



## Research Article

# Prevalence of Haemoparasites in Donated Blood from Selected Blood Banks within Kaduna Metropolis

B. Atahiru, P. A. Vantsawa, D. M. Dibal and \*Y. Rabe

Department of Biological Sciences, Nigerian Defence Academy Kaduna, Nigeria

\*Corresponding Authors' emails: [yusuf.rabe2020@nda.edu.ng](mailto:yusuf.rabe2020@nda.edu.ng)

## ABSTRACT

Haemoparasites are blood-dwelling parasites transmitted through transfusion of infected blood. This study aimed to determine the prevalence of haemoparasites in donated blood and assess their distribution based on sociodemographic factors. A total of 384 blood samples were collected from selected blood banks within Kaduna metropolis. Samples were collected into Ethylene Diamine Tetra Acetic Acid (EDTA) bottles, and both thin and thick smears were prepared and stained with Giemsa stain. Microscopic examination was carried out under  $\times 100$  oil immersion objective. Results showed that *Plasmodium falciparum* was the only haemoparasite detected in the samples. The overall prevalence was 27.7%. Among the locations, Tudun Wada had the highest prevalence (27.7%), while Gwamna Awam had the lowest (22.33%). Occupation-wise, farmers had the highest infection rate (77.77%), and artisans the lowest. Donors aged 18–28 years showed the highest prevalence (52.12%), while those aged 38–48 years had the lowest (28.57%). Prevalence was higher among single donors (33.33%) compared to married donors (23.98%). Educational level also influenced prevalence, with uneducated donors showing the highest (57.14%) and those with secondary education the lowest (39.09%). Rural residents recorded a higher prevalence (59.09%) than urban and semi-urban dwellers (15.66%). In conclusion, *Plasmodium falciparum* was the only haemoparasite found in donated blood within Kaduna metropolis. Molecular techniques are recommended for further detection of other possible haemoparasites such as *Trypanosoma*, *Leishmania*, and *Toxoplasma*.

**Keywords:** Blood donors; Haemoparasites; Kaduna Metropolis; Malaria; *Plasmodium*

**Citation:** Atahiru, B., Vantsawa, P.A., Dibal, D.M. & Rabe, Y. (2025). Prevalence of Haemoparasites in Donated Blood from Selected Blood Banks within Kaduna Metropolis. *Sahel Journal of Life Sciences FUDMA*, 3(1): 531-537. DOI: <https://doi.org/10.33003/sajols-2025-0301-64>

## INTRODUCTION

Haemoparasites are parasites found in the blood stream of infected people, and can be spread to other people through exposure to an infected person's blood by way of procedures such as blood transfusion with infected blood (Cheesbrough 1998). The usage of blood to patient management is potentially a lifesaving scheme that compels critical care. Subsequently, demand for blood has significantly increased over the years. In the face of several advances in the use of blood and its components in assuaging several ailments, challenges related to transfusion transmissible infections (TTIs) such as haemo parasites still stand, and transmission of haemo parasites through blood transfusion hypothetically contravenes the progress made in

infectious control in malaria endemic areas (Antwi-Baffour, 2019). These blood parasites include Malaria, African Trypanosomiasis, Babesiosis, Chagas disease, Leishmaniasis and Toxoplasmosis (Springer *et al.*, 2015). Some of these parasites spend most of their life cycle in the bloodstream, like *Babesia* and *Plasmodium* species; while others are found in the blood early in an infection like *Trypanosoma cruzi*. Their presence in blood stream depends on factors like, the duration of the parasite's life cycle is spent in the blood; parasite density, how long the parasite stays in the body of the treated and untreated people; as well as how the parasite affects people (Ike *et al.*, 2019). Blood transfusion is considered a life-saving intervention that has an essential role in patient management within health care systems. Consequently, demand for blood has greatly increased

