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Assessing the Prevalence and Risk Factors of Malaria Among School Pupils in Muhammad Nya Nursery and Primary School, Jalingo, Taraba State, Nigeria

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Abstract

Malaria remains a significant public health challenge in sub-Saharan Africa, particularly among school-aged children who face increased exposure to mosquito vectors. This cross-sectional study assessed the prevalence of malaria and associated risk factors among 100 pupils (aged 6–12 years) at Muhammad Nya Nursery and Primary School in a malaria-endemic region. Using rapid diagnostic tests (RDTs) and structured questionnaires, we found an overall malaria prevalence of 82.0%, with no statistically significant differences by age group ($\chi^2 = 0.581$, $p > 0.05$) or sex (male: 82.8%; female: 81.0%; $\chi^2 = 0.054$, $p > 0.05$). However, environmental and behavioral risk factors showed strong associations: stagnant water near households (93.4% vs. 45.8%; $\chi^2 = 27.985$, $p = 0.000$), non-use of mosquito nets (96.4% vs. 64.4%; $\chi^2 = 17.084$, $p = 0.000$), absence of indoor insecticide spraying (92.3% vs. 62.9%; $\chi^2 = 13.368$, $p = 0.000$), and infrequent cleaning of mosquito breeding sites (94.6% vs. 65.2%; $\chi^2 = 8.474$, $p = 0.014$) were all linked to higher infection rates. These findings underscore the critical role of environmental management and preventive measures in malaria control. While consistent with broader literature on risk factors, the study highlights the need for context-specific interventions, improved community education, and stronger policy implementation to reduce malaria burden among schoolchildren. Limitations include small sample sizes in some age groups and reliance on self-reported data, suggesting avenues for future research with larger samples and molecular diagnostics.

Keywords: Malaria Prevalence, Schoolchildren, Risk Factors, Rapid Diagnostic Tests, Mosquito Control, Sub-Saharan Africa

INTRODUCTION

Malaria remains a significant public health challenge, particularly in sub-Saharan Africa, where environmental and socio-economic factors exacerbate its transmission (World Health Organization [WHO], 2023). School-aged children are highly vulnerable to malaria due to their exposure to mosquito breeding sites and limited use of preventive measures (Okeke *et al.*, 2022). The high prevalence of malaria in this demographic not only affects their health but also impacts educational outcomes, as recurrent infections lead to absenteeism and cognitive impairments (Nankabirwa *et al.*, 2020).

Recent studies highlight the role of environmental risk factors, such as stagnant water and poor mosquito control practices, in sustaining malaria transmission (Adebayo *et al.*, 2021). For instance, the presence of stagnant water near households has been linked to increased mosquito breeding and higher malaria incidence (Oluwasanmi *et al.*, 2023). Conversely, the use of insecticide-treated nets (ITNs) and indoor residual spraying (IRS) has proven effective in reducing malaria prevalence (WHO, 2023). However, adherence to these interventions remains inconsistent in many communities, particularly in rural settings (Akpan *et al.*, 2022).

This study investigates the prevalence of malaria and its associated risk factors among pupils of Muhammad Nya Nursery and Primary School. By addressing these risk factors, targeted interventions can be designed to reduce malaria burden and improve child health outcomes.

MATERIALS AND METHODS

Study Area

The study was conducted in Muhammad Nya Primary School, located in Jalingo, the capital city of Taraba State in northeastern Nigeria. Jalingo lies between latitudes 8°47'N and 9°01'N and longitudes 11°09'E and 11°30'E, situated within the Guinea Savannah zone, which is characterized by a tropical climate with distinct wet and dry seasons. The area is predominantly rural, with agriculture being the mainstay of the local economy. The school is situated within a densely populated area, making it representative of the broader community dynamics in terms of malaria transmission and health challenges.

