BADEGGI JOURNAL OF AGRICULTURAL RESEARCH AND ENVIRONMENT, 2026, 07(01), 1 – 8

NCRI Press

Available online: www.ncribjare.org
ISSN: 2695-2122, e-ISSN: 2695-2114
DOI: https://doi.org/10.35849/BJARE202601/213/01
Journal homepage: www.ncribjare.org

Research Article

A cross-Sectional study of factors Associated with Malaria Prevalence among Rice Farmers in Badeggi and its environs

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Abstract

Malaria is one of the major tropical diseases associated with irrigation schemes, and changes in the transmission pattern of the parasites following irrigation development have been a perennial subject of debate. The economic importance of malaria parasites amongst rice farmers was compared in terms of demographic analysis and prevalence. A pretested questionnaire was used to collect socio-demographic data of factors associated with malaria prevalence. Three hundred (300) rice farmers were randomly selected to participate in this study from 10 Badeggi Communities; Majingari, Emidogo, Emisu, Ndawangwa, Mana, Ndaloke, Chanchaga, Badeggi, Emilugi and Kusotachi. Of all the study participants, (50.13%) had above primary school certificate in Emilugi the highest, while Majingari had the lowest (11.14%) of participants that had certificate above primary education The age groups of 15–40 years (26.8%) and 41–60 years (22.5%) had the highest prevalence of Plasmodium parasites. Abuse of anti-malarial drugs showed highest participants in Mana having (83.5%), while the least participants are Chanchaga having (61.2%). Demographic analysis showed that, Mana with (62.5%) had the most positive females with mean age of 33, while the least was Emilugi with (11.2%). Participants in Ndawagwa have a higher rate (16%) of using mosquito nets than Emidogo with (14.6%). Data for sleeping on time showed that Kusotachi was the highest with (17.59%) participants, the least was Ndaloke having only (3.7%) participants. Malaria prevalence varied significantly by sub-village of residence closeness to waterlogged farm Study participants who reported not using mosquito nets. Those sleeping late and reside close to waterlogged farms had the highest prevalence of malaria parasites and had higher geometric mean parasite densities than those who do not use any demographic control methods, this is vital in reducing malaria spread towards enhancing mosquito free rice production.

Keywords: Malaria, Parasites, Plasmodium, Resistance, Rice Farmers.

Introduction

Agrarian settlements like Badeggi possess lots of factors that predispose the populace to malaria. Specifically, management of irrigation in rice farming has contributed to environmental problems, including water adoption, water quality reduction and water logging, some of these problems encourage the breeding of mosquitoes which is the vector of *Plasmodium* parasite that causes malaria infection (John *et al.,* 2012).

Due to the high level of malaria parasites among Badeggi rice farmers, leading to some reported mortality cases, there is therefore a need to study the socio-demographic risk factors responsible for the infections, which includes, educational status, age, gender, use of nets, sleeping time, abuse of antimalarial drugs for prophylaxis and proximity to water.

Any one of the four species of tiny *Plasmodium* protozoan parasites can cause malaria among the rice farmers, which can be acute or chronic. Tajudeen and Tolupe (2018) stated that depending

Received on 31st March, 2025; Revised 1st November, 2025; Accepted 24th November, 2025 and Published on 1st August, 2026

on the species of *Plasmodium* involved and the state of the host at the time of infection, human malaria infections can range from a mild illness to a severely deadly condition reducing their ability to work on their rice farms. Fever and flu-like symptoms from malaria can include chills, headache, muscular aches, and exhaustion. one might also experience diarrhea, vomiting, and nausea. When an Anopheles mosquito bites a rice farmer, it transmits parasites from human to mosquito to human. According to a 2013 report from the World Health Organization (WHO 2012), mosquito-borne infections are a severe public health issue among many irrigated and rain fed rice farmers. It has been suggested that a number of mosquito vectors from various genera and species are responsible for the spread of dangerous diseases. According to WHO (2015), mosquitoes are thought to cause the deaths of roughly 1 in 17 individuals and spread diseases to more than millions of agrarian rice farmers annually. The objectives emphasize that malaria parasites are a major public health problem and cause of much suffering and premature death in the poorer areas of tropical Africa, Asia and Latin America particularly among agrarian rice farmers. Lowland rice farmers are prone to malaria infection due to their exposure to work in waterlogged areas, which are largely mosquito breeding sites. There is therefore the need to study the factors associated with proliferation of the *Plasmodium* parasites among Badeggi rice farmers

Materials and Methods

A cross-sectional study design and clustered random sampling technique were used in this study. Ten (10) communities including Badeggi village and others around Badeggi were selected. Participants were approached randomly in the selected communities and only those that gave consent were administered questionnaire and their blood samples taken within the ten locations selected. These ten locations represented the two major rice growing ecologies; irrigated and lowland rain fed. Within the ten locations, rice farmers were the subjects under consideration. Age, regular use of mosquito nets, proximity of houses to waterlogged farms, sleeping time, indiscriminate use of ACT medication, Sex and educational qualifications of the farmers with certificate above Primary school were carried out for each household.