over the years. The establishment of systems, like National Blood Transfusion Service in Nigeria, that ensure that all donated blood is screened for transfusion-transmissible infections (TTIs) is a core component of every National Blood Programme. Despite several advances in the use of blood and its components in alleviating several ailments, challenges related to transfusion transmissible infections such as haemoparasites still stand, and transmission of haemoparasites through blood transfusion potentially negates the progress made in control of tropical diseases such as malaria in endemic areas. In Nigeria, screening for parasitic infections is not routinely done in blood banks, nor stipulated in the current National Blood guidelines. This is because transmission of parasitic infections such as malaria through blood transfusion is generally not regarded as a serious problem in adult and adolescent whose level of immunity is thought to be sufficiently effective in combating post transfusion malaria in endemic area like Nigeria. The study therefore seeks to determine the prevalence of haemoparasites in donated blood from selected blood banks within Kaduna metropolis, north western Nigeria (World Health Organization (2009). This study therefore sought to establish the prevalence of haemoparasites among donor blood at selected

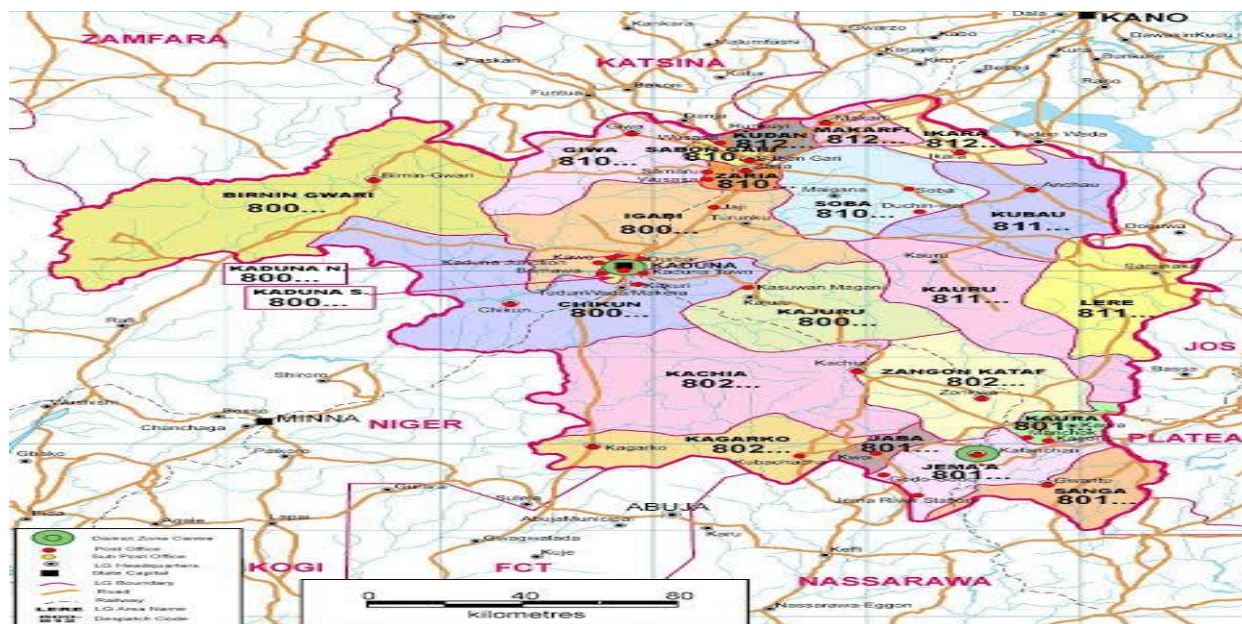
blood banks within Kaduna metropolis, north western Nigeria.

## MATERIALS AND METHODS

## Study Area

This study was conducted in Kaduna state. The state is in North-western geopolitical zone of Nigeria with a population of 6,066,562 and 23 local government areas (LGAs) which are further grouped into 3 senatorial districts (North, Central and South). It is a metropolitan as well as industrialized state with over 80 commercial and manufacturing industries. It is one of the education centers in Nigeria with many colleges and most recognized university in Nigeria.

Agriculture is the mainstay of the state with about 80% of the people actively engaged in farming. It is defined by longitude 10°20'N and Latitude 9°03'E. the vegetation characteristic is that of the guinea savanna with scattered trees and shrubs. There are two distinct seasons the wet (rainy) which last from April to October and dry season that occurs from November to March. It experiences a rainfall of 1530mm in Kafanchan/Kagoro in the South-East and 1015mm in Ikara/Makarfi districts in the North-East (Kaduna geographic information system, 2024).



