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The Levels Of Blood Glucose And Hemoglobin Among Malaria Infected Students In Nnamdi Azikiwe University, Nnewi, Anambra State, Southeast Nigeria

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Abstract: This study was designed to investigate the levels of blood glucose and hemoglobin among malaria infected students in Nnamdi Azikiwe University, Nnewi, Anambra State, Southeast Nigeria. A total of 100 participants (75 malaria infected and 25 control subjects) aged between 18 and 30 years were randomly recruited for the study. Thereafter, 5mls of blood sample each was collected from the subjects and dispensed in unit quantity into fluoride oxalate and EDTA bottles respectively for the determination of malaria parasites, hemoglobin (Hb) and fasting blood glucose levels respectively using standard laboratory methods. The results revealed no significant difference in the mean fasting blood glucose level ($p>0.05$), but there was a significant decrease in the mean hemoglobin level in malaria infected students than in control ($p=0.000$) respectively. Also, there was no significant difference in the mean values of fasting blood glucose level obtained between students with heavy malaria infection and those with moderate malaria parasitemia ($p>0.05$), while the mean hemoglobin level observed in the students with heavy malaria parasitemia was significantly lower compared with students with moderate malaria parasitemia ($p=0.000$). The implication of this finding is that malaria infection depletes the hemoglobin level in infected persons, thus predisposing them to the risk of anaemia.

Keywords: Malaria infection, Fasting blood glucose, Hemoglobin, students, moderate and heavy malaria parasitemia.

INTRODUCTION

Malaria remains one of the most critical public health concerns in the world, causing high rate of morbidity and mortality worldwide. Malaria is a mosquito borne disease in humans and animals [1]. It is caused by parasitic protozoans of the genus plasmodium and transmitted through the bite of an infected female anopheles mosquitoes including *Anopheles funestus, Anopheles moucheti, Anopheles gambiae* and *Anopheles arabiensis* [2, 3]. Five common plasmodium species are known to infect humans including *Plasmodium falciparium, Plasmodium vivax, Plasmodium ovale, Plasmodium knowlesi*, and *Plasmodium malariae;* with *P. falciparium* being the most dangerous species among them. Malaria infection is characterized by the following symptoms: fever, rigors, chills, profuse sweating, headache and vomiting [4]. These symptoms may be attributed to the waste and toxins which are liberated from the destruction of the red blood cell by plasmodium [4]. Of the plasmodium species infecting man, *P. falciparium* is responsible for the vast majority of severe disease and significant morbidity. *P. vivax* has also been increasingly recognized as causing potentially severe clinical disease [5], including renal and respiratory syndromes as well as severe anemia and variations of cerebral malaria [6]. Also, recently, *P. knowlesi* has been shown to cause severe clinical disease including syndromes of anemia, respiratory and renal impairment [7]. However, the relative mortality and prevalence of severe disease in vivax and knowlesi is less than falciparium [8]. Severe disease is commonly manifested as cerebral malaria, anemia and metabolic disturbance; with additional complications such as renal and hepatic dysfunction frequent in adults [9].

According to the World Health Organization, in 2016, there were approximately 216 million cases of malaria resulting in 445, 000 deaths globally [10]; with 90% of malaria cases and 91% of malaria deaths occurring in African countries [10].

In Nigeria, malaria is a major public health problem where it accounts for more cases and deaths than any other country in the world. Malaria is a risk for

about 97% of Nigeria's population [11] and affects over 60% of the Nigeria's population annually [12]. The prevalence of malaria infection has been widely reported in various parts of Nigeria ranging from 35.7% - 80.5% [13-21]. Also, some previous studies have reported significant reductions in hemoglobin levels of patients with malaria parasitemia [22, 23], and this has significant negative implications on the health of the Nigerian population in which malaria parasitemia is endemic. Therefore, this study investigated the levels of blood glucose and hemoglobin among malaria infected students in Nnamdi Azikiwe University, Nnewi, Anambra State, Southeast Nigeria.

MATERIALS AND METHODS

Research Design and Sample Collection

This is an experimental study designed to assess the blood glucose and hemoglobin levels among malaria infected students in Nnamdi Azikiwe University, Nnewi, Anambra State, Southeast Nigeria. A total of 100 participants (75 malaria infected and 25 control subjects) aged between 18 and 30 years were randomly recruited for the study. Thereafter, 5mls of blood sample each was collected from the subjects and dispensed in unit quantity into fluoride oxalate and EDTA bottles respectively for the determination of malaria parasites, hemoglobin level, and blood glucose levels respectively.

