

---

### ABSTRACT

The study assessed the prevalence of malaria in HIV/AIDS patients attending HIV clinic at Ishaka Adventist Hospital, the study objectives were to determine the proportion of HIV patients with malaria, to identify the clinical manifestations of malaria among HIV positive patients and to review different techniques used in diagnosis of malaria at Ishaka Adventist Hospital in Bushenyi district. A descriptive cross sectional study was used for known HIV positive patients attending Ishaka Adventist Hospital and involved systematic random sampling of participants. The study found out that malaria prevalence was high among HIV patients at 9.8%, nearly all patients who were diagnosed with malaria reported having had fever previously 87.1%, the presentation of malaria can better be assessed as uncomplicated malaria and complicated malaria and in this study majority of the signs assessed were of uncomplicated malaria, diagnostic measures of laboratory remain the most perfect way of diagnosing malaria other than clinical assessment especially in HIV patients who are immunocompromised and can be ill of various opportunistic infection. Although various methods have been advanced to curb malaria epidemic, the prevalence is still high, so the following are recommendation; the government should distribute more mosquito nets especially those who are immunocompromised like HIV patients, agencies for fighting malaria and those of HIV should work together in order to reduce the number of HIV patients getting malaria infection, patients should be health educated on the main signs and symptoms of malaria such that they can quickly seek medical attention in case of the need, patients should be encouraged to take their ARVs to maintain their immunity relatively high so that they are not severely affected by malaria.

**Keywords:** Ishaka, Adventist Hospital, Malaria, Immunocompromised, Infection.

---

### INTRODUCTION

Two of the greatest challenges facing Africa today are human immunodeficiency virus (HIV) infection and malaria, yet the interaction between these two infections has been scantily studied [1, 2, 3, 4, 5, 6,7]. An interaction between HIV infection and malaria could work in either direction, i.e. HIV infection might reduce immunity to clinical malaria resulting in more frequent infection among the semi-immune and non-immune, or malaria might enhance the progression of HIV infection to clinical AIDS [1,2,3,4,8,9,10,11]. Sub-Saharan Africa has >70% of the over 42 million persons infected with HIV/AIDS worldwide and it is now the leading cause of death in the region. Nigeria, the most populous country in Africa, has over four million persons living with HIV/AIDS and a national

seroprevalence of 5.8% at the end of 2001 Akinsete [5], with the north-central region harboring the highest HIV infection levels in the country [6,12,13,14]. Various reports stated that malaria is a powerful stimulator of the immune system and the subjects exposed frequently to malaria have enhanced serum levels of immunoglobulin and an accelerated rate of IgG turnover [7, 8,15,16,17]. Other authors like Whittle and Brown [9] also reported that malaria infection might have an adverse effect on HIV infection both by stimulating T-cell turnover and by impairing T-cell cytotoxic function. Malaria parasitaemia differs in instances of asymptomatic and clinical malaria, and the degree of parasitaemia may influence the pathological and biochemical

presentations of individuals presenting with either of these conditions [7, 10,11,12,13,14].

Reports have shown that in clinical cases of malaria, anemia is a prominent factor [18,19,20,21,22,23,24], which is possibly caused by destruction of infected blood cells by the reticulo-endothelial system and hemolysis of infected cells [25,26,27,28,29,30,31,32,33,34].

#### **Statement of Problem**

Human immunodeficiency disease (HIV) and malaria infections often coexist in patients in many parts of the world due to geographic overlap of these two diseases. This is particularly true in sub-Saharan Africa, where an estimated 40 million people are living with HIV and more than 350 million episodes of malaria occur yearly [18]. There is also evidence of a negative interaction between these two infections. HIV increases the risk of malaria infection. There are five malarial species that infect humans. Presently, most data on HIV interaction with malaria are derived from *P. falciparum* endemic regions of sub-Saharan Africa. However, as HIV spreads to areas endemic for *Plasmodium vivax*, similar important interactions may be identified. Immunity to malaria is characterized by an age-related reduction in parasite burden, clinical symptoms, and prevalence of severe disease in individuals residing in an endemic area [19]. *Plasmodium falciparum* infection and the burden of parasitaemia are often less severe in older adults than in children. Children are at increased risk since they have not yet acquired natural immunity; pregnant women transiently lose some of their acquired immunity due to the relative immunosuppression of pregnancy [20, 21]. The degree of immunity is also related to transmission intensity, which varies geographically. HIV-related immune suppression diminishes this acquired Immunity [22]. These two infections interact bidirectional and synergistically with each other. HIV infection can increase the risk and severity of malaria infection and the increased parasite burdens might facilitate higher rates of malaria transmission. Individuals

in malaria-endemic areas that are considered semi-immune to malaria can also develop clinical malaria if they are infected with HIV. Also malaria infection is associated with strong CD4+ cell activation and up-regulation of proinflammatory cytokines, providing an ideal microenvironment for the spread of the virus among CD4 + cells and thus for rapid HIV-1 replication [23-27].