This study was conducted among rice farmers in Badeggi area, Katcha LGA, with land area of 4,218.5km^2, Population of 110,127.76 and a density of 50, Niger State with 59sq km 26,363km^2 area, located within Longitude (9.0453^{0}N and Latitude (6.5703^{0}E) above sea level in the southern Guinea savanna ecological zone of Nigeria, with humidity of 80^{0}C and annual rainfall of 1,296.7mm in 2023, from January 2022 through November 2023. Ten (10) Communities were randomly selected for the study, these were: Emilugi, Majingari, Emitsu, Ndaloke. Ndawangwa, Mana, Emidogo, Kusotachi, Badeggi and Chanchaga. Active Rice farmers (issued the questionnaire) in their farms and some who patronized the drug selling chemist for diagnosis and treatment were recruited for this research. Fisher's formula was used to determined sample size taken at 300 farmers. National Cereals Research Institute (NCRI) Badeggi's Health care center and Umaru Sanda hospital laboratories were used to carry out the required diagnostic test and identification.

Finger prick Blood samples were collected and the test device was removed with the dropper and the foil pouch place on top of a flat dry surface, then was gradually put in 10ml (1 drop) of entire blood in the sample well and 70ul (2 drops) of the assay diluents was added. The change colour was observed to determine negative or positive result if it's moving transversely in the result window to the centre of the test device indicating a positive or negative result; the test result was confirmed after 15-20 minutes.

A drop of blood was placed on a clean slide and allowed to dry. It was stained with dilute 5% Giemsa stain and allowed to stand for 20 minutes, rinsed the film with buffered water for 3 minutes. The slide was allowed to air dry in a vertical position and examine under light microscope using x100 oil immersion objective lens. Staining of thin blood film was carried out to confirm the *Plasmodium* species if it is not clear from the thick film. The blood cells were fixed in a thin film and spread with another grease free slide, enabling the parasites to be seen in the red cells. Parasitized red cells become enlarged, oval in shape, or stippled. These features helped to identify *Plasmodium* species. Examination of a thin film greatly assists in the identification of mixed infections.

Results and Discussion

A pretested questionnaire was used to collect socio-demographic data of factors associated with malaria prevalence in the ten studied communities;

Educational qualification of the farmers with certificate above Primary school for each household. Of all the study participants, (50.13%) had above primary school certificate in Emilugi and Mana (47.35%), while Majingari had the lowest (11.14%) participants that had certificate above primary education (Figure 1). This could be the reason for the significant difference noticed (P=0.0160399, t=12.9253, X^2=2.4649) in the prevalence of malaria among the rice farmers, due to lack of knowledge on proper medication, control and preventive measures that is not regularly being adhere to by the farmers, this could spike vector presence and increase infection status amongst them thus leading to high malaria prevalence in the lowly educated communities. Educational factor is associated with malaria prevalence among the rice farmers.

The mean age of participants from Emitsu was 40, which was the highest followed by Ndaloke with mean age of 38, while the least was Majingari with a mean age of 27 years. The mean age of the entire study cohort was 21.9 ± 19.69 years. The age groups of 15–40 years (26.8%) and 41–60 years (22.5%) had the highest prevalence of *Plasmodium* parasites, likely due to the fact that, it's their active years and they usually spend more time in their farms and stay outdoors longer than the others age groups. However, there was no significant difference (P =0.639374, t= 8.925214, X^2=0.239729) and not associated with the prevalence of malaria between age groups of participants, even 61-80 years (18.5%) who spend more time indoors and spend less time in their farms, thus engaging in fewer activities in the community as shown in Figure 2.

Geo-referencing of case households widespread use of Artiminisinin combination therapy (ACT) anti-malarial drug showed that participants in Mana (83.5%) use (ACT) anti malaria drugs indiscriminately than participants in Ndaloke having (80.7%), the least participants that use (ACT) antimalarial drugs indiscriminately is Chanchaga having (61.2%) this could partly be responsible for their malaria levels as shown in Figure 3. Data analysis on the use of ACT drugs indiscriminately is not significantly different (P=0.1210, t= 5.191, X^2=2.3744) and is not a factor associated with malaria prevalence in the community which agrees with the findings of (Daressa *et al.,* 2004; Haldar *et al*., 2018) indiscriminate usage of antimalarial drugs without doctor's prescription leads to drug abuse thereby increasing the risk of drug resistance among rice farmers and also agreeing with WHO (2006) World report that only 3% of children in need of ACT medication has access to the drugs.

