Prevalence of Malaria Parasitaemia in Pregnant Women WHO Attended General Hospital Shendam, Plateau State, Nigeria

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Abstract: Malaria infection during pregnancy is a major public health problem in tropical and subtropical regions throughout the world. The study was designed to determine the prevalent of malaria parasitaemia among pregnant women who attended general hospital in shendam, Jos, Plateau State of Nigeria between the period of January and March, 2016. Participation was voluntary, pregnant women who gave consent to be part of the study were randomly selected. Questionnaires were distributed to the subjects to obtained demographic data. Blood samples were collected; thin and thick blood films were made and stained using Giemsa stain. The blood films were examined using oil immersion objective. The study revealed that an overall 5.6% of the 250 pregnant women were found to have malaria infections. It was found that women between the ages of 20-23 years had the highest prevalence of 2.0%. Highest prevalence of 3.6% was also recorded in non-formal education women. The results also showed that pregnant women in the first trimester recorded the highest prevalence of 4.8%. The study concludes that the low prevalence might be due to the intermittent prophylaxis given to pregnant women on antenatal care (ANC) and the use of long lasting insecticidal net by most pregnant women.
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Introduction

Malaria is a life threatening parasitic disease transmitted by infected female anopheles mosquito Malaria has infected human over 50, 000 years and many have been a human pathogen for entire history of the species.

Today malaria parasite remains one of the major causes of morbidity and mortality especially among children between the ages of 6 months to 5 years and pregnant women in Tropical and sub-tropical regions (WHO, 2001). Human malaria is caused by four (4) species of plasmodia; *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae.* The majority of malaria infection is caused by either *Plasmodium falciparum, Plasmodium vivax*, most malaria associated with deaths are due to *Plasmodium falciparum.* Mixed infections due to more than one malarial species occur in five (5) to seven (7) percent of infections (Cheesbrough, 1998).

Malaria infection has been increasing over recent years due to a combination of factors such as increasing resistance of malarial parasites to a combination of malaria parasite to chemotherapy, resistance of the anopheles mosquito vector to insecticide and ecologic and climatic change (Sigh *et al.,* 2004). Malaria during pregnancy has been most widely evaluated in Africa south of the Sahara, where 90% of the global malaria infection during pregnancy is caused mainly by *Plasmodium falciparum* which is the most common malaria species in Africa (Nosten *et al,* 1991). Every year at least three (3) million pregnancies occurs among women in malarious area of Africa, most of which resides in areas of relatively stable malaria transmission (Braham *et al,* 1990).

Malaria affects all age group but children, pregnant women and unborn children, are more vulnerable to malaria which is major cause of perinatal mortality, low birth weight maternal anaemia, abortion and still birth (Achidi *et al,* 1996). Malaria infection during pregnancy is a major public health problem in Tropical and Sub-tropical Regions.

Statement of the Problem

Malaria is an endemic disease and the most highly prevalent tropical disease with high morbidity, mortality and high economic and social impact. Malaria infection during pregnancy is a major public health problem in Tropical and Sub-tropical Regions.

Malaria in pregnant women is an important cause of still birth, infant mortality, low birth rate, maternal anaemia, abortion and prematurity. Women and unborn babies are vulnerable to malaria parasites; when pregnant women are infected with malaria parasites; large number of parasite accumulates in the

placenta causing problems for the mother and the baby.

Aim and Objectives of the Study

The study aim at determining the prevalence of malaria parasitaemia in pregnant women attending General Hospital Shendam. Its objectives are: to determine the prevalence of malaria in relation to age groups of pregnant women in Shendam General Hospital, determine the prevalence of malaria in relation to educational level of pregnant women in Shendam General Hospital and to determine the prevalence of malaria in relation to trimesters of pregnant women in Shendam General Hospital.

Justification of the Study

Little work has been documented on this topic in this part of the continent especially the Shendam Community where most of the residents are not much educated on the control and prevention of the infection.

This study makes it very vital in Shendam General Hospital as it will help in controlling the infection by enlightening the pregnant women attending Shendam General Hospital (population at risk) of the risk factors and the devastating effect of the infection and its prevention/control.

Life Cycle of Plasmodia

The life cycle of plasmodium exist in two basic stages.

a) Schzogory: This is the asexual process that occurs in man.

b) Sporogony this is the sexual phase and it occurs in the vector (female anopheles mosquitoes).