Inclusion and exclusion criteria

Apparently healthy male and female students aged between 18 and 30 years were recruited for the study while those who were younger 18 years or older than 30 years and who were sick and on anti-malaria drugs were excluded from the study.

Diagnosis of Malaria

Thick and thin films were prepared and stained with Giemsa stain for parasite identification and quantification using standard methods as described by WHO [24], assuming a leukocyte count of $8000\mu L^{-1}$. Films were examined microscopically for the presence of malaria parasites within red blood cells in thin films whereas, the ring forms, trophozoites and gametocytes were noted for in thick films. A smear was considered negative for malaria parasites if no parasites are seen after examining at least 100 microscopic fields.

Estimation of fasting blood glucose level

Fast blood glucose estimation was done using oxidase method as described by Tietz *et al*., [25].

Determination of hemoglobin level

Hemoglobin level was determined using Mythic 22 automated hematology analyzer.

Ethical Consideration

This was sought and obtained from Faculty of Health Sciences and Technology Ethical Committee, Nnewi. Informed consent was obtained from participants prior the commencement of the study.

Statistical analysis

Data obtained were tabulated and analyzed using SPSS version 20.0 (SPSS Inc. Chicago, IL, USA). Student's t-test was employed in comparing means and results expressed as Mean±SD. $P<0.05$ was considered statistically significant.

RESULTS

The mean age (years) of students with malaria parasitemia (20.52±1.91) was not significantly different compared with control (19.96±1.94), ($p>0.05$). Also, the mean fasting blood glucose level (mmol/l) did not differ significantly between malaria infected students and control ($p=0.663$). However, there was a significant decrease in the mean hemoglobin level (g/dl) of malaria infected students than in control ($p=0.000$); (See table-1).

Table-1: Comparisons of Mean (±SD) Age, Fasting blood glucose and Hemoglobin levels in malaria positive and malaria negative students

Variable	Age (years)	Fast blood glucose (mmol/l)	Hemoglobin (g/dl)
Malaria positive (n=75)	20.52±1.91	3.78±0.70	10.92±0.81
Malaria negative (n=25)	19.96±1.94	3.86±0.76	11.86±0.43
t-value	0.132	0.254	12.755
p-value	0.214	0.663	0.000*

*Statistically significant at $p<0.05$.

The mean age of students with heavy malaria parasitemia was not significantly different than in those with moderate malaria parasitemia ($p>0.05$). Also, there was no significant difference in the mean values of fasting blood glucose level obtained between students with heavy malaria infection and those with moderate malaria parasitemia ($p>0.05$). However, the mean hemoglobin level observed in the students with heavy malaria parasitemia was significantly lower compared with students with moderate malaria parasitemia ($p=0.000$), (See table-2).

Table-2: Comparisons of Mean (±SD) in Moderate and Heavy Malaria Parasitemia

Variable	Age (years)	Fast blood glucose (mmol/l)	Hemoglobin (g/dl)
Moderate Malaria Parasitemia (n=50)	20.52±1.85	3.89±0.68	11.06±0.65
Heavy Malaria Parasitemia (n=25)	20.58±2.91	3.76±1.19	10.20±1.81
t-value	0.426	10.021	19.247
p-value	0.910	0.588	0.000*

*Statistically significant at p<0.05.

DISCUSSION

The present study revealed no significant difference in the mean fasting blood glucose level of malaria infected students when compared with control. This may suggest that malaria parasitemia has no effect on the blood glucose level in the subjects studied. This finding is in contrast with the reports of some previous similar studies [26, 27].

In this study, the result showed a significant decrease in the mean hemoglobin level in malaria infected students than in control. This implies that malaria parasitemia has a negative effect on the hemoglobin level and induces a reduction in hemoglobin concentration which results in anemia in the subjects. Our finding is in consonance with the reports of previous similar studies [28, 29, 27, 30, 31].

