

PREVALENCE OF MALARIA IN ANIOCHA SOUTH LOCAL GOVERNMENT AREA OF DELTA STATE, NIGERIA

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ABSTRACT

Malaria continues to pose a major public health challenge in Nigeria and across sub-Saharan Africa, contributing significantly to the global burden of disease. Despite ongoing control efforts and extensive research, transmission remains complex, driven by interactions among mosquito vectors and environmental factors. This study evaluated malaria prevalence in Aniocha South Local Government Area of Delta State, Nigeria. A cross-sectional survey was carried out among 600 consenting participants. Blood samples were collected and examined using standard microscopic methods, including thin and thick blood film techniques, to determine both malaria prevalence and parasite density. Data analysis was performed using SPSS version 22, with statistical significance set at $p < 0.05$. The results showed significant variation in malaria prevalence across the study locations ($p < 0.05$). In Ogwashi-Uku, a prevalence rate of 19.5% was recorded, with an average parasite density of 7,600 parasites/ μ L. In Nsukwa, prevalence rates of 28.0% for *Plasmodium falciparum* and 11.0% for *Plasmodium ovale* were observed, with corresponding parasite densities of 8,100 parasites/ μ L and 1,300 parasites/ μ L. Aboh recorded the highest prevalence, with 41.0% for *P. falciparum* and 7.0% for *P. ovale*, alongside parasite densities of 9,700 parasites/ μ L and 500 parasites/ μ L, respectively. Species distribution varied by location: only *P. falciparum* (39 cases) was detected in Ogwashi-Uku, while both *P. falciparum* (56 cases) and *P. ovale* (22 cases) were identified in Nsukwa. Similarly, Aboh recorded 82 cases of *P. falciparum* and 14 cases of *P. ovale*. Malaria prevalence also varied by age and gender. In overall, *Plasmodium falciparum* was the dominant species across all study sites, whereas *P. ovale* was detected only in Nsukwa and Aboh. The findings suggest that vector abundance plays a crucial role in sustaining malaria transmission within the study area. Consequently, achieving long-term reductions in malaria prevalence will depend on integrated control approaches that incorporate vector surveillance, resistance management, improved access to healthcare, and strengthened community-based environmental and behavioral interventions.

Keywords: Prevalence, Malaria, Transmission, Parasite and Abundance

INTRODUCTION

Malaria remains one of the most pressing public health challenges worldwide, particularly in rural communities where access to healthcare and preventive measures is often limited. The disease is caused by parasites of the genus *Plasmodium* and is transmitted through the bite of infected female *Anopheles* mosquitoes. Although five *Plasmodium*, *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi* are known to infect humans, *P. falciparum* and *P. vivax* are the most widespread. Of these, *P. falciparum* poses the greatest threat, as it is responsible for most severe cases and deaths, especially across sub-Saharan Africa (WHO, 2023).

Globally, malaria continues to exert a substantial health burden. In 2021 alone, an estimated 247 million infections were recorded, contributing to millions of cumulative deaths between 2000 and 2021 (WHO, 2023). The African region remains disproportionately affected, accounting for roughly 94% of all reported cases and deaths (WHO, 2024). Within the continent, countries such as Nigeria, Uganda, and Mozambique experience some of the highest transmission levels. Notably, Nigeria remains the epicentre of the global malaria burden, contributing approximately 27% of worldwide malaria cases and 31% of all malaria-related deaths (WHO, 2023).

The persistence and widespread prevalence of malaria in Africa is primarily driven by high efficient vectors, particularly *Anopheles gambiae*, *Anopheles arabiensis*, and *Anopheles*

funestus, which exhibit strong anthropophilic and endophagic tendencies, allowing sustained and intense transmission cycles (Sinka *et al.*, 2010). Malaria is transmitted to humans when an infected female *Anopheles* mosquito bites a person who is not yet infected. The continued presence of malaria in many regions is largely due to favorable environmental and climatic conditions that support mosquito breeding and survival (Adefioye *et al.*, 2007, Musa *et al.*, 2022).