Life Cycle in man (Schizogony)

Human get infected with malaria parasites through the bite of an infected female anopheles mosquitoes. During the bites, sporozoites are injected into the blood circulation and within 30 minutes they are carried to the liver where they undergo pre/exoerythrocytic cycle (primary upon penetration of the parenchymal cells of the liver by the sporozoites.

It develops into trophozoites which undergo asexual reproduction by binary fission given rise to schizonts. The schizonts will infect fresh pavenchymal cells and undergo the same cycle. After series of erythrocytic cycle, some merozoites will develop into micro and macro gametocytes.

Life Cycle in the Vector (sporogony)

Female anopheles mosquitoes get infected when they take blood meal from an infected person.

During the process, micro and macro gametocytes are ingested in the gut of the vector, the micro gametocyte undergo exflagellation to become micro gamate, while the microgametocyte extrude granules in its cytoplasm to become macrogamates. The micro and macro gamates unites to form a zygote in the mid gut; this zygote is known as ookinate.

This ookinate moves to the mouth part of the mosquitoes and becomes dormant, it is rounded and known as oocysts. This oocysts contain sporozoites, when it burst open it releases sporozoites which infects the salivary gland of the female anopheles mosquitoes making the vector becomes infective.

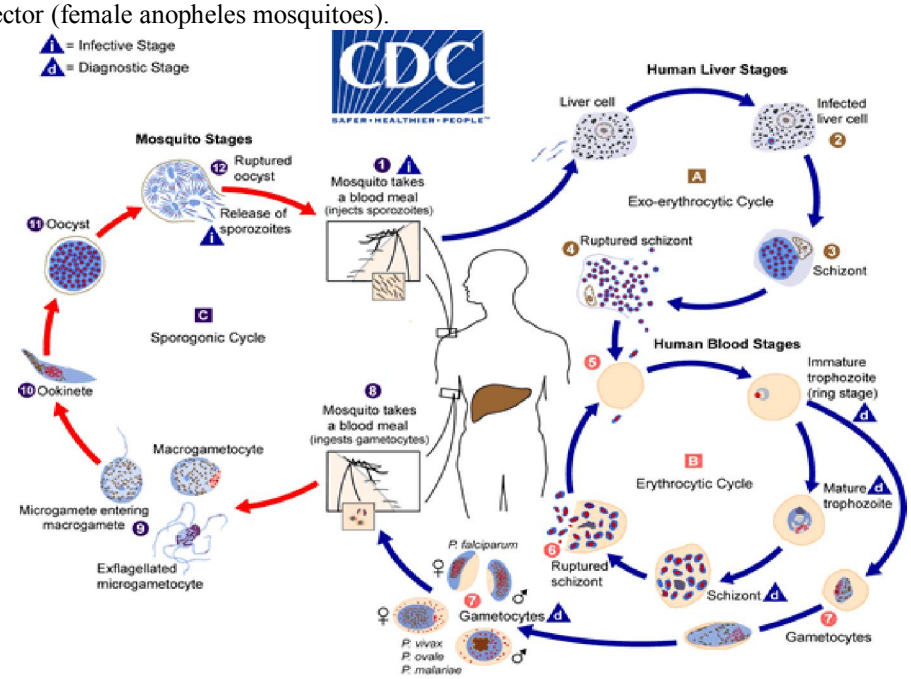

Fig. 1: Diagram showing life cycle of malaria parasite
(Adopted from CDC, 3/7/ 2016)

Mode of Transmission of Malaria

Malaria is transmitted through the bite of an infected female Anopheles mosquito after a period of cyclical development. Man is the only important source of infection of the mosquito.

Other comparatively rare mechanismsfor transmission includes contaminated needles, organ transplantation and blood transfusion. The trophozoites remain viable for up to 12 days at O^0C to 40^0C. Contaminated syringes are also potential sources of infection (Oyerinde, 1999).

Pathogenesis of Malaria Parasites

The incubation period of malaria depends largely on the species of the parasite, the size of the sporozoites received and the resistance of the host. The average figures are *Plasmodium falciparum* 12 days, *Plasmodium vivax* 14 days, *Plasmodium malariae* 30 days, and *Plasmodium ovale* 14 days.

During the incubation period, the pre-erythrocytic cycle occurs (Solomon *et al.*, 2014). The erythrocytic cycle involves the production of haematin pigments by the parasites. The pigment is toxic to the host. It is liberated into the host's circulatory system once the red blood cells rupture.

It is this foreign body which sensitizes the host and produces in him clinical manifestation of malaria fever. The process leading to the sensitization of the host includes; the release of toxins which induces the phagocytes to release endogenous pyrogen which circulates in the blood to reach the hypothalamus.

