

# Neonatal Malaria Prevalence Among Infant Aged 1-28 Days Admitted in Chukwuemeka Odumaegwu Ojukwu University Teaching Hospital Amaku Awka

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**Abstract:** A study of neonatal malaria infection was conducted between 1<sup>st</sup> April 2021 to 30<sup>th</sup> October 2021 to determine the prevalence of neonatal malaria among infant admitted in Chukwuemeka Odumaegwu Ojukwu University Teaching Hospital (COOHT) Amaku Awka Anambra State South Eastern Nigeria. Four Hundred and Twenty (420) neonates admitted at the General Outpatient Department (GOPD) of the Paediatrics unit. Two hundred 200 (47%) of the population were randomly selected and enrolled for the study after informed consent was sort and obtained from their mothers before enrolling them in the study The mean age of the subject is Mean ( $\pm$ SD) 6.86 $\pm$ 8.51 days. One hundred and eight 108 (54%) of the subject were male and 92 (46%) female. Neonate less than 7days were 125 (62%); neonate 7-14 days of age were 50 (25%) and 14-28 days were 25 (12.5%) respectively. Thick and thin blood films were prepared from the blood specimens obtained for the neonate persevered in Ethylene Diamine Tetracetic Acid (EDTA) on a microscopic slide stained with Giemsa solution and screened for malaria parasite under a microscope following the golden rule observing all the necessary precaution in the procedure. Grading parasitemia was done using Standard measure. The result showed an overall prevalence of malaria among neonates was 74 (37.0%), and 53 (26.5%) of the *Plasmodium* were negative while 73 (36.5%) of the screening test was not accessed (attrition). Recommendations were made and conclusion drawn.

**Keywords:** Malaria, Congenital, Neonatal, Prevalence

## 1. Introduction

Malaria in the newborn once considered rare has now been reported as a common phenomenon. Of the 219 million cases of malaria, 40% occurred in Nigeria of which 660,000 deaths were recorded [1] About 90% of all malaria deaths occurred in sub-Saharan Africa. In the year 2012, malaria killed an estimated 482,000 children under 5 years of age, implying that a child dies every minute or 1300 children each day from malaria in sub-Saharan Africa. Malaria accounts for about 60% of outpatient visits to health facilities, 30% of hospitalizations among children under 5 years of age, and 25% of deaths in children under 1 year [2, 3]. Children under 5 years have as many as three to four episodes of malaria every year [4]. Malaria can occur at birth at the 1<sup>st</sup> week as

congenital malaria or after the 1<sup>st</sup> week of birth as neonatal malaria.

While congenital malaria is acquired from the mother an infant during birth. Neonatal malaria is due to an infective mosquito bite after birth. Neonatal and congenital malaria (NCM) are potentially life-threatening conditions that are assume to occur at relatively low rates in malaria endemic regions [5]. However, recent reports suggest that the number of NCM cases is increasing, and its epidemiology remains poorly described. NCM can mimic other neonatal conditions and because it is thought to be rare, blood film examinations for malaria are not always routinely performed. Consequently, many cases of NCM are likely to be undiagnosed [5]. Congenital malaria is defined as malarial parasites demonstrated in the peripheral smear of the

newborn from twenty-four hours to seven days of life [6]. Clinically apparent congenital malaria is rare in areas in which malaria is endemic and levels of maternal antibody are high. Normally, symptoms occur 10 to 30 days postpartum [7]. The most common clinical features in 80% of cases are fever, anaemia, and splenomegaly [8]. Other signs and symptoms include hepatomegaly, jaundice, regurgitation, loose stools, and poor feeding. Occasionally, drowsiness, restlessness, and cyanosis may be seen [6, 7]. Respiratory distress, loose stools and hepatomegaly may also be present [9]. The diagnosis is frequently missed. In 2019, there were an estimated 229 million cases of malaria worldwide. The estimated number of malaria deaths stood at 409 000 in 2019.