Land use patterns, the types of aquatic habitats present, and changes in how land is utilized all play a significant role in shaping malaria vector productivity, particularly in highland areas where these factors help sustain continuous malaria transmission (Muturi *et al.*, 2006, Francis *et al.*, 2024). As population pressure increases, natural environments are altered such that, swamps are modified, forests are cleared, and farming practices shift to accommodate growing human needs (Kweka *et al.*, 2016). These alterations often create open and stagnant water bodies that serve as ideal breeding sites for mosquitoes, encouraging vector development and succession, which can ultimately lead to higher malaria infection rates (Ashley *et al.*, 2014). Supporting this, Mattah *et al.*, (2017) also reported that *Anopheles gambiae* is capable of breeding in a variety of aquatic habitats. Notably, the distribution of mosquito habitats and vector species changes across different geographic areas and evolves over time.

Malaria contribute significantly to illness and death across all regions of Nigeria. Despite ongoing control efforts, the disease remains particularly widespread among vulnerable groups. The Nigeria Malaria Indicator Survey (NMIS, 2021) reports that children under the age of five still experience a high burden of malaria, highlighting the persistent impact of the disease on young populations. A key sentinel population was 22 % nationally, with significant variations across states: Kebbi State was reported the highest prevalence at 35%, while Lagos state had the lowest at 3% (NMEP, 2021). Nigeria's malaria epidemiology is characterized by stable, high transmission throughout most of the year, with seasonal peak during and after the rainy

season (April to October in the South, and June to September in the North). Environmental and climatic factors are critical drivers of mosquito abundances. For instance, the tropical climate in the Southern and central zones supports year round of breeding of mosquito while the dry northern region experience seasonal malaria peak.

Malaria abundances and prevalence are influenced by a range of environmental, biological and socio-economic factors. High transmission rates are typically associated with warm temperatures, high humidity, and stagnant water bodies that serve as breeding grounds for mosquito vectors. (Mabaso *et al.*, 2007). In addition, population density, housing quality, access to healthcare, and the effectiveness of vector control measures play crucial roles in determining local malaria dynamics. (Trusting *et al.*, 2017). Malaria prevalence can vary significantly between and within geographical location due to local differences in vector species composition, resistances to insecticides and antibacterial drugs, and implementation of control interventions such as insecticide-treated nets (ITNs), indoor residual spraying (IRS), and chemoprevention strategies (Bhatt *et al.*, 2015). Recent advances in molecular surveillances have also revealed the emergence of insecticide and drugs resistances, which poses additional threats to malaria control and elimination efforts. (Ashley *et al.*, 2014). Therefore, there is need to assessed the prevalence of malaria among the population in different parts of Aniocha South LGA Delta State in order to ascertain the success or otherwise of the ongoing control programme in the state. The study work is designed to determine the prevalence of malaria among consenting participants of Aniocha South LGA. It is hoped that the data obtained from this study will provide useful information on the prevalence of malaria in relation to some associated risk factors in Aniocha South.

METHODOLOGY

Study Area

The cross-sectional study was conducted in Ogwashi Uku, Aboh and Nsukwa towns, located in Aniocha South Local Government Area of Delta State, Nigeria. It is located at latitude 6° 9' 59" N and longitude 6° 33' 46" E. The region is located within Nigeria's rainforest belt, experiences two main seasons: the rainy season from March to October and the dry season from November to February. Annual rainfall averages between 3000 mm and 4000 mm, with temperatures ranging from 29.0 °C to 36.0 °C respectively. As of the 2006 Nigerian census, Aniocha South Local Government Area in Delta State had a population of 140,604. The main socio-economic activities of the people are fishing, farming, trading and some are in public services.

Study Design.

The cross-sectional study was carried out in Ogwashi Uku, Nsukwa and Aboh communities, among consenting populations on Malaria prevalence in Aniocha South LGA of Delta State. Blood samples were collected and examined for prevalence studies. All individuals that volunteered to participate were recruited for the survey. Participants' consents were sought and they were duly informed of the significance of the study. Parasitological examinations were carried out in Cloval Medical Laboratory Ogwashi uku, Aniocha South, Delta State

Study population and Sample Size

A total of 600 participants were randomly selected using simple random sampling techniques. For this study, simple randomize technique was used which began by identification of Aniocha South LGA, Delta State as the primary focus area. A total of six hundred (600) samples were randomly selected from Aniocha Local Government Area of Delta State. Two hundred (200) samples from each community study area of Ogwashi Uku, Nsukwa and Aboh respectively were considered.