Following the incubation period and before the onset of malaria the patient suffers head ache, muscular aches and pains (Thwing *et al.,* 2007), malaria fever occurs in three (3) phases; the chill phase, the heat phase and sweating phase.

The chill phase: During the chill phase the patient feels cold while his temperature rises. Children may have convulsion. This phase last for 10-30 minutes depending on the species of the malaria parasite. The heat phase: During the heat phase, the temperature that started rising from the onset of the attack, as a result of the retention of heat now reaches its peak of about 40^0C.

The patient feels very hot and throws off his cover of blanket. At this stage the patient may become restless and may also have a severe headache. The heat phase last for between three (3) and eight hours. The sweating phase: The sweating is characterized by profuse sweating from all over the body by the patient as a result of vasodilation of the blood vessels. The phase lasts for five hours or more. The temperature returns to normal and the patient recovers but remains weak and exhausted for some few days. The malaria attack occurs at regular intervals which are governed by the length of the erythrocytic cycles.

Thus *P. vivax* and *P. ovale* which completes their erythrocytic cycles in 48 hours, produces fever every third day, and *P. malariae* completes its exythrocytic cycle in 72 hours and so produces fever irregularly. There may be double or mixed infections running concurrently and because their schizogonic cycle will overlap, the malaria will occur irregularly.

The pathogenicity of malaria is modified by the host resistance or level of immunity to the malaria parasite. In the endemic areas there may be a high resistance to malaria, with natives having some few parasites in the blood without showing symptoms (Oyerinde, 1999).

Signs and Symptoms of malaria

Symptoms of malaria includes fever, shivering, joints pain, nausea and vomiting, anaemia caused by haemolysis and convulsion (Keiser *et al.,* 2004). The classic symptoms of malaria are cyclical occurrence of sudden coldness followed by fever and sweating lasting for six hours. Children with malaria frequently exibits abnormal posturing, a sign indicating severe brain damage (Humphrey, 2001).

Malaria has been found to cause cognitive impairments, especially in children. It causes widespread anaemia during a period of rapid brain development and also direct brain damage. This neurologic damage results from cerebral malaria to which children are more vulnerable (Sachs *et al.,* 2002).

Consequences of severe malaria include coma and death if not treated on time. Young children and pregnant women are especially vulnerable. Splenomegaly, severe headache, cerebral ischemia, hepatomegaly, and haemoglobinuria where haemoglobin from lysed red blood cells leaks into the urine (Beare *et al.,* 2006).

Treatment of malaria

Active malaria infection with Plasmodium falciparum is a medical emergency requiring Hospiatlization. Infection with *Plasmodium vivax, Plasmodium ovale* or *Plasmodium malariae* can often be treated on an outpatient basis.

Treatment of malaria involves supportive measures as well as specific anti-malarial drug, when properly treated; someone with malaria can expect a complete recovery (Beare *et al.,* 2006).

Currently available anti-malarial drugs include; Artesunate-amodiquine, Artesunate-mefloquine, Artesunate-sulfadoxine/pryimethamine, Artemether and Lumefantrine, Quinine, primaquine and Proquanil.

Although effective anti-malarial drugs are on the market, the disease remains a threat to people

living in endemic areas who have no proper and prompt access to effective drugs. Access to pharmacies and health facilities, as well as drugs cost are major obstacles (Tsuyuoka *et al.,* 2006).

Prevention and Control

A. Measures directed against the parasite in man: several anti-malarial drugs as listed above very effective in the control of malaria in man.

B. Measures directed against the vector: The most successful methods of malarial control are those directed against the vector either in the larval or adult stage.

The main methods of controlling the larvae include: Elimination of breeding places, e.g by constructing drainages, burning all receptacles to discourage stagnant waters which are potential mosquito breeding sites around the house.

(i) By the use of larvicides: Application of petroleum oils on the surface of stagnant water blocks the spiracular opening of the larva there by preventing it from breathing leading to its sudden death.

(ii) Intermittent drying: periodic drying of irrigation channels and irrigated fields will helps in the elimination of breeding sites of the mosquitoes.

(iii) Flushing of streams; this involves the building of dams across the stream from where enough water is released periodically.

(iv)Biological control: This involves the introduction of other animals such as tadpoles which preys on mosquito larvae.

C. The adult mosquito:

(i) Insecticides: Many drugs are known with insecticidal properties. They belong to the broad groups, contact insecticides and residual insecticides. Contact insecticides e.g. pyrethrum, produces an immediate effect. It is often mixed with residual insecticides and spray on the habitat of the mosquito. The common residual includes the chlorinated hydrocarbons such as, Dichlor-Diphenyl-Trichlorethane (DDT), Benzenhexochloride (BHC).

