



STUDY ON RELATIVE ABUNDANCE OF *Plasmodium* SPECIES: A CASE OF PATIENTS ATTENDING JAHUN GENERAL HOSPITAL, JIAGAWA, NIGERIA.

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ABSTRACT

A study on relative abundance of *Plasmodium* species was conducted using blood film technique. For a 12 month period, 4037 positive blood films were examined for a particular species of *Plasmodium*. The result revealed that 3208 (79.46%) were *Plasmodium falciparum*, 157 (03.89%) were *P. ovale* and 672 (16.65%) were *P. malariae*. This showed that *P. falciparum* was the most abundant and the relative abundance of the species had heightened in July, 2008 due to rain which favours vector survival.

Keywords: abundance, plasmodium, relative, thin blood film, malaria control programmes.

INTRODUCTION

Plasmodium is carried by infected female *Anopheles* mosquito and eventually transmit it into humans through its bite. Human malaria is caused by four closely related species of *Plasmodium*. Which differ in their symptoms, virulence, pre-patient periods, immunological and epidemiological characteristics and sensitivity to drugs (Alnwick, 2000).

When an infected female *Anopheles* mosquito bites a health person it introduces parasites at the sporozoite stage into his body. These sporozoites migrates to the liver, multiply and develop into trophozoites which then invade the red blood cells. In these cells, they divide asexually forming numerous merozoites which when liberated attack many other red blood cells. *Plasmodium* undergoes sexual stage in humans and asexual stage in female *Anopheles* mosquito. Some merozoites also develop into gametocytes when it bites an infected person (Sarojini, 2007).

Four species of *Plasmodium* cause human malaria. They are *Plasmodium vivax* Grassi, 1890, *P. malariae* Laveran, 1897, *P. ovale* Stephens, 1922 and *P. falciparum* Welch, 1897 (Alnwick, 2000). *P. malariae* causes quartan malaria with a four day cycle comprising of one day fever two days of remission and another day fever (Alnwick, 2000). *P. vivax* causes benign tertan malaria but rarely encountered in comparison to the other three malarias. Its fevers are milder than those that caused by *P. vivax*. *P. falciparum* causes malignant tertian malaria, which is the most virulent, producing an acute course and often terminating fatally. It causes abortion and still birth (WHO, 2000).

Assessment of the *Plasmodium* species is crucial to the understanding of the type of infection as well as the malaria epidemiology (Crawley, 2004) for example, the type of parasite and the parasite load determine the type of treatment to be done.

MATERIAL AND METHODS

Study Area

The study area was Jahun Local Government Area of Jigawa State, Nigeria. it covers 1246.63 square

kilometers of landmass. It lies between latitude 12°06'N and longitude 9°63'E and is entirely in the Sudan savannah. Rain starts in June and ends in September. This study was done in the year 2009 and was localized to Jahun General Hospital. Jahun Local Government Area is inhabited predominantly by Hausas and Fulani's ethnic groups with other notable ethnic groups (Zakari, 2006).

The choice of the study site was based on the fact that the malaria cases record has shown a various among the parasite species. it was hypothesized that the highest malaria infection was due to *Plasmodium falciparum* species, and therefore, there is the need to clarify this variation and to verify the status of *P. falciparum* in malaria cases in the study area.

Sampling Technique

A total of 4037 blood samples of malaria positive patients were sampled and examined in twelve months according to (WHO, 2004). The lobe or the finger (or heel if it is an infant) was sterilized using a swab moistened with 70% v/v alcohol and the rea was allowed to dry. Using a sterile lancet, the finger or heel was pricked and squeezed gently. A small drop of blood was put at the centre of a completely clean grease – free microscope slide.

Preparation of Blood Film and Staining

Finger prick blood smears were used to prepare thin films. The slides were stained using Fields staining technique (WHO, 2004). Field stain is water-based Romanowsky stain composed of two solutions of fields stain A and fields stain B. Holding the slide with the dried thick film facing downwards, the slide was dipped into fields stain A for 5 seconds. The excess stain was drained off by touching a corner of the slide against the side of the stain container. The above was washed gently for about 5 seconds in clean water. The excess water was drained off and the slide is washed gently in clean water again, wiped at the back and placed upright in a draining rack for the film to air – dry (Moody, 2000).