Furthermore, there was no significant difference in the mean values of fasting blood glucose level observed between students with heavy malaria parasitemia and those with moderate malaria infection. However, the mean hemoglobin observed in the students with heavy malaria parasitemia was significantly lower compared with students having moderate malaria infection. This indicates that with increasing level of malaraia parasitemia, there is a corresponding reduction in the hemoglobin concentration, so that individuals having heavy malaria parasitemia suffer more severe anaemia than those with moderate malaria infection. This finding agrees with the report of Kotepui *et al*., [22].

CONCLUSION

The present study revealed no significant difference in the mean fasting blood glucose level; with a significant reduction in the mean hemoglobin concentration in malaria infected students than in control which implies that malaria infection induces anemia in infected subjects. Also, no significant difference was observed in the mean values of fasting blood glucose level between students with heavy malaria parasitemia and those with moderate malaria infection but the mean hemoglobin concentration observed in the students with heavy malaria parasitemia was significantly lower compared with students having moderate malaria infection suggesting more severe anemic outcomes in subjects with heavy malaria parasitemia.

REFERENCES

1. Ukaegbu, C. O., Nnachi, A. U., Mawak, J. D., Igwe, C. C. (2014). Incidence of Concurrent Malaria and Typhoid Fever Infections in Febrile Pa-tients in Jos, Plateau State Nigeria. *International Journal of Scientific and Technology Research;* 3(4): 157-161.
2. Kar, N. P., Kumar, A., Singh, O. P., Carlton, J. M., & Nanda, N. (2014). A review of malaria transmission dynamics in forest ecosystems. *Parasite Vectors;* 7:265.
3. WHO. (2015).World Malaria Report. Geneva: World Health Organisation.
4. CDC. (2010). Malaria disease. Available from: http://www.cdc.gov/malaria/about/disease.html
5. Anstey, N., Douglas, N. M., Poespoprodjo, J. R., & Price, R. N. (2012). *Plasmodium vivax*: clinical spectrum, risk factors and pathogenesis. *Advances in Parasitology*; 80:151-201.
6. Storm, J., & Craig, A. G. (2014). Pathogenesis of cerebral malaria--inflammation and cytoadherence. *Frontiers in Cellular and Infection Microbiology*; 4:100.
7. Cox-Singh, J., Culleton, R. (2015). *Plasmodium knowlesi*: from severe zoonosis to animal model. *Trends in Parasitology*; 31(6):232-238.
8. Barber, B. E., William, T., Grigg, M. J., Menon, J., Auburn, S., Marfurt, J., Anstey, N. M., Yeo, T., & W. (2013). A prospective comparative study of knowlesi, falciparum and vivax malaria in Sabah, Malaysia: high proportion with severe disease from *Plasmodium knowelsi* and *Plasmodium vivax* but no mortality with early referral and artesunate therapy. *Clinical Infectious Diseases*; 56(3):383-397.
9. WHO. (2014). Severe malaria. *Tropical Medicine and International Health;* 19(1):7-131.
10. WHO. (2016). Malaria Fact Sheet. Retrieved 15th October, 2018.
11. Nigeria Malaria Fact Sheet. (2011). United States Embassy in Nigeria. Retrieved 15th October, 2018.
12. Ekwebene, O. (2012). Malaria: Prevalence and control infants and pregnant women: Nigeria.
13. Oyeyi, T. I., Hamidu, M. R., & Dakata, M. A. (2009). Slide positivity rate of malaria among patients attending two hospitals in Kano Metropolis. *Bayero Journal of Pure and Applied Sciences*; 2:194–196.
14. Olasehinde, G. I., Ajayi, A. A., Taiwo, S. O., Adekeye, B. T., & Adeyeba, O. A. (2010). Prevalence and management of falciparium malaria

among infants and children in Ota, Ogun State, Southwestern Nigeria. *African Journal of Clinical and Experimental Microbiology*; 11: 159-163.