(ii) Trapping: mosquitoes may be trapped or caught by hand and kill.

D. Measures designed to prevent mosquito-man contact:

(i) Screening: Houses may be made mosquito proof by screening all doors and windows with wire netting of appropriate mesh. The use of mosquito nets made of cotton or nylon over bed is a highly effective means of keeping mosquitoes away from man.

(ii) Clothing: Long trousers, long sleeved shirts, gloves, high boot and head nets, have some protective value.

(iii) Repellants such as dimethyl-phthalate, diethyl-toluamide, indalone, benzyl benzoate, when applied to exposed parts of the body repels mosquitoes for some hours (Oyerinde, 1999).

Rollback Malaria

In 1998, the world health organization (WHO), world ban, and United Nations International Children's Emergency Fund (UNICEF) conceived and partnered to create the Roll Back Malaria movement with the goal of reducing malaria deaths by 2010 that was the first major effort against the disease in four decades (Nabarro *et al.,* 1998).

Study Area

This study was carried out in General Hospital Shendam. It is located in the southern senatorial district of Plateau State, Nigeria. The hospital has two (2) hundred bed carrying capacity with Antenatal clinic running in the morning and received patients from parts of Nasarawa and Taraba States. Women who came for antenatal clinic in the Hospital were examined.

Study Population and Design

Patients were selected by simple random sampling with the first patient balloted from a yes answer and subsequent patients were selected one after the other. This included pregnant women who attends antenatal clinic at the hospital.

Questionnaires were administered for the purpose of the research which carried the patients' demographic information such as name, age, trimester, drug usage and educational status.

Sample Size

The sample size was determined using the equation for calculating the minimum sample size according to (Thrushfield, 1997) as shown below:

$$N = \frac{(1.96)^2 \times pexp(1-pexp)}{d^2}$$

Where;

N = number of sample

pexp = expected prevalence of 20.1% (Samaila *et al.,* 2014)

d = desired absolute precision of 5%

$$N = \frac{(3.84) \times 0.201(1-0.201)}{(0.05)^2}$$

$$N = \frac{(3.84) \times 0.201(0.710)}{0.0025}$$

$$N = \frac{(3.84) \times 0.142}{0.0025}$$

$$N = \frac{0.545}{0.0025}$$

N = 218 (minimum)

Ethical Clearance

The ethical clearance for this research was received from the ethical committee of Jos University Teaching Hospital Plateau State, Nigeria (see appendix).

Informed Consent

Written and verbal consents were received from the patients.

Inclusion Criteria

Pregnant women attending antenatal clinic in Shendam General Hospital who gave consent to be part of the study.

Exclusion Criteria

Pregnant women not attending antenatal clinic in Shendam General Hospital.

Sample Collection

Blood samples were collected from enrolled pregnant women by finger prick method using sterile blood lancets. The index finger was first cleaned with cotton wool soaked in methylated spirit. When the index finger was dried blood lancet was used to prick the index finger.

The samples were collected on a clean grease free slide by gently massaging the index finger for blood to come out and placing it on the slides i.e. for thick and thin blood films respectively, making two slides per patient.

Sample Processing

Both thick and thin blood films were made on the same glass slide for each sample and stain using Giemsa stain techniques.

Microscopic Examination of the stained blood films

A drop of oil immersion were applied on an area of the thick blood film. A drop of oil immersion were applied on the tail region of the thin blood film.

Both the thick and thin blood films were examined under the microscope using X100 objective for the identification of malaria parasites. Species for differentiation were based on size of plasmodia, number of trophozoites on the red cells and shape of gametocytes (Cheesbrough, 1998).

Data Analysis

The results obtained were statistically analyzed used statistical package for social science SPSS version 21. Values of $P < 0.05$ were considered statistically significant while values of $P > 0.05$ were considered statistically insignificant (see appendix).

Results

The results are shown in Table 1-3.