**Fig. 1: Map of Kaduna Metropolis showing the study area (Kaduna Geographic Information System, 2024)**

### Selected Study Site

This study was carried out at the following study sites:

1. Yusuf Dantsoho Memorial Hospital, Tudun Wada, Kaduna
2. Gwamna Awam Hospital, Kakuri, Kaduna
3. General Hospital, Sabo Tasha, Kaduna.

## Study Design

A laboratory based cross-sectional descriptive study was carried out. The laboratory analysis was conducted at National Ear Care Centre Haematology and Blood Transfusion Laboratory Kaduna. Sample collection started from October to November, a

period of one month. Samples were collected from blood bank that was kept up to 24hrs in the blood bank.

#### **Ethical Consideration**

The Protocol for this study was approved by Kaduna State Ministry of Health and Human services department with approval number MOH/ADM/744/VOL.1/1146 and the various blood banks before commencement of the study.

#### **Sample Size**

This is determined using formula;  $N = (Z^2 p (1-p)/d^2)$ . Where; N = sample size, Z= score on normal standard variance curve that corresponds to 95% (1.96) level of confidence; d = desired level of precision (proportion of sampling error 5% i.e. of 0.05); P =estimated prevalence of haemoparasites among donor blood (Approximately 50% for unknown prevalence). Thus on substituting for: Z=1.96 (95% level of confidence) P= 0.5 (prevalence of haemoparasites) Then;  $N = (1.96^2/0.05 \times 0.5)/0.05^2 = 384.16 \times 0.25/0.0025 = 0.9604/0.0025$ , N= 384.16. N = 384 Therefore, a minimum of 384 blood will be considered for haemoparasites screening (Cochran *et al.*, 1977).

**Study Variables:** The variables were haemoparasites in blood samples.

#### **Specimen Collection**

Samples were collected from blood bags that has stayed up to 24hrs at 4°C – 6°C in the blood bank, about 2mls of blood were collected and stored in aliquot bottles. Each sample were labeled appropriately.

#### **Data Collection Methods**

##### **Laboratory Methods**

Rapid diagnostic test (CareStart™ Malaria pLDH Pf/PAN) and microscopic examination of blood samples for haemoparasites thick and thin blood films were stained using Giemsa technique and Leishman technique and examined for the presence of haemoparasites as described by (Cheesbrough, 1998). The microscopic examination result were considered as the gold standard test.

##### **Parasitological Examination**

Thick and Thin film were prepared in duplicate form each blood sample on grease-free slides, allowed to dry and stained by 3% Giemsa solution for 45min which is the Giemsa technique (Chesbrough, 1998). Stained blood films were examined under x100 objective lens of a microscope with the aid of immersion oil for the detection of the haemoparasites present. Thin films were for the species identification of parasites. Further confirmation of positive samples were undertaken.

#### **Microscopy Examination**

The microscopy technique was used for this research. Thick and thin blood smear study is the gold standard method for diagnosis of these parasites. The procedure follows these steps: collection of peripheral blood, staining of smear with Giemsa for thin blood stain and Leishman stain for thick blood stain and examination of red blood cells for the parasites under the microscope (Djimde *et al.*, 2015).

#### **Quality Control**

Standard operating procedures for Giemsa stain was followed. The stains were quality controlled using known positive and negative control slides. Wet and stained thick and thin blood preparations were double-checked by another laboratory technician.

#### **Data Processing and Analysis**

Data collected were entered and analyzed using the SPSS (software version 20.0). Microsoft office excel 2007 computer program was also used to present the results in form of tables, bar graphs and pie charts. And it was used to determine the prevalence and most prevalent haemoparasites and to calculate the proportion using 95% confidence interval.