#### **Aim of the Study**

To determine the prevalence of malaria among HIV patients attending Ishaka Adventist Hospital in Bushenyi district.

#### **Specific Objectives of the Study**

- ❖ To determine the proportion of HIV patients with malaria attending Ishaka Adventist Hospital.
- ❖ To identify the clinical manifestations of malaria among HIV positive patients attending HIV clinic at Ishaka Adventist Hospital.
- ❖ To review different techniques used in diagnosis of malaria at Ishaka Adventist Hospital.

#### **Research questions**

- What is the proportion of HIV patients with malaria attending Ishaka Adventist Hospital?
- What are the clinical manifestations of malaria among HIV positive patients attending HIV clinic at Ishaka Adventist Hospital?
- What are the different techniques used in diagnosis of malaria at Ishaka Adventist Hospital?

#### **Justification of Study**

HIV/AIDS is a major public health problem in Uganda. The overall national HIV Sero-prevalence is 6.4 % in adults according to the national sero-survey and a study in Mulago hospital in 2004 found a sero-prevalence of 6.8% among patients attending the outpatient clinic, although different comparative studies between HIV and malaria co infection have been done, little literature has been availed in Ishaka Bushenyi Municipality and so the study to determine the prevalence of malaria among HIV patients attending Ishaka Adventist Hospital can bridge this gap.

## METHODOLOGY

### Area of Study

The study was carried in Ishaka Adventist Hospital located in Ishaka municipality Igara County, Bushenyi district in south western Uganda, Ankole sub-region. It is approximately 62Km by road west of Mbarara the largest city in the sub-region along Kasese-Mbarara road. The 2014 Uganda Bureau of Statistics showed that the total population of the town is 41063 people (UNBS 2014).

Bushenyi District lies between 00° N and 00° 46' S of the equator and 290° 41' East and 300° 30' East of Greenwich. Its headquarters are located 340kms from Kampala in the South Western part of Uganda. It neighbors the districts of Rubirizi in the North, Buhweju and Sheema in the North East, Sheema in the East, Mitooma in the South West and Sheema in the South. The district has a land area of 3'949 square kilometers and lying between 910 - 2,500 meters above sea level and the main physical features within the district include natural tropical forests of Karinzu and Imaramagambo covering an area of 784 square kilo meters.

### Study Design

A descriptive cross sectional study was used for known HIV sero positive patients attending medical Ishaka Adventist Hospital and will involve systematic random sampling of participants. A cross sectional study was selected because one of the objectives of the study was to determine the proportion of patients with malaria among HIV sero positive patients attending Ishaka Adventist Hospital.

### Sample Size Determination

The sample size was determined using Fishers et al. [28] formula. The formula was used to estimate the smallest possible categorical sample size for the population for the patients attending medical wards at IAH, Bushenyi district.

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where d = margin of error.

n= minimum sample size.

z=standard normal deviation set at 95% confidential level corresponding to 1.96.

p= expected prevalence (proportion).

Therefore taking

$$p = 18\% = 0.18$$

$$z = 1.96$$

$$1-p = 0.5$$

$$d = 5\% = 0.05$$

$$\text{Thus } n = \frac{(1.96)^2 \times 0.18 \times (1-0.18)}{(0.05)^2}$$

$$n = 194$$

Therefore, the sample size will be 194.

### Study population

The study was done among known HIV seropositive patients attending Ishaka Adventist Hospital Bushenyi district.

### The sampling method

The study was carried out among patients who were attending IAH and a total of 59 were considered where all those who came within the time of the study were considered for an interview and caretakers or any elder participating in the study were considered to provide relevant information on behalf of the patients. And using random sampling method the participants in the study were chosen.

### Inclusion criteria

The study included HIV patients that accepted to give consent, patients attending Ishaka Adventist Hospital.

### Exclusion criteria

Patients that did not give consent for the interview were excluded from the study, patients who were too sick to participate.

### Data collection method

A semi-structured questionnaire was designed to collect data on selected variables. Two research assistants were then trained on the questionnaire and assisted in piloting and subsequent collection of the main data. The variables of interest included age, sex, education, occupation, marital status, income among others. Also any history of fever, headache, and chills, joint were obtained.

### Laboratory investigation.

After the questioner the patients were then be sent to the hospital laboratory for investigations where a blood smear for malaria parasites or An RDT strip used was

used to diagnosis malaria. After that the laboratory results were entered into a corresponding data correction sheet for the patient.