Blood sample collection

Blood samples were collected into EDTA containers which were labelled with information such as Date, Sex, Age and Serial Numbers. The samples were later transported to Cloval medical laboratory Ogwashi – Uku, Delta State, for examination of malaria presence and parasite loads following (Norgan *et al.*, 2013, Musa *et al.*, 2022).

Sample Preparation for thick film

Clean, grease-free glass slides were first selected and appropriately labeled with identification details to prevent sample mix-up. well-mixed anticoagulated venous blood was used for the preparation of the thick film. A large drop of blood was placed at the center of the slide using a capillary tube. Using the edge of another clean slide, the blood drop was gently spread in a circular motion to form a thick, even smear. The smear was carefully made to cover an area of approximately 10 mm in diameter. Care was taken to ensure that the film was not excessively thick, as this could delay drying and interfere with proper staining and microscopic examination. The prepared thick film was allowed to air-dry thoroughly at room temperature. Drying was allowed to occur naturally. After complete drying, the film was stained with 10 % Giemsa stain for 10 minutes. The slide was rinsed gently with buffered water, and allowed to dry. The stained preparation was then examined under the microscope using oil immersion for the detection and estimation of malaria parasites. (Cheesbrough, 2003).

Sample Preparation for thin film

A well-mixed anticoagulated venous blood was used for the preparation of the thin film. Small drop of blood was placed near one end of the slide using a capillary tube. A second clean slide, serving as a spreader, was held at an angle of approximately 30–45° to the slide containing the blood. The spreader was gently drawn backward until it touched the blood drop, allowing the

blood to spread evenly along its edge. The spreader was then pushed forward smoothly and steadily across the surface of the slide to produce a thin, even smear with a feathered edge. Care was taken to ensure that the film was neither too thick nor too short, and that it covered about two-thirds of the slide. The prepared smear was allowed to air-dry completely at room temperature. After drying, the thin film was fixed by flooding it with absolute methanol for 2 minutes. The methanol was then drained off, and the slide was allowed to dry again. The fixed thin film was subsequently stained using 10 % Giemsa stain for 10 minutes and examined microscopically for the detection and identification of malaria parasites.

Staining Techniques

The laboratory method employed for staining and identification of malaria parasites in collected blood samples was as described by (Cheesbrough, 2003).

Microscopic Examination

The stained slides were examined for malaria parasites. Immersion oil was spread to cover about 10mm in diameter in the areas of the film. Both the thick and thin smears prepared were examined microscopically under oil immersion with the (x100) objective.

Determination of parasite load

The number of parasites were counted in a specific number of high-power fields of 100 fields. Parasite density were determined using a factor of 500 derived from the assumed 0.002 µL per field volume of blood according to Greenwood and Armstrong, 1991. As:

$$\frac{\text{Parasites}}{\mu\text{L}} \text{ of blood} = \text{Average parasites per field} \times 500$$

Statistical Analysis of Data

Descriptive data analyses of the variables were done using SSPS version 22. The results were presented in frequency table. Categorical data were presented as frequency and percentages, while continuous variables were presented as mean $\pm$ SD. Chi-square was used to determine the association of some sociodemographic characteristics. A p-value of < 0.05 was considered statistically significant.

RESULT

The results showed that out of 200 blood samples examined in Ogwashi-Uku area, 19.5% prevalence of malaria parasite was observed. Meanwhile in Nsukwa area, 39.0% prevalence of malaria parasite was observed, while in Aboh area 48.0 % prevalence was observed. The results (Table 1) showed significant difference ($p < 0.05$) among the three study locations. The highest mean parasite count (10,200 / μ L) was observed in Aboh area, while the lowest mean parasite count (7,200 / μ L) was observed in Ogwashi-Uku area. Based on the observed plasmodium species, it was observed that only *P. falcifarum* (39) was detected at Ogwashi-Uku area, while *P. falcifarum* (56) and *P. ovale* (22) were detected in Nsukwa however, *P. falcifarum* (82) and *P. ovale* (14) were detected in Aboh (Table 2).