## **RESULTS**

Table 1 shows the prevalence of haemoparasites in donated blood from banks within Kaduna metropolis, the result shows that Tudunwada recorded the highest parasites (27.70%) detected out of 148 samples tested, from the blood samples in their blood banks, with Gwana Awam having only (22.33%) positive out of 103 tested samples and Sabo with (27.07%) out of 133 samples, thus the difference is not statistically significant at  $P > 0.05$  (0.9999).

The result in Table 2 shows prevalence of haemoparasites in relation to gender, with female having 25.08% positive out of 287 samples that were examined, while male were having 28.87% out of 97 samples examined, the difference is statistically significant at  $P < 0.05$  (0.0268).

The result in Table 3, shows the prevalence of haemoparasites in relation to occupation with student having the highest number of positive samples (46.47%) out of 71 tested, followed by Artisan with (33.33 % out of 96 samples tested, Business owners with (67.44%) out of 43 samples examined, other categories of participant having (38.09%) out of 63 that were sampled and tested, farmers (21%) out of 27 samples tested, civil servant (36.17%) out of 47 and teachers having (43.24%) out of 37 sample that were examined. Thus the different

between the samples is very significant statistically at P 0.0078. (<0.005).

**Table 1: Prevalence of Haemoparasites in donated blood from blood Banks within Kaduna Metropolis in relation to parasites**

Study Facility	No. Examined	No. Positive	Prevalence %	P – Value
Tudun Wada	148	41	27.70	0.9999
Sabo	133	36	27.07	
Gwana Awam	103	23	22.33	
<b>Total</b>	<b>384</b>			

The P - Value is > 0.9999, is considered not significant

**Table 2: Prevalence of Haemoparasites in donated blood from blood Banks within Kaduna Metropolis in relation to gender**

Gender	No. Examined	No. Positive	Prevalence %	P – Value
Male	97	28	28.87	0.0268
Female	287	72	25.08	
<b>Total</b>	<b>384</b>			

The two-tailed P value of 0.0268 is considered significant

**Table 3: Prevalence of Haemoparasites in Donated Blood from Blood Banks within Kaduna Metropolis in relation to Occupation**

Occupation	No. Examined	No. Positive	Prevalence %	P – Value
Civil Servant	47	17	36.17	0.0078
Business	43	29	67.44	
Artisan	96	32	33.33	
Farmer	27	21	77.78	
Teachers	37	16	43.24	
Student	71	33	46.47	
Others	63	24	38.09	
<b>Total</b>	<b>384</b>			

The one-tailed P value of 0.0078, is considered very significant

Table 4 shows the result of the prevalence of haemoparasites in donated blood from blood banks in relation to educational status, participant with tertiary education having prevalence of 48.06% out of 129 samples, those at secondary school level with 39.09% out of 110, those with informal education has 53.94% out of 76 and 40.74% out of 27. Obtained from those with primary school level of education; the difference is statistically significant at P 0.0313 (<0.05).

Table 5 shows the prevalence of haemoparasites in relation to age groups, sample examine from participants age 18 -2 8 has the highest prevalence with 52.12% out of 188 samples, 58 - 65 has (33.33%) out of 15 samples. 23-38 having (51.68%) out of 89 samples, 38-48 has (28.57%) out of 63 samples examined. 48-58 has (34.48%) out of 29 samples

examined. Thus, the difference between age group is statistically significant at p 0.0313 (< 0.05).

Table 6 shows the prevalence of haemoparasites in donated blood in relation to marital status, with single having the highest prevalence with (33.33%) out of 117 sampled, divorced having (28.26%) out of 46 sampled, followed by married with the lowest prevalence (23.98%) out of 221 sampled. The difference between the samples is not statistically significant at P 0.999 (> 0.005).

The prevalence of haemoparasites among settlement type shows rural settlement having (50.09%) out of 44 sample, followed by urban settlement blood bank having (33.20%) with 259 sampled, and semi-urban having the lowest prevalence with (15.6%) out of 81 sampled. The P value is not significant at p 0.1250. Column with different superscript significant P<0.05

**Table 4:** Prevalence of Haemoparasites in Donated Blood from Blood Banks within Kaduna Metropolis in relation to Educational Status.