**Data Analysis Method**

The data collected from the study was computed using Microsoft excel. The analysis was made in line with the study objectives so as to achieve the purpose of the study and was presented inform of tables, pie-charts, bar-graph, and

narratives depending on the data analyzed.

**Data quality control**

To ensure quality control, the researcher prior to the exercise conducted one day training for three research assistance who there-after will be set for field testing of the study tools. A total of six questionnaires will be distributed for the pre-test. The research assistants will be supervised closely by the principle invigilator himself.

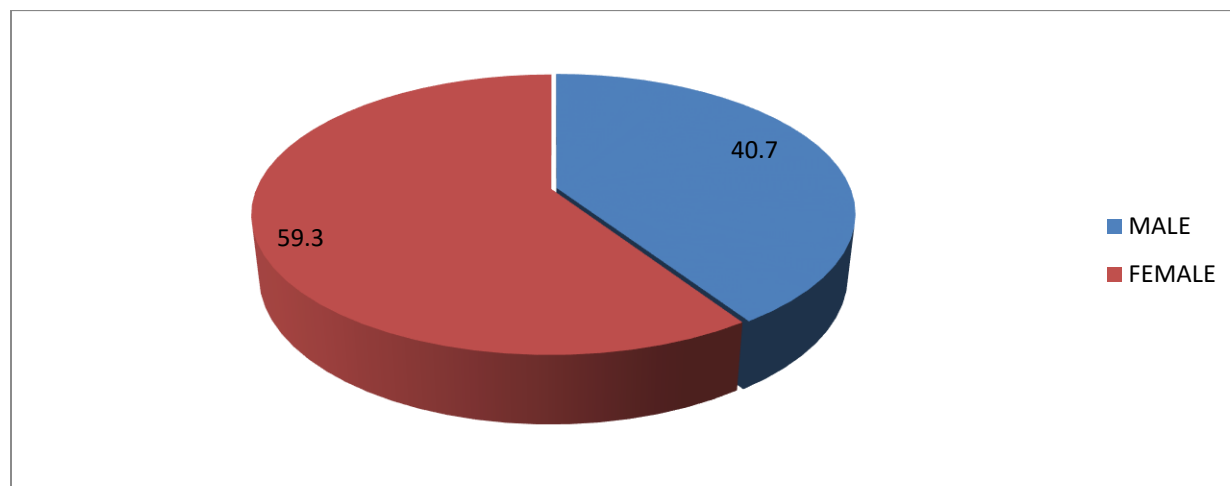
**RESULTS**

**Table 1: Socio and Demographic Factors, Age distribution n= 194**

Age( years)	Frequency	Percentage
<25	23	11.9
25-34	51	26.3
35-54	90	46.4
>54	30	15.5
<b>Total</b>	<b>194</b>	<b>100</b>

Majority of the respondents 90 (46.4%) were in the age bracket of 35-54, followed by those in 25- 34 years who were 52

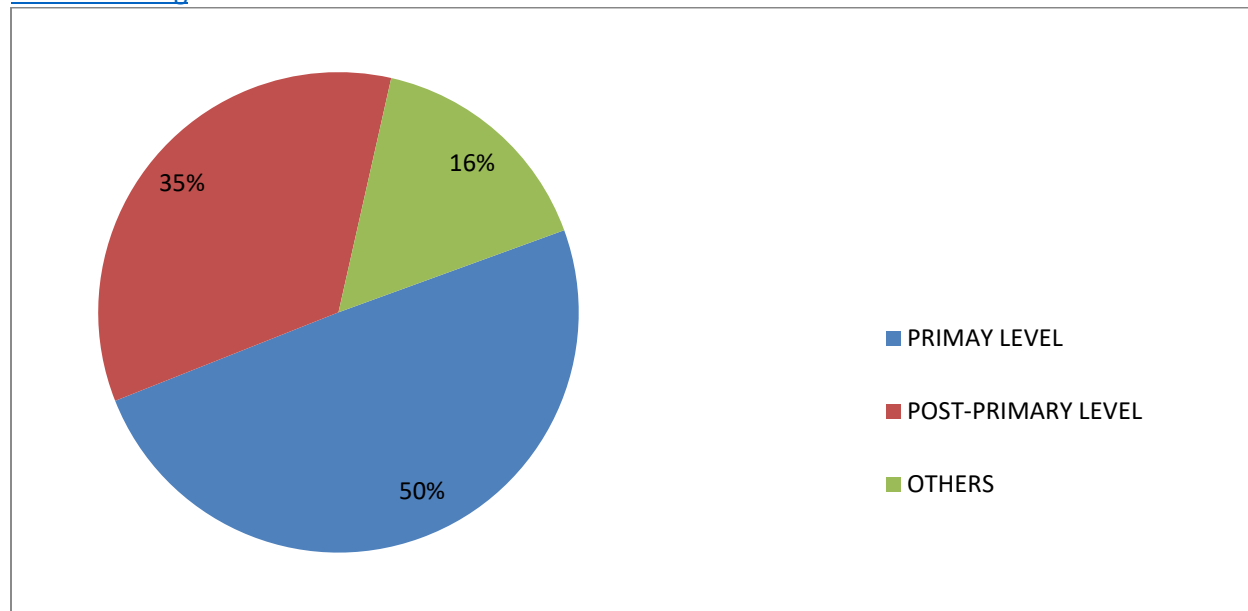
(26.3%), 30 (15.5%) were above 54 years and 23 (11.9%) were below 25 years.