Table 1 Prevalence of Malaria and Parasite Load in the three study areas

Study Locations	Number Examined	Plasmodium species	Number Positive	Mean Parasite Count (/ μ L) $\pm$ SD	Prevalence (%)
Ogwashi-ukwu	200	<i>P. falcifarum</i>	39	7,200 $\pm$ 0.2	19.5
Nsukwa	200	<i>P. falcifarum</i>	56	8,100 $\pm$ 0.1	28.0
		<i>P. Ovale</i>	22	1,300 $\pm$ 0.7	11.0
		Total positive	78	9,400 $\pm$ 0.6	39.0
Aboh	200	<i>P. falcifarum</i>	82	9,700 $\pm$ 0.3	41.0
		<i>P. Ovale</i>	14	500 $\pm$ 0.1	7.0

Total positive **96** **10, 200 ± 1.3** **48.0**

Grand Total = 600

$X^2 = 5.61$, $df = 2$, p value = 0.300

Table 2 Prevalence of Malaria in relation to Gender

Gender	Number examined	Number positive (%)
Ogwashi-uku area		
Male	88	16 (18.2)
Female	112	23 (20.5)
TOTAL	200	39 (19.5)
Nsukwa area		
Male	105	37 (35.2)
Female	95	41 (43.1)
TOTAL	200	78 (39)
Aboh area		
Male	94	39 (41.4)
Female	106	57 (53.7)
TOTAL	200	96 (48)
GRAND TOTAL	600	213(35.5)

$X^2 = 4.96$, $df = 1$, p value = 0.026

The prevalence of malaria infection among male and female participants in the three study areas (Ogwashi Uku, Nsukwa and Aboh) is presented in table 3. The results of the study show that malaria prevalence differed across the various study locations and also showed slight variation between male and female participants. In Ogwashi-Uku, the prevalence of malaria among females was 20.5%, which was slightly higher than the 18.2% recorded among males. In Nsukwa, the female participants recorded a malaria prevalence of 43.1%, while male participants had a prevalence rate of 35.2%. In Aboh, the highest malaria prevalence among the study locations was recorded. In this area, females showed a prevalence rate of 53.7%, while males recorded 41.4%.

When comparing the overall gender malaria prevalence result across the three communities, Aboh recorded the highest prevalence rate at 48.0%, followed by Nsukwa with 39.0%, while Ogwashi-Uku had the lowest prevalence of 19.5%. There is a significant difference ($p < 0.05$) among the gender groups. These differences indicate that malaria transmission is not evenly distributed across the study locations.

Table 3 Prevalence of Malaria in relations to Age Group

Ogwashi-ukwu area						
Age group	Male Number examined	Number positive(%)	Female Number examined	Number positive(%)	Total Number examined	Number positive(%)
0 – 9	4	1 (25.0)	8	4 (50.0)	12	5 (41.7)
10 – 19	23	10 (43.5)	27	12 (44.4)	50	22 (44)
20 – 29	20	4 (20.0)	25	3 (12.0)	45	7 (15.6)
30 – 39	21	1 (4.8)	28	3 (10.7)	49	4 (8.2)
40 – 49	14	0 (0)	12	1 (8.3)	26	1 (3.8)
50 – 59	2	0 (0)	8	0 (0)	10	0 (0)
>60	4	0 (0)	4	0 (0)	8	0 (0)
TOTAL	88	16(18.2)	112	23 (20.5)	200	39 (19.5)
Nsukwa area						
0 – 9	6	6 (100.0)	3	1 (33.3)	9	7 (77.8)
10 – 19	29	12 (41.4)	28	17 (60.7)	57	29 (50.9)
20 – 29	25	10 (40.0)	26	7 (26.9)	51	17 (33.3)
30 – 39	25	8 (32.0)	21	10 (47.6)	46	18 (39.1)
40 – 49	10	1 (10.0)	8	2 (25.0)	18	3 (16.7)
50 – 59	5	1 (20.0)	6	1 (16.6)	11	2 (18.2)
>60	5	0 (0)	4	0 (0)	9	0 (0)
TOTAL	104	38 (36.5)	96	38 (39.6)	200	76 (38.0)
Aboh area						
0 – 9	9	7 (77.8)	6	5 (83.3)	15	12 (80.0)
10 – 19	27	11 (40.7)	29	19 (65.5)	56	30 (53.6)
20 – 29	23	10 (43.5)	35	17 (48.6)	58	27 (46.6)
30 – 39	19	9 (47.4)	19	8 (42.1)	38	17 (44.7)
40 – 49	8	1 (12.5)	9	1 (11.1)	17	2 (11.8)
50 – 59	5	1 (20.0)	2	2 (100.0)	7	3 (42.9)
>60	4	2 (50.0)	5	3 (60.0)	9	5 (55.6)
TOTAL	95	41 (43.2)	105	55 (52.4)	200	96 (48.0)