15. Okolie, V. E., Obiechina, N. J., Okechukwu, Z. C., Oguejiofor, C. F., Okor, L., Onyegbule, A. O., Udegbunam, O. I., Nwajiaku, L. S. A., Ogbuokiri, C., & Egeonu, R. (2014). Prevalence and Risk Factors for Placental Malaria in Nnewi, South East Nigeria. *International Journal of Tropical Disease and Health;* 4(3): 374-383.
16. Ukibe, S. N., Ikeako, L. C., Mbanugo, J. I., Obi-Okaro, A. C., Eneanya, C. I., & Ukibe, N. R. (2014). Prevalence of low birth weight (LBW) babies in malaria pregnant women attending antenatal clinics in hospitals in Anambra State, south eastern Nigeria. *Health Science Research*; 1(1): 8-11.
17. Umaru, M. L., & Uyaiabasi, G. N. (2015). Prevalence of Malaria in Patients Attending the General Hospital Makarfi, Makarfi Kaduna – State, North-Western Nigeria. *American Journal of Infectious Diseases and Microbiology*; 3(1): 1-5.
18. Olasehinde, G. I., Ojurongbe, D. O., Akinjogunla, O. J., Egwari, L. O., & Adeyeba, A. O. (2015). Prevalence of Malaria and Predisposing Factors to Antimalarial Drug Resistance in Southwestern Nigeria. *Research Journal of Parasitology;* 10 (3): 92-101.
19. Onyiri, N. (2015). Estimating malaria burden in Nigeria: a geostatistical modelling approach. *Geospatial Health*; 10:306.
20. Dawaki, S., Al‐Mekhlafi, H. M., Ithoi, I., Ibrahim, J., Atroosh, W. M., Abdulsalam, A. M., Sady, H., Elyana, F. N., Adamu, A. U., Yelwa, S. I., Ahmed, A., Al‐Areeqi, M. A., Subramaniam, L. R., Nasr, N. A., & Lau, Y. (2016). Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. *Malaria Journal;* 15:351.
21. Okonkwo, V. O., & Okaka, C. E. (2017). Epidemiology of Placental Malaria in Nnewi North L.G.A Anambra South-Eastern Nigeria. *International Journal of Scientific Engineering and Applied Science*; 3(4):104-113.
22. Kotepui, M., Piwkham, D., PhunPhuech, B., Phiwklam, N., Chupeerach, C., & Duangmano, S. (2015). Effects of Malaria Parasite Density on Blood Cell Parameters. *PLoS ONE*; 10(3): e0121057.
23. Jamal, M., Hameed, A., & Imtiaz, F. (2015). Burden of Anemia in Malarial Parasite Infection. *Journal of Infectious Diseases and Therapy*; 3: 228.
24. World Health Organisation. (1995). Methods of counting malaria parasites in thick blood films. Bench Aids for the Diagnostic of malaria; 1-8.
25. Tietz, N. W., Pruden, E. L., & Siggaad-Anderson, O. (1994). In: Tietz Textbook of Clinical Chemistry. W.B Saunders Company London, 1354-1374.
26. Onyesom, I., & Agho, J. E. (2011). Changes in serum glucose and triacylglycerol levels induced by the co-administration of two different types of antimalarial drugs among some Plasmodium falciparum malarial patients in Edo–Delta region of Nigeria. *Asian J Sci Res*, *4*, 78-83.
27. Akaninwor, J. O., Essien, E. B., Chikezie, P. C., & Okpara, R. T. (2013). Haematologic and Biochemical Indices of *Plasmodium falciparum* Infected Inhabitants of Owerri, Imo State, Nigeria. *Journal of Biological and Chemical Research*; 30(2): 682-694.
28. Maina, R. N., Walsh, D., Gaddy, C., Hongo, G., Waitumbi, J., Otieno, L., Jones, D., & Ogutu, B. R. (2010). Impact of *Plasmodium falciparum* infection on haematological parameters in children living in Western Kenya. *Malaria Journal;* 9:S4.
29. Igbeneghu, C., & Odaibo, A. B. (2012). Plasmodium Species among the Inhabitants of Iwo Community, Southwestern Nigeria. *American-Eurasian Journal of Scientific Research*; 7 (3):118-122.
30. Kotepui, M., Phunphuech, B., Phiwklam, N., Chupeerach, C., & Duangmano, S. (2014). Effect of malarial infection on haematological parameters in population near Thailand-Myanmar border. *Malaria journal*, *13*(1), 218.
31. Singh, G., Urhekar, A. D., Maheshwari, U., & Sharma, S. (2014). Effects of malarial parasitic infections on human blood cells. *International Journal of Current Microbiology and Applied Sciences;* 3(12):622-632.