**Figure 1: Gender of respondents.**

Majority of the respondents 115 (59.3%) that were interviewed were females where

as 79 (40.7%) of the respondents were males .



**Figure 2:Level of Education of these respondents.**

The majority of the respondents stopped at primary level 96,(49.5%) commonly between P.5 and P.7, 67 (34.5%) had studied beyond primary level including

those who reached secondary school and tertiary institutions,31 ( 15.9%) had other levels of education among them were those who had never attended school.

**Table 2: Occupation of the respondents, n= 194**

Occupation	Frequency	Percentage(%)
Unemployed	13	6.7
Peasant farmer	93	47.9
Business man/woman	33	17.0
Student	18	9.3
Others	37	19.1
<b>Total</b>	<b>194</b>	<b>100</b>

Most of the patients, 93 (47.9%) were peasant farmers, 33 (17.0%) were business men and women, 37 (19.1%) were doing

other forms of occupation, 18 (9.3%) were students and only 13 (6.7%) were unempolyed.

**Table 3: Marital status of respondents, n =194**

Marital status	Frequency	Percentage(%)
Single	67	34.5
Married	102	52.6
Others	25	12.9
<b>Total</b>	<b>194</b>	<b>100</b>

Majority of the respondents, 102 (52.6%) were married followed by those who were single, 67 (34.5%) and finally, 25 (12.9%)

who were belonging to other status such as those that had separated and widowed.

**Table 4: Tribe of respondents ( n= 194)**

Variable(Tribe)	frequency	Percentage(%)
Munyankole	113	58.2
Mukiga	43	22.2
Others	38	19.6
<b>Total</b>	<b>194</b>	<b>100</b>

The majority of the patients who were interviewed were Banyankole 113 (58.2%), 43 ( 22.2%) were Bakiga, and 38 (19.6%)

were belonging to other ethnicity such as the Batoorro, Baganda and Bakonzo.

**Prevalance Of Malaria**

**Table 5: To show the prevalence of malaria in the study patients.**

Investigation	Results		
	Postive	Negative	Percenatge(%)
Blood smear for malaria parasites	19	175	9.8%
Rapid diagnostic test	12	182	6.1%
<b>Total</b>	<b>31</b>	<b>357</b>	<b>15.9%</b>

The prevalence/frequence of malaria is shown in table .Out of 194 patients enrolled in the study, a total of 19 were diagnosed with malaria using blood smear for malaria parasites 5 cases higher than those of rapid diagnostic test who were

only twelve. An overall prevalence of malaria among a total 194 HIV seropositive patients was 9.8% was observed from the study participants during the study period. From these majority were diagnosed using microscopy technique.