The prevalence of malaria infection across different age groups in the three study areas (Ogwashi-uku, Nsukwa and Aboh) is presented in table 4.4. The analysis showed that malaria prevalence varied markedly by age group and location. For example, in Ogwashi-Uku area, malaria prevalence was significantly ($p<0.05$) higher among younger age groups and declined progressively with increasing age. Among children aged 0 – 9 years, 12 individuals were examined and 5 tested positive (41.7%). The 10 – 19 years group recorded 22 positives out of 50 examined (44.0%), representing the age group with the highest prevalence in Ogwashi-Uku. Malaria prevalence declined sharply among adults. The 20 – 29 years group recorded 7 positives out of 45 examined (15.6%), while the 30 – 39 years group had 4 positives out of 49 examined (8.2%). The 40 – 49 years' category had only 1 positive case (3.8%), and no infections were recorded among individuals aged 50 -59 years and 60 years and above. Overall, the infection pattern in Ogwashi-Uku shows that children and adolescents carried the highest burden of malaria, while prevalence was extremely low among older adults.

Nsukwa showed a similar trend of higher malaria prevalence among younger age groups, although the magnitude was greater compared with Ogwashi-Uku. Among children aged 0 – 9 years, 9 individuals were examined and 7 were positive (77.8%), representing the highest prevalence recorded across all locations in this age bracket. The 10 – 19 years age group recorded 29 positives out of 56 examined (51.8%), while the 20 – 29 years group had 17 positives out of 51 examined (33.3%). Among adults aged 30 – 39 years, 18 of 46 individuals tested positive (39.1%). Malaria prevalence declined in older groups, with 40 – 49 years recording only 3 positives out of 18 examined (16.7%) and 50 – 59 years having 2 positives out of 11 examined (18.2%). No infections were detected among individuals aged 60 years and above, where 9 were examined and all tested

negative. These result indicate that in Nsukwa, malaria transmission remains high among children and young adults, reflecting intense local exposure.

Malaria prevalence in Aboh was higher than in the other two study areas across almost all age groups. Among children aged 0 – 9 years, 12 out of 15 examined were positive (80.0%). The 10 – 19 years group recorded 30 positives out of 56 examined (53.6%), while the 20 – 29 years group had 27 positives out of 58 examined (46.6%). Prevalence remained high among adults, with 17 positives recorded in the 30 – 39 years group (44.7%). The 40 – 49 years group had 2 positives out of 17 examined (11.8%), while 50 – 59 years recorded 3 positives out of 7 examined (42.9%), indicating a spike in this age category. Among individuals aged 60 years and above, 5 of the 9 examined were positive (55.6%), showing that the older population in Aboh was also significantly affected.

DISCUSSION

The findings of this study indicate that malaria remains endemic in Aniocha South Local Government Area of Delta State, Nigeria. The continued presence of malaria transmission is strongly supported by the high abundance of mosquito vectors and the prevalence of malaria parasites observed across the study locations. These two factors are closely interconnected and together can create a conducive environment for continuous transmission of the disease. This is consistent with the study by Enerijiofi *et al.* (2023).

The clear differences in malaria burden across the three study locations Ogwashi-Uku, Nsukwa, and Aboh communities, highlight some important spatial variations in both prevalence and parasite density. Among these communities, Aboh recorded the highest malaria prevalence as well as the

greatest parasite density, suggesting a more intense level of transmission compared to the other areas. In Ogwashi-Uku, the parasite density among infected individuals was estimated at 7,600 parasites per microliter of blood. Although malaria was present in this location, the burden appeared relatively lower when compared to the other study sites. A total of 39 cases of *Plasmodium falciparum* were identified in this area, reinforcing its role as the dominant malaria parasite species. In Nsukwa, malaria prevalence was notably higher and more diverse in terms of species composition, which is consistent with the work by Enerijiofi *et al.* (2024). The prevalence of *Plasmodium falciparum* was recorded at 28.0%, while *Plasmodium ovale* accounted for 11.0% of infections. Parasite density among infected individuals in Nsukwa reached 8,100 parasites/ μ L for *P. falciparum* and 1,300 parasites/ μ L for *P. ovale*. In total, 56 cases of *P. falciparum* and 22 cases of *P. ovale* were detected, indicating the co-circulation of multiple malaria parasite species within the area.