Microscopy and Reporting Blood Films

The blood films were examined microscopically using the 40x and 10x immersion oil objectives against 7x eye piece for brighter and clearer image (WHO, 2004). The examination was made using standard keys of Edington and Gills (1976) as follows:

1. Many ring forms or crescent – shaped gametocytes indicate *P. falciparum*.
2. Parasites surrounded by pale pink semi lunar containing pale red dots indicate *P. vivax*.
3. Parasites more compact and smaller, some oval shaped parasitized cell with ragged ends indicate *P. ovale* and few thick compact rings or small round gametocytes with yellow-below pigment indicate *P. malariae*. In this way the blood films were examined and the *Plasmodium* species abundance was noted.

Data Analysis

The data obtained in the study were analyzed with respect to number *Plasmodium* species obtained.

These were presented in tables, interpreted in percentages analyzed with respect to the number of species.

RESULTS

The annual relative abundance of *Plasmodium* species for the year 2009 was shown in Table 1. The total number of positive blood films were 4037, of which *P. falciparum* was the most abundant, 3208 (79.46%), followed by *P. malariae*, 672 (16.65%), then *P. ovale*, 157 (03.89%) and there was no *P. vivax* reported.

The monthly abundance revealed January, 322 (7.98%), February, 147 (3.64%), March, 118 (2.92%), April, 154 (3.81%), May, 141 (3.49%), June, 158 (3.91%), July, 513 (12.71%), August, 522 (12.93%), September 514 (12.73%), October, 542 (13.43%), November, 495 (12.26%) and December, 411 (10.18%). This showed that the *Plasmodium* species were most abundant in October and *P. falciparum* was most in September, 467.

Table 1: Monthly abundance of *Plasmodium* species for the year 2009

Months	No. of <i>Plasmodium falciparum</i>	<i>Plasmodium malariae</i>	<i>Plasmodium ovale</i>	Overall	
January	322	244	72	644	
February	147	100	33	280	
March	118	85	22	236	
April	154	101	38	308	
May	141	79	39	282	
June	158	116	34	316	
July	513	423	80	1023	
August	522	431	76	1044	
September	514	467	34	1128	
October	542	441	82	1084	
November	495	411	73	990	
December	411	310	89	822	
Relative abundance (%)	100.00	79.46	16.65	03.89	100

DISCUSSION

P. falciparum is the most pathogenic of human malaria species with untreated infections causing severe disease and death, particularly young children, pregnant women and non-immune adults (Cheesbrough, 2005). This agreed with findings of this study where *P. falciparum* was 3208 (79.46%).

The abundance of *P. falciparum* can be attributed to the high temperature situation of the study area been a Sudan savannah region as indicated by Blackwell (2004) that *P. falciparum* is found the hotter and more humid regions of the world.

Moreover, WHO reported that in Nigeria *falciparum* malaria is the most prevalent and constitutes about 100% of all infections, while quartan malaria has 15-20% prevalence. Similarly, Tertian *ovale* malaria had the least prevalence of about 2% and occurring as mixed infection quartan and *malariae* infection, while the benign tertian *vivax* malaria is not endemic to Nigeria and West Africa (WHO, 2000). *Plasmodium malariae* infection is relatively rare and responsible for

7% of malaria incidence in the world. This coincided with findings of this study where *P. falciparum* was 79.46%.

P. malariae has much higher prevalence than *P. ovale*, 672 (16.65%) and 157 (0.89%) respectively. In Tropical Africa, it accounts for up to 25% of *Plasmodium* infections (Cheesbrough, 2005).

On the other hand, *P. ovale* was least in abundance 157 (03.89%) and this had agreed with Cheesbrough (2005), that *P. ovale* has low prevalence, where it accounts for up to 10% of malaria infections in West Africa and has also been reported from other parts of Africa. And this study had not reported *P. vivax*, similarly, WHO (2000) reported that the *vivax* malaria is not endemic to Nigeria and West Africa.

The relative abundance of *Plasmodium* species according to months showed that October had the most abundant, 542 and this may be attributed to the fact that rain was plenty in that month and provides much more breeding sites for the *Anopheles* and hence *Plasmodial* transmission as in Service (1980);

Anopheles mosquitoes breed in areas with water bodies which are suitable for the growth and development of various strains of mosquitoes as ponds, wells and surface water bodies of different sizes are available during rainy season which could also serve as breeding sites.

CONCLUSION

This study had indicated the abundance of *Plasmodium* species responsible for malaria cases in the study area namely *P. falciparum*, *P. malariae* and *P. ovale* with *P. falciparum* bearing the highest

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number. This means that *P. falciparum* is responsible for most of the malaria cases among the patients attending Jahun General Hospital during the study period.

Recommendation

This study should attract multifaceted malaria control programme to include administration of Artemisinin combined therapy (ACT), Immediate destruction of malaria vector and use of insecticide treated bed nets (ITNs).

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