**Clinical Manifestations Of Malaria**  
**Table 6: Clinical manifestation of malaria among HIV patients.**

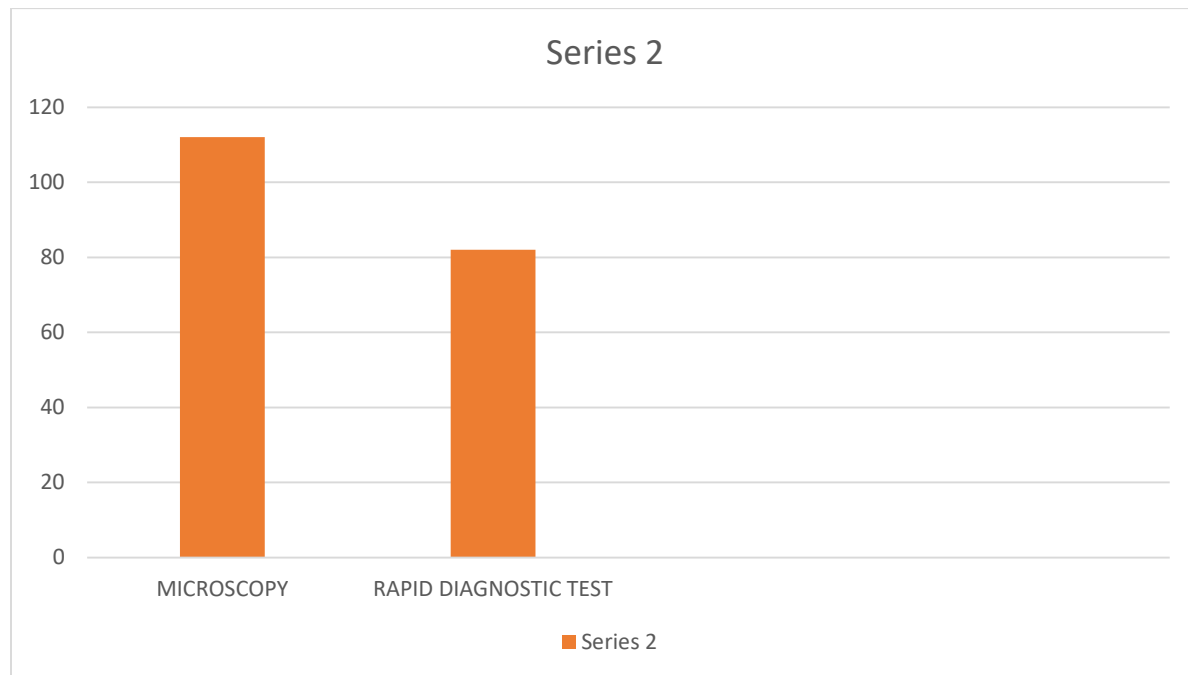
Clinical manifestation	Patient's response	Frequence	Percentage(%)
Fever	Yes	24	87.1
	No	7	12.9
Headache	Yes	23	74.2
	No	8	25.8
Joint pain	Yes	16	51.6
	No	15	48.4
General malaise	Yes	11	35.5
	No	20	64.5
Vomiting and diarrhea	Yes	9	29
	No	22	71
Back pain	Yes	13	41.9
	No	18	58.1
Reduced appetite	Yes	24	77.4
	No	7	22.6

From the study conducted out of the 31 patients who had been diagnosed with malaria, 24 (87.1%) reported to have had Fever before while 7 (12.9%) said they had not experienced any Fevers, also 23(74.2%) of the patients reported having experienced Headache prior to coming to the hospital, 8(25.8%) of the patients diagnosed acknowledged not to have had Headache prior to their coming to the hospital. Also to note is that from the study 16(51.6%) of the patients reported to have experienced Joint pains before coming to the hospital while 15(48.4%) reported not to have experienced any Joint pains even prior to coming to the hospital. More so from the table above of results, 20(64.5%) of the patients reported to have

had general body weakness as compared to 11 (35.5%) who reported not to have experienced any general weaknesses. Also to note is that 9(29%) of the patients diagnosed with malaria reported to have experienced some Vomiting and diarrhea before coming to the hospital as compared to the 22(71%) never experienced any vomiting or diarrhea. On the other hand 13(41.9%) of the patients reported to have had Back pains while 18(58.1) said they had not experienced anything to do with Back pain. Lastly out of the 31 patients diagnosed of malaria, 24(77.4%) reported to have experienced Reduced appetite while 7(22.6%) said they never experienced any reduced appetite.

**Diagnostic Techniques For Malaria**

**Fig 3: Identification of techniques used in diagnosis of malaria at Ishaka Adventist Hospital.**



From the bar graph above, of the HIV seropositive patients that were diagnosed with malaria, majority of them 112 (57.7%) were diagnosed using the laboratory

technique of microscopy which involves a blood smear for malaria parasites. Whereas 82 (42.3%) were diagnosed using a strip of an RDT test.

**DISCUSSION**

**The prevalence/frequence of malaria is shown in table**

On the prevalence of malaria, Out of 194 patients enrolled in the study, a total of 31 were diagnosed with malaria using both blood smear for malaria parasites and rapid daignostic test. An overall prevalence of malaria among a total 194 HIV seropositive patients was 9.8 was observed from the study participants during the study period using a blood smear microscopy. From these majority were diagnosed using micrscopy technique. Microscopy was used as a better option because it could help also to identify the species most common in causing malaria. The 15.9 prevalence is comparngly also high as compared to the related studies of Muller and Moser [29] who had projected their prevalence in uganda at 18% in 2010.