Aboh exhibited the highest malaria burden among all the locations studied. The prevalence of *Plasmodium falciparum* was 41.0%, while *Plasmodium ovale* was recorded at 7.0%. Parasite density levels were also highest in this area, with *P. falciparum* reaching 9,700 parasites/ μ L and *P. ovale* 500 parasites/ μ L among infected individuals. The number of detected cases further emphasized this trend, with 82 cases of *P. falciparum* and 14 cases of *P. ovale* recorded. These findings strongly suggest that Aboh experiences more intense and sustained malaria transmission. The findings of this study revealed a higher prevalence of malaria infection when compared to the report by Ekesiobi *et al.*, (2009), who documented a relatively lower infection rate of 6.44% for *Plasmodium falciparum*. Also, the characteristic parasite density among infected individuals in the study locations is significantly higher than the 285 parasites/ μ L of blood average reported by Aina

et al., 2013. This observed difference suggests that malaria transmission intensity may vary significantly across different study areas and time periods.

The observed differences in malaria prevalence and parasite density across the three locations were statistically significant ($p < 0.05$). These variations may be explained by several underlying factors, including differences in environmental conditions such as the presence of stagnant water bodies that support mosquito breeding, variations in vector density, levels of sanitation, and access to preventive and treatment measures like insecticide-treated nets and effective antimalarial drugs.

Across all study sites, *Plasmodium falciparum* was the predominant species identified. This aligns with existing knowledge that *P. falciparum* is the most widespread and clinically significant malaria parasite in Nigeria and across sub-Saharan Africa, where it is responsible for the majority of severe malaria cases and related complications. Happi *et al.*, 2009 in their study reported also a predominant *Plasmodium spp.* of *P. falciparum*, which is the most virulent and also has the greatest propensity for developing resistance. The presence of *Plasmodium ovale* in both Nsukwa and Aboh, although at lower prevalence rates, indicates that multiple malaria parasite species continue to circulate within these communities. This highlights the need for comprehensive malaria control strategies that address not only the dominant species but also less prevalent ones that may contribute to persistent transmission.

Gender-based analysis revealed slightly higher malaria prevalence among females than males across all study locations, although the differences were not statistically significant ($p < 0.05$). The difference between the two groups (Male and Female) in the areas was more noticeable at Aboh other than in Ogwashi-Uku and Nsukwa, indicating that certain environmental or socio-behavioral factors in Aboh may contribute to increased malaria risk among females. The finding of this study

differs slightly from reports by Salisu and Abdulhadi (2015), who observed higher prevalence among males, but aligns with findings by Ocheje and Dogara *et al.*, (2016), who reported higher malaria prevalence among females. These variations may be influenced by gender-specific roles and behaviors, such as prolonged indoor exposure, childcare responsibilities, or sleeping patterns that increase contact with mosquito vectors, particularly in areas with poor housing conditions.

Age-specific analysis demonstrated that malaria prevalence was highest among younger age groups in Ogwashi-Uku and Nsukwa, with prevalence declining progressively with increasing age. This pattern is consistent with established epidemiological trends, where children and adolescents bear the highest burden of malaria due to lower acquired immunity. However, in Aboh, malaria prevalence remained high across almost all age groups, including older adults. This deviation from the expected pattern suggests intense and persistent transmission, likely driven by high vector density and inadequate control measures. The elevated prevalence among individuals aged 10–19 years may be attributed to increased outdoor activity, reduced compliance with protective measures, and greater exposure to mosquito bites during peak biting periods. The findings from this study indicate a slightly lower malaria infection rate compared to the results reported by Igbo-dika *et al.*, (2014), where individuals within the age group of 24–27 years recorded the highest prevalence of malaria infection. This variation may be attributed to differences in environmental conditions, study locations, sample size, and the level of exposure to mosquito vectors across the populations studied.