Education Status	No. Examined	No. Positive	Prevalence %	P – Value
None	42	24	57.14	0.0313
Informal	76	41	53.94	
Primary	27	11	40.74	
Secondary	110	43	39.09	
Tertiary	129	62	48.06	
<b>Total</b>	<b>384</b>			

The one-tailed P value of 0.0313 is considered significant

**Table 5:** Prevalence of Haemoparasites in Donated Blood from Blood Banks within Kaduna Metropolis in relation to Age Groups

Age Group	No. Examined	No. Positive	Prevalence %	P – Value
18 – 28	188	98	52.12	0.0313
28 - 38	89	46	51.68	
38 – 48	63	18	28.57	
48 – 58	29	10	34.48	
58 – 65	15	05	33.33	
<b>Total</b>	<b>384</b>			

The one-tailed P value of 0.0313 is considered significant

**Table 6:** Prevalence of Haemoparasites in Donated Blood from Blood Banks within Kaduna Metropolis in relation to Marital Status

Marital Status	No. Examined	No. Positive	Prevalence %	P – Value
Single	117	39	33.33	0.9999
Married	221	53	23.99	
Divorce	46	13	28.26	
<b>Total</b>	<b>384</b>			

The P value is > 0.9999 is considered not significant

**Table 7:** Prevalence of Haemoparasites in Donated Blood from Blood Banks within Kaduna Metropolis in relation to Settlement Type

Settlement	No. Examined	No. Positive	Prevalence %	P – Value
Urban	259	86	33.20	0.1250
Semi-Urban	81	32	15.60	
Rural	44	26	59.09	
<b>Total</b>	<b>384</b>			

The one-tailed P value is 0.1250, considered not significant

## DISCUSSION

The presence of only *plasmodium spp* in the blood sample of donors in the study areas could be that the method used was not sensitive enough to detect other haemoparasites in the blood or the donors are only exposed to only the malaria parasite within Tudun Wada having the highest parasites (27.7%), while Gwana Awam having the lowest parasites (22.33%). This is in line with the work of Paul *et al*, (2021) who reported a prevalence of haemoparasites among blood donors in Calabar Nigeria with Plasmodium having the highest prevalences of (38%)

and microfilaria having only (5%) while the rest have not been found. Our findings is also in line with the work of Bukar *et al*, (2017) at University of Maiduguri Teaching Hospital, who reported the prevalence of (33.9%) of Malaria being the only haemoparasite found among the subjects.

The prevalence of Plasmodium parasites was higher among donors age 58 – 65years with prevalence of (56.55%) and 38 – 48years having the least prevalence of (28.57%). The difference could be attributed to the fact that 58 – 65years are older people whose immune system has become weak and are prone to

infections associated with haemoparasites. This is in disagreement with the findings of Paul *et al*, (2021) who reported a prevalence of haemoparasite among blood donors in Calabar Nigeria in relation to age with 18 – 24 years having the highest prevalence of (52.4%) plasmodium in the blood samples examined.

The higher prevalence of Plasmodium parasites in male with (28.87%) than female (25.08%). This could be attributed to the fact that males were more exposed to malaria and other haemoparasites as they work more outside the home front. This finding is not in line with the work of Paul *et al*, (2021) who reported a prevalence of haemoparasites among females' blood donors in Calabar having highest prevalence of 50% Plasmodium parasites in the blood samples examined, while males had 37.2%.

The higher prevalence of Plasmodium parasites among farmers (77.77%) than Artisans (33.33%). could be due to the fact that farmers were more exposed to the breeding sites of mosquitoes and small vegetations in the farms during the day time while cultivating the farms and doing other farming activities. This finding is in agreement with the work of Eze *et al*, (2016) who reported that farmers had the highest prevalence rate of haemoparasites with (80.4%) compare to other types of occupation e.g. cattle rearers, house wives and artisans.

The higher prevalence of plasmodium parasites among rural dwellers (59.09%) than the semi urban areas (15.6%), could be due to the fact that those in urban areas have more access to health care and preventive measures e.g fumigation, migration, treated nets and prophylaxis drugs. This is not in line with the findings of Ali *et al*, (2023) who reported that the prevalence of haemoparasites among communities in Akwanga Local Government Area of Nasarawa state with Akwanga having the highest prevalence of (23.25%) plasmodium falciparum compared to other villages in the study area.