**Clinical presentation of malaria among HIV patients**

From the study conducted out of the 19 (9.8%) patients who had been diagnosed with malaria using a blood smear microscopy tecnnique, 24 (87.1%) reported to have had Fever before while 7 (12.9%) said they had not experienced any Fevers, also 23(74.2%) of the patients reported o have experinced Headache prior to coming to the hospital, 8(25.8%) of the patients diagnosed acknoveledged not to have had Headache prior to yheir coming totha hospital. A bigger percentage presenting with fever indicates that fever is a cardinal sign of malaria and is very significant in its clinical assessment. In related studies, Van Geerttruyden in 2009 [30] cited that presence of fever in malaria patients who are HIV sero positive is usually aggreaviated by co infection with other infections. Also to note is that from the study 16(51.6%) of the patients reported to



have experienced Joint pains before coming to the hospital while 15(48.4%) reported not to have experienced any Joint pains even prior to coming to the hospital. More so from the table above of results, 20(64.5%) of the patients reported to have had General body weakness as compared to 11 (35.5%) who reported not to have experienced any general weaknesses. This can be attributed to the fact that many red blood cells are destroyed and so less oxygen is transported to the tissues to produce enough body energy to run daily activities. Also to note is that 9(29%) of the patients diagnosed with malaria reported to have experienced some Vomiting and diarrhea before coming to the hospital as compared to the 22(71%) never experienced any vomiting or diarrhea. According to Gatchel [31], he identified a normal malaria as involving joint pains, nausea, vomiting among others. On the other hand 13(41.9%) of the patients reported to have had Back pains while 18(58.1) said they had not

Malaria prevalence was high among HIV patients so an urgent intervention should be sought. Nearly all patients who were diagnosed with malaria reported having had fever previously and so fever remains a cardinal sign in identifying patients with malaria. The presentation of malaria can better be assessed as uncomplicated malaria and complicated malaria and in this study majority of the signs assessed were of uncomplicated malaria. Diagnostic measures of laboratory remain the most perfect way of diagnosing malaria other than clinical assessment especially in HIV patients who are immunocompromised and can be ill of various opportunistic infection. However in some instances a patient who took antimalarials prior to coming to the hospital may not give proper results and therefore a patient with clinical manifestation of malaria ruling other infection of malaria like presentation should be initiated on antimalarials. Malaria can have life threatening complications which may present with reduced consciousness such as cerebral malaria and in such incidences a quick intervention is needed.

experienced anything to do with Back pain. Lastly out of the 31 patients diagnosed of malaria, 24(77.4%) reported to have experienced Reduced appetite while 7(22.6%) said they never experienced any Reduced appetite. These were already cited in previous studies by Muller O et al in 2010 as being the clinical manifestations of uncomplicated malaria.

#### **Review of diagnostic techniques in malaria diagnosis**

From the study on malaria diagnosis of the HIV seropositive patients that were diagnosed with malaria, majority of them 112 (57.7%) were diagnosed using the laboratory technique of microscopy which involves a blood smear for malaria parasites. Whereas 82 (42.3%) were diagnosed using a strip of an RDT test. Although Rapid Diagnostic Test is faster, microscopy is better because it can also identify which species of plasmodium species is commonest and this would help in management.

#### **CONCLUSION**

The government should distribute more mosquito nets especially those who are immunocompromised like HIV patients. Agencies for fighting malaria and those of HIV should work together in order to reduce the number of HIV patients getting malaria infection. Patients should be health educated on the main signs and symptoms of malaria such that they can easily and quickly seek medical attention in case there is need. Patients should be encouraged to take their ARVs to maintain their immunity relatively high so that they are not severely affected by malaria. The public should be health educated to reduce the breeding areas for mosquitoes that spread malaria like draining away stagnant water and slashing any bushes around their homes. HIV patients should be encouraged to quickly seek health services any time they are ill because a delay would lead to faster progression of these diseases malaria inclusive. Patients should be requested not to take any antimalarials prior to coming to the hospital because this can lead to false laboratory findings.