Conclusion

This study investigated the prevalence of malaria among selected participants in Aniocha South Local Government Area of Delta State. The results showed that malaria remains a major health concern in the area, with variations in prevalence and parasite density across the three communities

studied. Ogwashi-Uku recorded a malaria prevalence of 21%, with only *Plasmodium falciparum* detected among infected individuals. The parasite density in this community was 7,600 parasites/ μ L of blood. In Nsukwa, malaria prevalence was 28% for *P. falciparum* and 11% for *P. ovale*, with parasite densities of 8,100 parasites/ μ L and 1,300 parasites/ μ L, respectively. Aboh had the highest malaria burden, with prevalence rates of 41% for *P. falciparum* and 7% for *P. ovale*. Parasite densities in Aboh were 9,700 parasites/ μ L for *P. falciparum* and 500 parasites/ μ L for *P. ovale*. The study further revealed that *P. falciparum* was the dominant malaria parasite species in all communities. A total of 39 cases of *P. falciparum* were detected in Ogwashi-Uku, while Nsukwa recorded 56 cases of *P. falciparum* and 22 cases of *P. ovale*. In Aboh, 82 cases of *P. falciparum* and 14 cases of *P. ovale* were identified. Malaria prevalence also varied by age and gender. Finally, the findings indicate that malaria transmission is still prevalent in Aniocha South, particularly in Aboh, and that *Plasmodium falciparum* remains the most common and significant malaria parasite species in the area. These results highlight the need for strengthened malaria prevention and control measures to reduce the burden of the disease in the affected communities.

Availability of data and materials

The authors affirm that all the data generated from the findings are fully available without restriction.

Ethical consideration

An ethical approval for this study was obtained from Aniocha South Local Government secretariat.

The Permission was obtained to carry out the study in the communities.

Competing interests

The authors declare that they have no competing interests.

REFERENCE

- Adefioye, O. A., Adeyeba, O. A., Hassan, W. O., and Oyeniran, O. A. (2007). Prevalence of malaria parasite infection among pregnant women in Osogbo, Southwest, Nigeria. *American Euroasian Journal of Scientific Research*, 2(1):43-45.
- Aina, O.O, Agomo,C.O, Olukosi, Y.A, Okoh, H.I, Iwalokun, B.A, EgbunaK.N, (2013). Malariometric survey of Ibeshe community in Ikorodu, Lagos state: dry season, *Malaria Research and Treatment*, 487250.
- Ashley, E.A., Dhorda, M., Fairhurst, R.M., Amaratunga, C., Lim, P., Soun, S., and Dondorp, A.M. (2014). Spread of artemism resistances in plasmodium falciparum malaria. *New England Journal of medicine*, 371(5): 411-423.
- Bhatt S, Weiss DJ, Cameron E, Bisanzio D, Mappin B, and Dalrymple U, (2015). The effect of malaria control on Plasmodium falciparum in Africa between 2000 and 2015. *Nature*, 526: 207–211.
- Cheesbrough, M. (2003). *District Laboratory Practice in Tropical Countries* (Part 1). Cambridge University Press.
- Ekesiobi, A., Igbodika, M., and Njoku, O. (2009). Co-infection of malaria and typhoid fever in a tropical community. *Animal Research International*, 5(3).
- Enerijiofi, K. E., Musa, S.I., Igiebor, F.A., Lawani, M., Chuka, N.E., Odozi, E.B. and Ikhajiagbe, B. (2024). Nanotechnological approaches for enhanced microbial activities, sustainable agriculture, and the environment. *Sustainable Agriculture: Nanotechnology and Biotechnology for Crop Production and Protection*. Berlin, Boston: De Gruyter. Pp 153-184. <https://doi.org/10.155/9783111234694-009>
- Enerijiofi, K. E., Musa, S.I., Okolafor, F.I., Okolafor, Francis Aibuedefe Igiebor, Efota Bright Odozi and Beckley Ikhajiagbe (2023). Sustainable approaches for the remediation of agrochemicals in the environment. In: Ogwu, M.C., Chibueze Izah, S. (eds) *One Health Implications of Agrochemicals and their Sustainable Alternatives, Sustainable Development and Biodiversity*. Vol 34. Springer Nature, Singapore Pte Ltd. https://doi.org/10.1007/978-981-99-3439-3_19
- Francis Aibuedefe Igiebor, Edokpolor Osazee Ohanmu, Gloria Omorowa Omoregie, Ojo Otokiti Jennifer, S.I. Musa, Denzel Ejale, Nathaniel Okojie, Richard Afe, Stanley Ivbobie,