Children aged under 5 years are the most vulnerable group affected by malaria; in 2019, they accounted for 67% (274 000) of all malaria deaths worldwide [10]. Malaria is a disease of global importance and the third leading cause of death in children under 5 years, after pneumonia and diarrhea diseases. It is a major health problem and one of the leading causes of preventable deaths in Nigeria. Globally, 300 - 600 million cases are seen annually and an estimated 2.2 billion people are at risk of this infection [11]. A million annual deaths have been estimated to occur as a result of malaria of which about 80% are seen in infants and young African children. Malaria in the neonatal period was considered rare in the past especially in endemic areas [12]. This was attributed to various protective mechanisms such as; the milk diet of the infant being deficient of P-amino-benzoic acid, hematologic factors such as an aging red cell population, the presence of erythrocyte fetal hemoglobin and selective biting of mosquitoes among different age groups [13]. Trans placentally acquired antibodies have also been observed to play a role. Recent studies however have shown that malaria can occur in the newborn period as these protections may not be complete [12]. Malaria diagnosis in the neonatal period could be delayed as the clinical features of malaria are non-specific, variable and similar to those of neonatal sepsis [11]. Information about neonatal malaria is scarce and inadequate data, in Nigeria, hence this study is to generate more data on neonatal malaria in Anambra State South East Nigeria, among these vulnerable groups, and to find the potential benefits of effective prevention of neonatal malaria.

## 2. Methods

This is a descriptive study. The study was carried out within the period of 6 months from 1<sup>st</sup> April 2021 to 30<sup>th</sup> October 2021. Out of four hundred and twenty (420) neonates admitted at the outpatient department of neonatal unit of Chukwuemeka Odumegwu Ojukwu University teaching Hospital Amaku Awka (COOUTHAA). Two hundred neonates were taken for the study.

Subjects were recruited after obtaining verbal and written informed consent after explanation to them in both English language and vernacular.

The subjects comprise of neonates between the ages of 0-28 days after delivery, while the consent was obtained from

the parents /care giver of the neonates.

Out of four hundred and twenty (420) neonates admitted in the General Outpatient Department (GOPD) of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Amaku Awka (COOUTHAA) Anambra State South Eastern Nigeria. Two hundred neonates that met inclusion criteria were consecutively enrolled after obtaining consent from their parents /caregiver.

Neonates that are above 28 days old of births were excluded, and also those whose their parents/caregivers rejected consent were not qualified for the enrollment.

Detailed clinical history including age, sex, birth weight, gestational age, place of birth, mode of delivery, place of residence, age at onset of fever, other symptoms as well as maternal use of intermittent prophylactic anti-malarial and the use of insecticide treated nets during the period of pregnancy were obtained.

Immediately upon admission half a milliliter of venous blood was obtained from each neonate recruited and sent to the microbiology laboratory for the preparation of thick and thin blood smears.

The collected sample was used to prepare slides shortly after collection to prevent alteration in the morphology of white blood cells (WBCs) and malaria parasite to ensure proper estimation of parasite. Prepared slides were air dried thereafter stained with Giemsa within 24 hours of collection of blood sample. Each film was examined microscopically at a magnification of X100 under oil immersion. The presence of asexual forms of malaria parasite (trophozoites or ring forms) was said to be positive for malaria parasite. Asexual malaria parasites were counted concomitantly with the leucocytes in each field and the parasite count recorded as the ratio of asexual forms per 200 leucocytes in each field. A slide is said to be negative if after examining a minimum of 200 leucocytes no malaria parasite was found. For the purpose of this study, a neonate with fever was said to have congenital malaria if there was presence of malaria parasites in the peripheral blood film in the first seven days of life while acquired neonatal malaria was defined as the presence of malaria parasites in the peripheral blood film within 8-28 days of life. Full blood count was also done for each recruited neonate to exclude probable sepsis.

Thick and thin blood films were stained with 10% Giemsa and read for malaria parasites following standard quality control procedure. An ethical clearance was sought and obtained from the department of Research and Ethics Committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Amaku Awka Anambra State.

Data were analyzed using SPSS version 10.1 for windows. Descriptive statistics were computed for all relevant data. Chi square analysis was used to compare proportions within and among groups, for statistical significance.

### 3. Result and Discussion

**Table 1.** Describing the basic statistics of age.

AGE (days)	Descriptive Statistics
Mean ( $\pm$ SD)	6.86 $\pm$ 8.51 days
Median	4 (1-7) days
Minimum	0.042 days
Maximum	30 days