## REFERENCES

1. Obeagu, E. I., Okwuanaso, C. B., Edoho, S. H., & Obeagu, G. U. (2022). Under-nutrition among HIV-exposed Uninfected Children: A Review of African Perspective. *Madonna University Journal of Medicine and Health Sciences ISSN: 2814-3035*, 2(3), 120-127.
2. Akunueze, E. U., Ifeanyi, O. E., Onyemobi, E. C., Johnson, N., & Uzoanya, E. A. U. (2018). Antioxidants in the Management of Human ImmodeficiencyVirus Infection. *J HIV Retrovirus*, 4(2), 1-12.
3. Nwosu, D. C., Obeagu, E. I., Nkwocha, B. C., Nwanna, C. A., Nwanjo, H. U., Amadike, J. N., ... & Nwankpa, P. (2016). Change in Lipid Peroxidation Marker (MDA) and Non enzymatic Antioxidants (VIT C & E) in HIV Seropositive Children in an Urban Community of Abia State. Nigeria. *J. Bio. Innov*, 5(1), 24-30.
4. Chandramohan, D. and Greenwood, B. M. (2008). Is there an interaction between human immune deficiency virus and Plasmodium falciparum? *Internat J Epidemiol* 27: 296- 301.
5. Akinsete I. (2012). HIV/AIDS: the Nigerian and global situation analysis and response. Abuja, Nigeria: National Action Committee on AIDS (NACA). p. 120.
6. Achidi, E.A., Salimonu, L. S, Asuzu, M. C., Berzin, K. and Walker, O. (2006). Studies on Plasmodium falciparum parasitaemia and development of anemia in Nigeria infants during their first year of life. *Am J Trop Med Hyg* 55(2): 132-43.
7. Obeagu, E. I., Alum, E. U. and Obeagu, G. U. (2023). Factors Associated with Prevalence of HIV Among Youths: A Review of Africa Perspective. *Madonna University Journal of Medicine and Health Sciences*. 3 (1): 13-18.
8. Cohen, C., Karstaedt, A., Freaan, J., Thomas, J., Govender N, Prentice E, Dini L., Galpin, J, and Crewe-Brown, H.(2005). Increased prevalence of severe malaria in HIV-infected adults in South Africa. *Clin Infect Dis*.
9. Whittle, H. C., Brown, J. and Marsh, K. (2008) T-cell control of Epstein Barr virus infected B-cells is lost during P. falciparum malaria. *Nature*; 312: 449-50.
10. Muema, D. K., Ndungu, F.M, Kinyanjui, S. M and Berkley, J. A. (2011). Effect of HIV infection on the acute antibody response to malaria antigens in children: an observational study. *Malaria Journal*; 5:10-55.
11. Ekpono, E. U., Aja, P. M., Ibiam, U. A., Alum, E. U. and Ekpono, U. E. (2019). Ethanol Root-extract of *Sphenocentrum jollyanum* Restored Altered Haematological Markers in *Plasmodium berghei*-infected Mice. *Earthline Journal of Chemical Sciences*,2 (2):189203. <https://doi.org/10.34198/ejcs.2219.189-203>.
12. Obeagu, E. I., Ibeh, N. C., Nwobodo, H. A., Ochei, K. C., & Iwegbulam, C. P. (2017). Haematological indices of malaria patients coinfectd with HIV in Umuahia. *Int. J. Curr. Res. Med. Sci*, 3(5), 100-104.
13. Obeagu, E. I., Okeke, E. I., & Anonde Andrew, C. (2016). Evaluation of haemoglobin and iron profile study among persons living with HIV in Umuahia, Abia state, Nigeria. *Int. J. Curr. Res. Biol. Med*, 1(2), 1-5.
14. Obeagu, E. I., Eze, V. U., Alaebob, E. A., & Ochei, K. C. (2016). Determination of haematocrit level and iron profile study among persons living with HIV in Umuahia, Abia State, Nigeria. *J BioInnovation*, 5, 464-71.
15. Obeagu, E. I., Didia, B., Obeagu, G., & Azuonwu, O. (2017). Evaluation of changes in haematological profile of cerebral malaria patients in Enugu State, Southeast, Nigeria. *Ann Clin Lab Res*, 5(4), 202.
16. Obeagu, E. I., & Obeagu, G. U. (2015). Effect of CD4 Counts on