- Beckley Ikhajiagbe (2024). Nanobioherbicides and plant growth hormones synthesis and stress-mediated hormones. 6. <https://doi.org/10.1002/9781394234769.ch20>
- Greenwood, B.M., and Armstrong, J.R.M. (1991). Comparison of Two Simple Methods for Determining Malaria Parasite Density. *Transactions of the royal Society of Tropical Medicine and Hygiene*, **85**(2): 186-188.
- Happi, C.T, Gbotosho, G.O, Folarin O.A, Sowunmi, A, Hudson, T, O'Neil, M, Milhous, W, Wirth, D.F, Oduola, A.M.J, (2009). Selection of Plasmodium falciparum multi-drug resistance gene 1 alleles in asexual stages and gametocytes by artemether-lumefantrine in Nigerian children with uncomplicated *falciparum* malaria” *Journal of Antimicrobial Agents and Chemotherapy*, **53**: 888-895.
- Igbodika, M.C., Ekesiobi, A.O., Nwosu, M.C., Ibemenuga, K.N. and Obianika, S.O. (2014). Placental Malaria Infection among Pregnant Women in Tropical Rural Community. *Tropical Journal of Applied Natural Sciences*. **1**(1): 81.
- Ikhajiagbe, B. and Musa, S.I. (2020b). Studies on foliar bioconcentration of metals by *Vernonia amygdalina* in a model heavy metal-polluted soil. *Studia Universitatis-Vasile Goldis, Seria Stiintele Vietii*. **30**(2): 64 – 68.
- Kweka, E.J., Kimaro, E.E., Munga, S., (2016). Effect of deforestation and land use changes on mosquito productivity and development in Western Kenya Highlands: implication for malaria risk. *Front Public Health*, **4**:238.
- Mabaso, M.L.H., Craig, M., Ross, A., and Smith, T. (2007). Environmental predictors of the seasonality of malaria transmission in Africa: the need for an integrated approach. *Acta tropica*, **102**(2): 106 – 114.
- Mattah, P.A.D., Futagbi, G., Amekudzi, L.K., Mattah, M.M., de Souza, D.K., Kartey-Attipoe W.D. (2017). Diversity in breeding sites and distribution of Anopheles mosquitoes in selected urban areas of southern Ghana. *Parasite Vectors*, **10**(1):25.
- Musa Saheed Ibrahim, Nathan Moses and Beckley Ikhajiagbe (2022). Seed priming with phytohormones. Plant hormones: Recent Advances, New Perspectives and Applications. IntechOpen, London. <https://doi.org/10.5772/intechopen.102660>
- Muturi, E.J., Shililu, J., Jacob, B., Gu, W., Githure, J., Novak, R., (2006). Mosquito species diversity and abundance in relation to land use in a riceland agroecosystem in Mwea, Kenya. *J Vector Ecol.*, **31**(1):129–37. 15.

- National Malaria indicator survey (NMIS). (2021). *Nigeria Malaria Indicator Survey 2021*. Abuja: Federal Ministry of Health.
- Norgan, A.P, Arguello, H.E, Sloan, L.M, Fernholz, E.C, and Pritt, B.S, (2013). *Malaria Journal* **12**: 231.
- Ocheje, A. J. and Dogara, M.M. (2016). Prevalence of malaria and risk factors among patients attending Dutse General Hospital, Jigawa State, Nigeria. *International Research Journal of Public and Environmental Health* **3** (11): 270-277.
- Salisu, A., Abdulhadi, Y., (2015). Prospective Study on the incidence of malaria parasite infection among children (0- 15 Years Age) attending Dutse General Hospital, Jigawa State, Nigeria. *Nigerian Journal of Microbiology.*, **28**: 2915 - 2918.
- Sinka, M.E., Bangs, M.J., Manguin, S., Coetze, M., Mbogo, C.M., Hemingway, J., and Hay, S.I. (2010). The dominant Anopheles vectors, of human malaria in Afric, Europe and the Middle East: Occurrence data, distribution maps and bionomics précis. *Parasites and vectors* **3**: 117.
- Trusting, L. S., Gething, P.W., Gibson, H.S., Greenwood, B., Knudsen, J., Lindsay, S.W., and Bhatt, S. (2017). Housing and child health in sub-Saharan Africa: A cross- sectional analysis. *PLoS. Medicine*, **14**(3):22-34
- World Health Organization (2024). Insecticide-Treated Mosquito Net. <https://www.who.int/news-room/feature-stories/detail/expanded-use-of-new-dual-insecticide-nets-offers-hope-for-malaria-control-efforts-in-africa>
- World Health Organization (WHO). (2023). *World Malaria Report 2023*. <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>