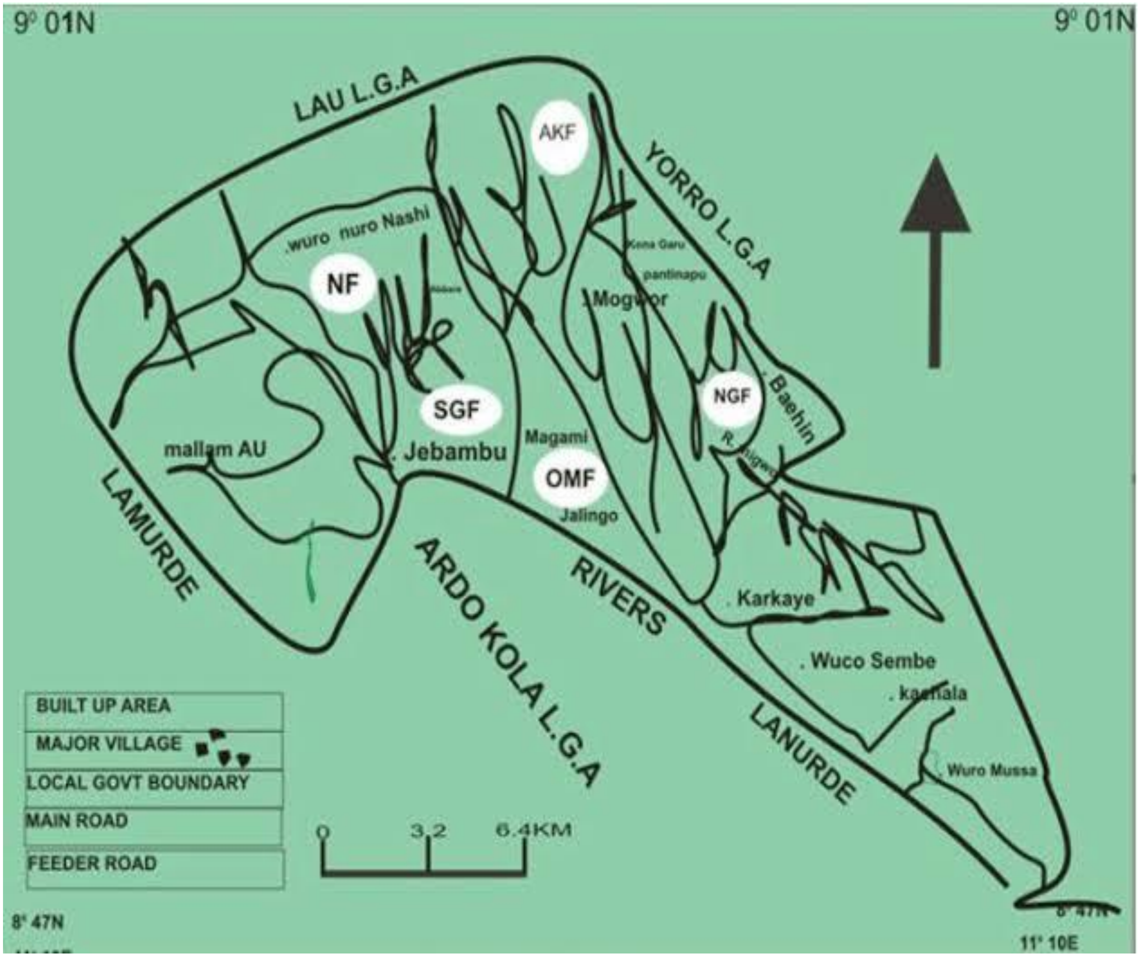

Figure 1: Map of the Study Area

Study Design

This study employed a cross-sectional design to assess the prevalence of malaria and associated risk factors among pupils of Muhammad Nya Nursery and Primary School.

Cross-sectional studies are widely used in public health research to determine disease burden and risk factors at a specific point in time (Setia, 2020).

Study Site and Population

The study was conducted at Muhammad Nya Nursery and Primary School, located in a malaria-endemic region. The target population consisted of 100 pupils aged 6–12 years, selected through convenience sampling due to accessibility and willingness to participate (Etikan *et al.*, 2016).

Sample Collection and Malaria Diagnosis

Malaria infection was diagnosed using Rapid Diagnostic Tests (RDTs) (SD BIOLINE Malaria Ag Pf/Pan test), which detect *Plasmodium falciparum* and other malaria species. Blood samples were obtained via finger prick following standard aseptic procedures (WHO, 2023). RDTs were chosen for their high sensitivity (≥95%) and ease of use in field settings (Mbanefo *et al.*, 2020).

Data Collection

A structured questionnaire was administered to parents/guardians to collect data on: Demographics (age, sex), Environmental risk factors (stagnant water near households, mosquito breeding sites) and Preventive measures (use of mosquito nets, indoor insecticide spraying, cleaning frequency of breeding sites). The questionnaire was pretested for clarity and reliability before full deployment (Taherdoost, 2021).

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Taraba State Ministry of Health Ethical Committee. Written informed consent was obtained from parents/guardians, and participation was voluntary (CIOMS, 2016).