Table 1: Prevalence of malaria parasitaemia among pregnant women attending General Hospital Shendam in relation to age

Age group (year)	Number examined	Number positive	Prevalence (%)	X^2	P-value
20-23	30	5	2.0	2.056	0.561
24-27	68	3	1.2		
28-31	80	2	0.8		
32-35	50	3	1.2		
36-39	22	1	0.4		
Total	**250**	**14**	**5.6**		

Table 2: Prevalence of malaria parasitaemia among pregnant women attending General Hospital Shendam in relation to educational level

Education level	Number examined	Number positive	Prevalence (%)	X^2	P-value
Informal	80	9	3.6	1.746	0.48
Primary	71	3	1.2		
Secondary	59	1	0.4		
Tertiary	40	1	0.4		
Total	**250**	**14**	**5.6**		

Table 3: Prevalence of malaria parasitaemia among pregnant women attending General Hospital Shedam in relation to trimester

Trimester	Number examined	Number positive	Prevalence (%)	X^2	P-value
First	150	12	4.8	0.144	0.930
Second	80	2	0.8		
Third	20	0	0.0		
Total	**250**	**14**	**5.6**		

Discussion

Pregnancies in women living in malaria endemic regions, particularly in sub-Saharan Africa are associated with high frequency of *Plasmodium falciparum* parasitaemia with high rates of maternal morbidity (Mkandala, 2003).

Plasmodium falciparum being the only species found in this study is in line with studies of (Abdullahi *et al*., 2009 and (Adefioye *et al*., 2007) which showed that plasmodium falciparum is the most dominant species in pregnancy. In highly endemic malarious area where semi-immune adults usually have substantially acquired resistance to local strains of *Plasmodia*, the prevalence of clinical malaria is higher and its severity greater in pregnant women than non pregnant women (Okwa, 2003).

The low prevalence rate of 14 (5.6%) of the 250 samples examined recorded in this study was in accordance with 7.7% prevalence reported by (Chimere *et al.,* 2009) in pregnant women in Lagos South-West Nigeria.

Though the prevalence of this study was rather lower than that study mentioned above, this may be attributed to the improved understanding of the Antenatal clinic and the use of long lasting insecticide treated nets (LLIN) or alternative intermittent preventive treatment with pyrimethamine-sulfadoxine (SP).

The lower prevalence might also be for the reason that this study was conducted during the dry season. According to Ayanda (2009) and Solomon *et al*. (2014), prevalence of malaria infection is higher in the wet season than the dry season.

Minakaw *et al.* (2002) reported that the rainy season presents favourable environmental conditions that enhance mosquito breeding and survival, through the proliferation of larval habitats and improved humidity respectively.

The study also contradicts the report by (Michael *et al.,* 2001) who recorded a higher prevalence of 26% in pregnant women in Port-Harcourt, Rivers State Nigeria and that of Adefioye *et al.* (2004) in pregnant women in Osogbo, South West, Nigeria supports the reason in this study and those that recorded a higher prevalence of 72%.

The reasons for the variation might be due to the seasonal difference of the study and the life style of the people. Younger women appeared to be susceptible to malaria in this study as prevalence was higher among age group 20 – 23 (2.0%).

This contradicts the findings of (Adefioye *et al.,* 2007) that found age groups 36 – 39 year old susceptible but agreed with the findings of (Dicko *et al.,* 2003) who reported that adolescents and young adult pregnant women were more susceptible to malaria than older pregnant women, because of continuous development of malaria immunity in older women.

Prevalence of malaria parasitaemia in pregnant women attending General Hospital Shendam in relation to their educational level. It was discovered that the informally educated pregnant women recorded the highest prevalence of (3.6%).

This is in line with the observations of most studies in endemic settings (Adedotun *et al.,* 2010), (Hlongwana *et al*., 2009) and (Oreaba *et al.,* 2004) that house hold persons with good knowledge of the signs, symptoms and preventive measures of malaria seems to be less susceptible as shown in this study where the formally educated pregnant women recorded the lowest prevalence i.e. primary secondary and tertiary educated pregnant women.

First trimester prevalence in this study is in line with previous studies as (Brabin, 2000) found in Western Kenya that prevalence was higher in first trimester than second and third trimester.

The observation could be as a result of constant intermittent preventive treatments (IPTP) given to pregnant women during antenatal visits which usually commence at the second trimester as seen in table 3.

Conclusion

The study recorded a low prevalence of malaria parasite in pregnant women attending General Hospital Shendam and it might be due to the intermittent prophylaxis treatment given to pregnant women on antenatal care.

Recommendations

We wish to make the following recommendations to further reduce the prevalence of malaria infection among pregnant women.

1. Pregnant women should be encouraged to go for medical examination from time to time and infected individuals should be given treatment to avoid complication of malaria parasite infection.
2. Government should therefore put in measures to educate the general public on the prevention and control measures of the infection.
3. Government should pay more attention to eradicating malaria parasite by distributing mosquito treated nets, insecticides, prophylactic drugs to its citizens.

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