- Coagulation Parameters among HIV Positive Patients in Federal Medical Centre, Owerri, Nigeria. *Int. J. Curr. Res. Biosci. Plant Biol*, 2(4), 45-49.
17. Cartwright, G.E and Lee, G.R. (2011). The anemia of chronic disorder. *Br J Haematol*; 21: 147-52. 14.
  18. Gossele, O.N. Onwuliri, C.O.E and Onwuliri V.A., (2007). Malaria and effect of malaria parasitaemia on Albumin level Among HIV patients in Jos, Nigeria. *Journal of Medical Sciences*, 7: 1187-1191
  19. Egwu, C.O., Alope, C., Chukwu, J., Nwankwo, J.C., Irem, C., Nwagu, K.E., Nwite, F., Agwu, A.O., Alum, E., Offor, C.E. and Obasi, N .A. (2023) .Assessment of the Antimalarial Treatment Failure in Ebonyi State, Southeast Nigeria. *J. Xenobiot.*, 13, 16-26. <https://doi.org/10.3390/jox13010003>.
  20. Ogomaka, I. A., & Obeagu, E. I. (2019). Methods of Breast Feeding as Determinants of Malaria Infections among Babies in IMO State, Nigeria. *breast*, 2(01), 17-24.
  21. Ogah, A. O., JOC Ezeonwumelu, AG Okoruwa, CP Adiuoku, AM Ajayi, and Akib, S. (2013). Manifestations of severe malaria among the under-five children attending Kampala international university teaching hospital, Bushenyi, western Uganda: pilot study. *British Journal of Pharmacology and Toxicology*, Volume 4, Issue 4, Pages 128-135.
  22. Mouala C, Houzé S, Guiguet M. (2013). Imported malaria in HIV-infected patients enrolled in the ANRS CO4 FHDH study. *J Acquir Immune Defic Syndr* ; 49:55
  23. Odwee, A., Kasozi, K. I., Acup, C. A., Kyamanywa, P., Ssebuufu, R., Obura, R. & Bamaiyi, P. H. (2020). Malnutrition amongst HIV adult patients in selected hospitals of Bushenyi district in southwestern Uganda. *African health sciences*, 20(1), 122-131.
  24. Nkemakonam, O. C., Nkiloka, O. E., Fidelia, E. O., Ann, M. I., Uchenna, E. G., & Sophia, K., (2021). Outcome of Fixed Dose Combination of Tenofovir, Lamivudine and Dolutegravir in Rural HIV Care Facility in Nigeria. *International Journal of Health Sciences and Research* 11 (12), 1-8.
  25. Corbett EL, Steketee RW, Kuile FO, Latif AS, Kamal A, Hayes RJ (2012): HIV-1/AIDS and the control of other infectious diseases in Africa. *Lancet*, 359:2177-2187.
  26. Egwu, C. O., Alope, C., Chukwu, J., Agwu, A., Alum, E., Tsamesidis, I, Aja, P. M., Offor, C. E. and Obasi, N. A. (2022). A world free of malaria: It is time for Africa to actively champion and take leadership of elimination and eradication strategies. *Afri Health Sci.*; 22(4). 627-640. <https://dx.doi.org/10.4314/ahs.v22i4.68>.
  27. Ugwu, O. P., Nwodo, O. F., Joshua, P. E., Odo, C. E., Bawa, A., Ossai, E. C., & Adonu, C. C. (2013). Anti-malaria and hematological analyses of ethanol leaf extract of *Moringa oleifera* on malaria infected mice. *International Journal of Pharmacy and Biological Science*, 3(1), 360-371.
  28. Jung, S. H. (2014). Stratified Fisher's exact test and its sample size calculation. *Biom J.*; 56(1):129-40. doi: 10.1002/bimj.201300048. Epub 2013 Nov 11. PMID: 24395208; PMCID: PMC3884832.
  29. Muller, O. and Moser, R. (2010). The clinical and parasitological presentation of *Plasmodium falciparum* malaria in Uganda is unaffected by HIV 1 infection. *The Transactions of the Royal Society of Tropical Medicine and Hygiene*; 84 (3):336-338.
  30. Van Geertruyden, J. P., Moody, A., and Muema, D. K, (2009). The relationship of *Plasmodium falciparum* humoral immunity with HIV 1 immunosuppression and treatment efficacy in Zambia. *Malaria Journal*; 20 (8):258.
  31. Gatchel, R. J., Peng, Y. B., Peters, M.L., Fuchs, P.N. and Turk, D.C

- (2007). The biopsychosocial approach to chronic pain: scientific advances and future directions. *Psychol Bull.*133(4):581-624. doi: 10.1037/0033-2909.133.4.581. PMID: 17592957.
32. Ugwu OPC, OFC Nwodo, PE Joshua, CE Odo, EC Ossai, B Aburbakar (2013). Ameliorative effects of ethanol leaf extract of *Moringa oleifera* on the liver and kidney markers of malaria infected mice. *International Journal of Life Sciences Biotechnology and Pharma Research*,2(2): 43-52.
33. Ugwu Okechukwu P.C., Nwodo, Okwesili F.C., Joshua, Parker E., Odo, Christian E. and Ossai Nassuna Emmanuel C (2013). Effect of Ethanol Leaf Extract of *Moringa oleifera* on Lipid profile of malaria infected mice. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*,4(1): 1324-1332.
34. Enechi OC, CC Okpe, GN Ibe, KO Omeje, PC Ugwu Okechukwu (2016). Effect of *Buchholzia coriacea* methanol extract on haematological indices and liver function parameters in *Plasmodium berghei*-infected mice. *Global Veterinaria* 16 (1), 57-66.