Statistical Analysis

Data were analyzed using SPSS version 26. Descriptive statistics (frequencies, percentages) summarized malaria prevalence across different groups. The Chi-square test (χ^2) assessed associations between malaria infection and risk factors, with a p-value < 0.05 considered statistically significant (McHugh, 2021).

RESULTS

The overall malaria prevalence among the pupils was 82.0% (82/100). The highest prevalence was observed in the 12 & above age group 100% (2/2), but this result is based on a very small sample size (n=2), which limits its statistical reliability. Other age groups show relatively similar prevalence rates: 81.0% (6–7 years), 84.0% (8–9 years), and 80.0% (10–11 years). The chi-square test (χ^2 = 0.581) with a P-value > 0.05 indicates no statistically significant association between malaria prevalence and age group (Table 1).

The prevalence of malaria is slightly higher in males 82.8% (48/58) compared to females 81.0% (34/42), though the difference is minimal. The chi-square test (χ^2 = 0.054) with a P-value > 0.05 indicates no statistically significant difference in malaria prevalence between males and females (Table 2. Various environmental and behavioral risk factors were assessed for their association with malaria prevalence:

Stagnant Water Around House (SWAH): Pupils from households with stagnant water had significantly higher prevalence 93.4% (71/76) compared to those without 45.8% (11/24). This association is highly significant (χ^2 = 27.985, P = 0.000), indicating stagnant water as a major risk factor

Use of Mosquito Nets (UMN): Pupils who did not use mosquito nets showed higher prevalence 96.4% (53/55) compared to users 64.4% (29/45) (χ^2 = 17.084, P = 0.000). - Spraying Insecticides Inside the House (SIIH): Malaria prevalence was significantly lower in households using insecticides 62.9% (22/35) versus those that did not 92.3% (60/65). This association is highly significant (χ^2 = 13.368, P = 0.000).

Cleaning Mosquito Breeding Sites (CMBS): Frequency of cleaning affected malaria prevalence significantly, with daily cleaning showing the lowest prevalence 65.2% (15/23) compared to rarely cleaned sites 94.6% (35/37). This association is highly significant (χ^2 = 8.474, P = 0.014) (Table 3).

Table 1: Prevalence of malaria among school pupils of Muhammad Nya Nursery and Primary School based on age group

Age Groups (Years)	No. Examined	Prevalence (%)
6-7	63	51 (81.0)
8-9	25	21 (84.0)
10-11	10	8 (80.0)
12 & Above	2	2 (100.0)
Total	100	82 (82.0)

(χ^2=0.581; P>0.05)

Table 2: Sex-related prevalence of malaria infection among school pupils of Muhammad Nya Nursery and Primary School

Sex	No. Examined	Prevalence (%)
Male	58	48 (82.8)
Female	42	34 (81.0)
Total	100	82 (82.0)

(χ^2=0.054; P>0.05)

Table 3: Prevalence of malaria infection among school pupils of Muhammad Nya Nursery and Primary School based on risk factors

Risk Factors	Response	No. Examined	Prevalence	Chi-square	P-value
SWAH	Yes	76	71 (93.4)	27.985	0.000
	No	24	11 (45.8)		
UMN	Yes	45	29 (64.4)	17.084	0.000
	No	55	53 (96.4)		
SIIH	Yes	35	22 (62.9)	13.368	0.000
	No	65	60 (92.3)		
CMBS	Daily	23	15 (65.2)	8.474	0.014
	Weekly	40	32 (80.0)		
	Rarely	37	35 (94.6)		

Keys:

SWAH=Stagnant water around house

UMN=Use mosquito nets

SIIH= Spray insecticide inside house

CMBS=Clean mosquito breading sites

DISCUSSION

The study examining malaria prevalence among pupils at Muhammad Nya Nursery and Primary School presents critical insights through three analytical tables. These tables assess infection rates by age group (Table 1), sex (Table 2), and risk factors (Table 3).