The higher prevalence of Plasmodium parasites among donors without formal education and informal education (57.14%) than Secondary School (39.9%) maybe due awareness about Haemoparasites and the dangers it possess among those with formal Education.

The higher prevalence of Plasmodium Parasites among the single (33.33%) than the Divorced (28.26%) maybe due to single having more outdoor activities and nocturnal activities than the divorced and married, which exposes them to more Mosquitoes bites.

## CONCLUSION

These findings revealed the presence of haemoparasites in donated blood from blood banks within Kaduna metropolis Nigeria. The most prevalent haemoparasites were malaria parasites, other haemoparasites e.g. Microfilaria, Trypanosomes, Babesia and Leishmania were not detected. It is established that plasmodium is the common haemoparasites found in donated blood from blood banks within Kaduna metropolis. The results also indicate that the incidence of haemoparasitemia is not associated with Age, gender, educational qualification and marital status. Overall finding reveals the need to screen all donated blood for haemoparasites to reduce the spread of parasites through blood and blood products transfusion and to minimize its effects on the recipients.

## RECOMMENDATION

It is recommended that more research be carried out to find out if there are presence of other haemoparasites apart from plasmodium species in the study area using Advanced Techniques.

## Conflicting interest

The author reported no conflict of interest.

## REFERENCES

- Ali, A.A., Pam, V.A., Ombugadu, A., Uzoigwe, N.C., & Uzoigwe, N.R. (2023). Haemoparasites infection in rural agrarian communities' infection in Akwanga LGA of Nasarawa State, Nigeria. *Acta Scientific Clinical Case Reports*, 4(4), 26-30.
- Antwi-Baffour S, Kyeremeh R, Amoako AP, Annison L, Tetteh Ocquaye-Mensah J, (2019). The incidence of malaria parasites in screened donor blood for transfusion. *Malar Res Treat*.
- Baer K, Klotz C, Kappe SH, et al. (2007). Release of hepatic *Plasmodium yoelii* merozoites into the pulmonary microvasculature. *PLoS Pathogens*. (11):e171.
- Barbara, J.A.J., 1998. Microbiological safety of blood transfusion. *Vox Sanguinis*, 74:113.
- Cheesbrough, M. (1998). *District Laboratory Practice in Tropical Countries*, Part 1 Cambridge University Press.
- Cochran, W.G. (1977). *Sampling Techniques* (3<sup>rd</sup> edition). New York: John Wiley & Sons
- Djimde, A. (2015). Field assessment of SD Bioline malaria species antigen detection by rapid diagnostic tests in Mali. *Malaria Journal*, 14:109.

Eze, C.N., & Amadi, E.C. (2016). Survey haemoparasitic infections among Fulani pastoralists in Rivers State. *Journal of Applied Sciences & Environmental Management*, **20**(3), 790-794.

Ike, M.E., Onuoha, E.C., Yohanna, A.J., Dakul, A.D., Dame, G.J., Hallie, E.J., Maduka, V.A., Nelson-Ebimie, N., Nden, J. N. and Dipreye, T. A. (2019). Detection of haemoparasites in 9 locations in and around Plateau State, Nigeria. *Journal of Biology, Agriculture and Healthcare*, **9**(22):1-6.

Paul, B. T., Bello, A. M., Ngari, O., Mana, H. P., Gadzama, M. A., and Abba, A. (2021). Risk Factors of

Haemoparasites and Some Haematological Parameters of Slaughtered Trade Cattle in Maiduguri, Nigeria. *Sokoto Journal of Veterinary Sciences* **19**;1:1-10.

Springer, A., Fichtel, C., Calvignac-Spencer, S., Leendertz, F. H., & Kappeler, P. M. (2015). Hemoparasites in a wild primate: Infection patterns suggest interaction of *Plasmodium* and *Babesia* in a lemur species. *International Journal for Parasitology: Parasites and Wildlife*, **4**(3), 385–395.