pink line at the positive and control band indicated a positive reaction whereas only one pink line at the control band indicated negative reaction. No pink line at both positive and negative control bands indicates an invalid result. Thick and thin blood films from each blood specimen were made, allowed to air-dry and stained in 10% Giemsa stain solution for 30 min. The stained smears were rinsed in buffer solution and allowed to air-dry. The stained thick films were examined under bright field light microscope for estimation of malaria parasite density while the thin films were examined for species of Plasmodium.

$$\text{Malaria Parasite Density} = (\text{Number of parasite} / \text{Number of White blood cell (200)}) \times 8000$$

Full Blood Count (FBC): Measurement of haemoglobin, red blood, cells, white blood cells and platelets count were done by using ADVIA® 2120i Haematology system (SIEMENS). The cell count was cross-checked by experienced Medical Laboratory Scientist on duty.

2.6 Methods of Data Analysis

The data were presented in tables and as mean \pm standard deviation and analyzed using student-test for parametric data and chi-square for non parametric data by statistical packages for social sciences (SPSS, Version 20.0) and level of significance set at as $p \leq 0.05$.

3. RESULTS AND DISCUSSION

The Table 1 showed significant difference in PCV ($38.80 \pm 4.89\%$, $31.84 \pm 4.86\%$, $p=0.000$) RBC ($4.70 \pm 0.84 \times 10^{12}/L$, $3.80 \pm 0.64 \times 10^{12}/L$, $p=0.000$), HGB (12.97 ± 1.55 g/dL, 10.59 ± 1.63 g/dL, $p=0.000$), PDW (7.64 ± 1.51 fL, 8.54 ± 1.37 fL, $p=0.033$) and no significant difference in WBC

Table 1. Mean \pm standard deviation of haematological parameters of asymptomatic malaria patient based on gender

| Parameters | Male | Female | t-value | P –value |
|--------------------|--------------------|--------------------|---------|----------|
| PCV(%) | 38.80 \pm 4.89 | 31.84 \pm 4.86 | 5.042 | 0.000* |
| WBC(10^9 /L) | 8.91 \pm 4.40 | 11.16 \pm 7.03 | -0.201 | 0.180 |
| LYM(%) | 26.92 \pm 14.91 | 27.85 \pm 17.41 | 0.018 | 0.841 |
| GRAN(%) | 66.24 \pm 16.55 | 66.15 \pm 20.56 | -0.859 | 0.986 |
| MID(%) | 4.86 \pm 4.77 | 6.39 \pm 7.50 | -1.173 | 0.395 |
| RBC(10^{12} /L) | 4.70 \pm 0.84 | 3.80 \pm 0.64 | 5.283 | 0.000* |
| Hb(g/dl) | 12.97 \pm 1.55 | 10.59 \pm 1.63 | 5.108 | 0.000* |
| MCV(fL) | 79.66 \pm 8.40 | 83.35 \pm 7.67 | -1.328 | 0.111 |
| MCH(Pg) | 26.66 \pm 2.89 | 27.71 \pm 2.68 | 0.266 | 0.191 |
| MCHC(g/dL) | 33.42 \pm 1.12 | 33.33 \pm 1.20 | -1.377 | 0.791 |
| PLT(10^9 /L) | 170.75 \pm 54.48 | 171.58 \pm 57.44 | 0.817 | 0.959 |

(8.91 \pm 4.40 $\times 10^9$ /L, 11.16 \pm 7.03 $\times 10^9$ /L, p=0.180), LYM (26.92 \pm 14.91%, 27.85 \pm 17.41%, p=0.841), GRAN (66.24 \pm 16.55%, 66.15 \pm 20.56%, p=0.986), MID (4.86 \pm 4.77%, 6.39 \pm 7.50%, p=0.395), MCV (79.66 \pm 8.40 fL, 83.35 \pm 7.67 fL, p=0.111), MCH (26.66 \pm 2.89Pg, 27.71 \pm 2.68 Pg, p=0.191), MCHC (33.42 \pm 1.12 g/dL, 33.33 \pm 1.20 g/dL, p=0.791), PLT(170.75 \pm 54.48 $\times 10^9$ /L, 171.58 \pm 57.44 $\times 10^9$ /L, p=0.959) when compared between male and female respectively.

The study showed increase that was statistically significant in packed cell volume, red blood cell and haemoglobin and no changes in other haematological parameters studied of males compared to the females. The increase of these red blood cells, packed cell volume and haemoglobin could be due to hormonal effects and menstrual loss of blood in females. It could also be related to the malaria having a suppressing effect on the bone marrow. Malaria is associated with anaemia in the patients resulting from dyserythropoiesis and ineffective erythropoiesis but may be more pronounced in females due to these variations observed in this study [20,13]. These mechanisms could be responsible for the decrease in the haemoglobin level observed among the seemingly healthy parasitaemic subjects. A report suggested that persistent asymptomatic malarial infections significantly increase the risk of becoming anaemic [20]. The physicians taking care of the male and females with asymptomatic malaria should take note of these variations in the red cell lines. The red cell indices did not show any variations and the white cell lines.

The changes in the red cell line may be associated to bone marrow activity difference in

the patients and effects of hormonal difference on the males and females.

4. CONCLUSION

The study showed increase in packed cell volume, haemoglobin and red blood cells of male compared to females of asymptomatic malaria patients. There were no variations in other haematological parameters studied. The changes in the red cell line may be associated to bone marrow activity difference in the patients and effects of hormonal difference in the males and females.

CONSENT

Informed consent was obtained from the subjects who participated in the study. The purpose of the study was explained to all participants. Participation in the study was entirely voluntary. Anonymity and confidentiality was ensured and maintained.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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