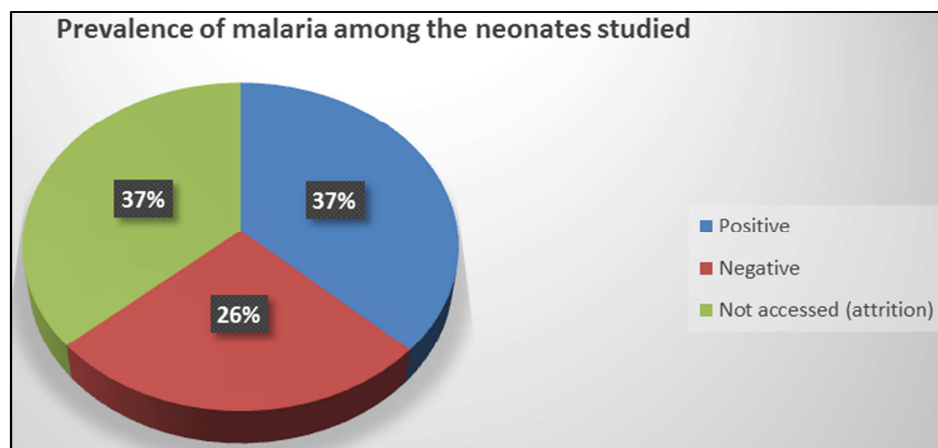
Majority of the subject fall between 6 to 8 days old neonates.

Results from table 1 showed that the mean age of the neonates studied was 6.86 $\pm$ 8.51 days with a range of 0.042-30 days.

**Table 2.** Prevalence of malaria among the neonates studied.

Malaria infection (n=200)	Frequency	Prevalence (%)
Positive	74	37.0
Negative	53	26.5
Not accessed (attrition)	73	36.5
Total	200	100

Out of the 200 subjects studied, the prevalence of malaria among neonates was 74 (37.0%), and 53 (26.5%) of the *Plasmodium* were negative while 73 (36.5%) of the screening test was not be accessed (attrition).



**Figure 1.** Prevalence of malaria among the neonates studied.

Seventy four neonates out of 200 enrolled in this study tested positive 74 (37.0%).

**Table 3.** Cross-tabulation analysis between gender and prevalence of malaria among the neonates.

Gender	Total (%)	Malaria			$\chi^2$ -value	p-value
		Positive (%)	Negative (%)	Not accessed (%)		
Male	108 (54.0)	29 (39.2)	33 (62.3)	46 (63.0)	6.584	0.037*
Female	92 (46.0)	45 (60.8)	20 (37.7)	27 (37.0)		
Total	200 (100)	74 (100)	53 (100)	73 (100)		

$\chi^2$ -value (Chi-square test statistic value), \*= significant p-value<0.05.

**Table 4.** Cross-tabulation analysis between age and prevalence of malaria among the neonates.

Variable	Total (%)	Malaria			$\chi^2$ -value	p-value
		Positive (%)	Negative (%)	Not accessed (%)		
Age					10.134	0.038*
< 1 week	125 (62.5)	51 (68.9)	35 (66.0)	39 (53.4)		
1-2 weeks	50 (25.0)	14 (18.9)	5 (9.5)	31 (42.5)		
> 2 weeks	25 (12.5)	9 (12.2)	13 (24.5)	3 (4.1)		
Total	200 (100)	74 (100)	53 (100)	73 (100)		

$\chi^2$ -value (Chi-square test statistic value), \*= significant p-value<0.05.

In Nigeria neonatal malaria has led to the death of neonates, and in Africa the story is the same all over. According to WHO, in the year 2012, malaria killed an estimated 482,000 children under 5 years of age, implying that a child dies every minute or 1300 children each day from malaria in sub-Saharan Africa [14]. The overall prevalence of neonatal malaria observed in this study is 37.0% (Table 4), which was relatively high, but lower than 26.5%, observed by [23]. 37.0% records in this study as well

were not accessed.

The prevalence in this study was higher than that observed by [15] who reported a prevalence of 24.8% in Olabisi Onabanjo University Teaching Hospital, Shagamu, Nigeria.

When compared with the result from other African countries there were variations. The prevalence was lower than that reported [16], who recorded a prevalence of 52% in Zambezia province, Mozambique.

These differences in findings by other studies may be due

to environmental factors and data collection methods. Awka which is found in Anambra state is located in south eastern part of Nigeria and with the history of rain forest and lower land and average high yearly rain fall a condition that favours the thriving of malaria vectors. Poor drainage system, poor sanitary habit, collection of water in cans, etc. characterized the environment that provides good breeding good breeding sites for the mosquito vector.

These factors may account for the high prevalence of neonatal malaria in the study.

The prevalence observed in the current study was lower than that observed in Mozambique that observed in Tanzania, Mozambique environment and rainfall pattern varied greatly from that of Nigeria and method of study.