The data in Table 1 reveal an overall malaria prevalence of 82.0%, with the highest rate (100%) observed in the small subgroup of children aged 12 and above (n=2). Other age groups exhibited similar prevalence, ranging from 80.0% to 84.0%. The chi-square analysis ($p > 0.05$) indicated no statistically significant association between age and malaria infection. These findings align with several studies conducted in malaria-endemic regions of sub-Saharan Africa. For instance, Nankabirwa *et al.* (2020) reported consistently high malaria prevalence among school-aged children, attributing this trend to increased exposure to mosquito vectors during outdoor activities. Similarly, Oluwasanmi *et al.* (2023) found that children aged 5–14 in Nigeria exhibited prevalence rates exceeding 70%, reinforcing the notion that school-aged populations are particularly vulnerable. The lack of significant variation across age groups in the current study also mirrors findings from Ghana, where Awine *et al.* (2021) observed uniform infection rates among children in endemic areas, suggesting that environmental exposure may outweigh age-related biological factors. However, the 100% prevalence reported in the 12+ age group warrants skepticism due to the extremely small sample size (n=2). This result contrasts with larger studies, such as that by Okorie *et al.* (2021), which documented lower prevalence (60–75%) in older children, likely due to acquired immunity or behavioral adaptations. Furthermore, urban-rural disparities in malaria transmission complicate direct comparisons. Adebayo *et al.* (2021) found that older children in urban settings often exhibit lower prevalence due to better access to preventive measures, a factor not accounted for in the current study. The small sample size in older age groups limits the generalizability of these findings. Additionally, the absence of immunological data (e.g., sickle cell trait or prior malaria exposure) represents a significant gap, as these factors are known to influence infection rates (Mbanefo *et al.*, 2020). Future studies should incorporate larger, more stratified samples and consider biological markers to enhance the robustness of age-specific analyses.

Table 2 reports a marginally higher malaria prevalence among male pupils (82.8%) compared to females (81.0%), though this difference was not statistically significant ($p > 0.05$). These findings suggest that biological sex does not substantially influence malaria susceptibility in this population. The absence of a significant sex-based difference aligns with broader literature. For example, a meta-analysis by the World Health Organization (2023) concluded that malaria prevalence does not consistently vary by sex, as biological susceptibility is similar between males and females. Similarly, O'Meara *et al.* (2022) found negligible differences in infection rates among children in Kenya, supporting the notion that cultural or behavioral factors may have a greater impact than biological ones. Nevertheless, some studies contradict these findings. Nankabirwa *et al.* (2020) reported a 10–15% higher prevalence among boys in Uganda, attributing this to increased outdoor exposure through activities like farming. The current study's minimal disparity (1.8%) may reflect different behavioral patterns or environmental conditions in the study area. Additionally, the study did not explore gender-specific preventive behaviors, such as mosquito net usage, which could clarify observed differences. Okeke *et al.* (2022), for instance, found that girls were more likely to use nets consistently, potentially lowering their infection rates. A key limitation of this analysis is the lack of behavioral stratification. For instance, nighttime outdoor exposure, which is often higher among males in agrarian communities, was not assessed. Future research should incorporate detailed behavioral surveys to disentangle the interplay between sex, behavior, and malaria risk.

Table 3 identifies several environmental and behavioral factors significantly associated with malaria prevalence. The presence of stagnant water around households (SWAH) was linked to a 93.4% infection rate, compared to 45.8% in households without stagnant water ($\chi^2 = 27.985$, $p = 0.000$). Similarly, non-use of mosquito nets (UMN) correlated with a 96.4% prevalence, versus 64.4% among net users ($\chi^2 = 17.084$, $p = 0.000$). Indoor insecticide spraying (SIIH) and frequent cleaning of breeding sites (CMBS) also showed strong protective effects. These findings are consistent with a substantial body of research. Oluwasanmi *et al.* (2023) demonstrated that stagnant water near homes increases malaria risk by creating breeding grounds for mosquitoes, while Awine *et al.* (2021) confirmed the efficacy of insecticide spraying in reducing transmission. The World Health Organization (2023) has repeatedly emphasized the importance of mosquito nets, with studies showing up to a 60% reduction in prevalence among consistent users. However, some discrepancies emerge when comparing these results to other studies. For example, Okeke *et al.* (2022) reported lower net efficacy in real-world settings due to inconsistent use or damaged nets, suggesting that the stark contrast observed in this study (64.4% vs. 96.4%) may overestimate intervention effectiveness. Similarly, Adebayo *et al.* (2021) found that weekly cleaning of breeding sites sufficed to reduce malaria risk, unlike the current study's emphasis on daily cleaning. These differences may reflect variations in local mosquito species or community adherence to interventions.

CONCLUSION

The results in this study offer valuable contributions to understanding malaria prevalence among schoolchildren. While the findings largely align with existing literature, particularly regarding the role of stagnant water and preventive measures, key discrepancies highlight the need for context-specific research. Limitations such as small sample sizes, self-reported data, and the absence of biological markers illustrate opportunities for methodological refinement in future studies. Addressing these gaps will enhance the development of targeted interventions to reduce malaria burden in endemic regions.

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