The prevalence is gender bias oriented, result from table 1 showed that the majority of the study participants were males 108 (54%) then the remaining 92 (46%) were females. From the study it was observed that the prevalence is more on the female the neonates. Which implies that the prevalence of neonatal malaria is gender bias oriented [17].

On treatment, amodiaquine, chloroquine and sulfadoxine–pyrimethamine have all been successfully used in Nigeria to treat neonates with malaria [18]. Although artemisinin-based combination therapy (ACT) is the recommended treatment for uncomplicated malaria in infants, the neonates have been largely excluded from ACT clinical trials. There are, therefore, limited data available on the use of ACT in neonates and many of them carry label restrictions for neonates.

The level of mother's compliance to malaria preventive measures is very low, because mother's attitude toward assessing control and adherence to preventive measures plays prominent role.

It is also a reminder that NCM still exists despite IPTp and other malaria preventive measures, and its diagnosis may be missed especially when malaria screening measures are not put in place in NNUs in malaria endemic areas. Other reports suggest that the incidence of NCM may be increasing. Proper descriptions of NCM are important to ensure more comprehensive understanding of the clinical spectrum and outcomes of malaria in neonates. Malaria endemicity has been suggested to play a role in the prevalence of NCM. There are reports suggesting in hyperendemic areas the prevalence of NCM is higher [11, 19], while others are contrary. It is however, plausible epidemiologically that in settings of intense perennial transmission the mothers have developed herd immunity, their newborn babies have protective antibodies to the disease, and therefore the prevalence is negligible.

A study had earlier identified that signs and symptoms of malaria in the newborn may be indistinguishable from other neonatal infections [20].

As clinical signs of neonatal malaria may be indistinguishable from that of neonatal sepsis, it has been suggested that screening for malaria parasite be included as part of routine investigation in newborn infants with fever. Sometimes, the inability of clinicians to exercise that index

of suspicion for congenital malaria has unwittingly increased the duration of hospital stay of the neonate or led to an increase in neonatal mortality.

The burden of malaria in non-malarial countries had led to the suggestion by workers that neonatal malaria is to be considered in those newborns with congenital infection born to mothers who had travelled to endemic areas, even when they appear clinically healthy. Previous studies have shown that chemoprophylaxis in infants has the potential to reduce malaria-related morbidity and mortality.

In a pooled analysis of six randomized, placebo-controlled trials of IPTi using sulphadoxine-pyrimethamine delivered at the same time as EPI immunizations, a protective efficacy against clinical malaria of 30.3% was reported [21]. Seasonal malaria chemoprevention (SMC), previously referred to as IPT in children (IPTc), involves the administration of full anti-malarial treatment courses during the malaria season to children aged 3–59 month. The WHO recommends that SMC be used in areas of high seasonal malaria transmission across sub-Saharan Africa, and that treatment with amodiaquine plus sulphadoxine-pyrimethamine should be given at monthly intervals from the start of the transmission season, up to a maximum of four doses [22]. The main potential risks associated with SMC are safety and drug resistance [23]. However SMC may provide a substantial protective effect against malaria, and is a potentially valuable tool that could contribute to reducing the malaria burden in infants aged over three months in areas with seasonal transmission.

## 4. Limitations

A larger study with capacity to conduct molecular, parasite count and pharmacokinetic and dynamic testing, and long term follow up would help better refine definitions, outcomes and interpretation of these findings. Nonetheless, this report has been able to demonstrate the prevalence of Neonatal and congenital malaria.

## 5. Conclusion

A larger study with capacity to conduct molecular, parasite count and clinical trial, and long term follow up would help better refine definitions, outcomes and interpretation of these findings. However, this study has been able to demonstrate the prevalence of Neonatal malaria Awka, South Eastern Nigeria. The study equally gave a clear illustration in appropriate description of the spectrum of disease among this age group and will strengthen interpretation of anti-malarial pharmacokinetic and dynamic studies in this population in relation to the physiological immaturity.

## Authors' Contributions

OVO, NIC, and IIM—collected the data and participated in writing the manuscript; OVO—conceived the idea and wrote the manuscript. All authors read and approved the final manuscript.

## Competing Interests

The authors declare that they have no competing interests.

## Availability of Data and Materials

The study data is available on personal request to the corresponding author.

## Ethics Approval and Consent to Participate

This study was conducted within the provisions of ethical standards in Nigeria.

Consent to participate was sort and obtained from the mothers /parents of the infants.

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