In all the rice field communities there is existence of well-established drug sales outlets easily accessible to the communities, but no well-established health infrastructure which is in agreement with Dondorp *et al*. (2009) that, this may contribute to the general lower level of malaria, although the growing problem of drug resistance will make control more difficult in the future. A total of 300 individuals participated in this study, of these, (24.23%) were females and (75.77%) were males. There was significant difference in the prevalence of plasmodium parasites between male and female participants, with males having a higher prevalence. Malaria prevalence varied significantly by sex (P = 0.011, t=0.06238, X^2=2.3816).

The prevalence of malaria in the sampled communities stratified according to sex is presented in Figure 4. The result showed that for male participants, malaria prevalence was significantly ($p < 0.05$) higher among Emidogo residents (92.86%) than their Ndawangwa counterparts (92.31%), with an overall prevalence of 92% respectively. While the least community with Male prevalence is Emilugi (58.82%) shown in figure 4; when compared with the sampled communities, Mana significantly ($p < 0.05$) had higher malaria prevalence among participants for both sexes (male: 22, 91.67%; female: 13, 81.75%) than the rest of the communities (Figure 4). The least in prevalence was Badeggi with a prevalence of 70.83% and 40.0% for males and females respectively.

A total of (20.89%) of the study participants reported to own and use mosquito nets. There was a significant difference and association in relation to the reported use of mosquito nets, with participants in Ndawangwa having a higher rate (16%) of using mosquito nets than Emidogo (14.6%) (P = 0.003) Figure 5, Study participants who reported not using mosquito nets had the highest prevalence of malaria parasites and had higher geometric mean parasite densities than those who reported using mosquito nets (X^2 =110.58, t =3.22, P =0.003). WHO (2006) world report agrees with this finding, that only 23% of children and 27% of pregnant women slept under bed net, malaria prevalence varied amongst sub-village of residence (P = 0.0479) and reported use of mosquito nets (P = 0.069) (Figure 5). This is in

agreement with Mwai *et al*. (2012) who discovered in his research work on malaria prevalence among rice farmers that, irrigation communities often have greater use of bed nets, better access to improved healthcare and receive fewer infective bites compared with those outside such development schemes, since people will often avoid receiving large numbers of bites by sleeping under a bed net or use some other means of protection. Malaria prevalence varies significantly by reported use of mosquito nets (P = 0.004) by females than their male counterparts.

Irrigated rice-growing communities in Badeggi and environs are exposed to greater malaria risk, as well as more mosquitos' bites due sleeping time and staying outdoors. Among the communities and ten sub-villages that were selected, Kusotachi was the highest with 17.59% participants, followed by Chanchaga with 15.74% participants; the least was Ndaloke having only 3.7% participants sleeping after 10pm, not significantly different amongst the communities ((P = 0.22216, t=1.087142, X2=1.79510(P = 0.22216, t=1.087142, X^2=1.79510) indicating that there is no association between sleeping time and malaria prevalence recorded in the community figure 6. Rice farming is considered to pose the greatest danger to health since it is grown in flooded conditions which provide ideal breeding sites for malaria mosquitoes. Malaria prevalence varied significantly by sub-village of residence closeness to waterlogged farm (P = 0.031). Geo-referencing of case households' proximity to waterlogged farms, was carried out (X^2= 0.6553, t= 3.671, correlation =1). Malaria prevalence varied significantly different by sub-village of residence (P = 0.031) indicating that there is an association between their residence and malaria prevalence in the community as shown in Table 1. Chi-square value(X^2) P =0.031showed that there is significant difference between the proximity of communities to water logged farms across the sampled location and is an associated factor.

Conclusion

The socio Demographic risk factors showed that education plays a key role in malaria control, knowledge on malaria control methods is vital and seen to be an associated factor in the communities. Age was however not a significant factor associated with malaria prevalence in the communities. Though many of them buy and use drugs across the counter it was not associated with malaria prevalence since it did not change their Plasmodium parasites status. Gender was a factor; it is expected that men are more active and participate in more outdoor activity and liable to more mosquito bites. Use of mosquito nets was a factor associated with malaria prevalence since women tend to use protective nets than most men. Sleeping time was not an associated factor probably because they may apply some control measure while outside. Proximity to water log farm was associated with malaria prevalence most likely because mosquitoes breeds and spreads to closer houses faster. Mana has the highest number of drug abuse cases, but from all the samples screened for malaria parasites were positive indicating that malaria is very low in the ten communities studied, but they should be encouraged to stop indiscriminate drug abuse by conducting malaria test and obtained recommendation from doctor before taking any antimalarial drug. Inadequate education and lack of knowledge on health information, non-regular use of bed nets, proximity to water logged farms, male gender's knowledge on malaria were associated risk factors for the malaria infections recorded, which is similar to most Nigerian rice farming villages. Irrigated rice-growing communities in many of this Badeggi area are exposed to greater malaria risk because of the socio-demographic factors highlighted and the causative risk factors indicated, as well as not taking proactive measures to prevent more mosquitoes' bites, which would be highly unfortunate. Nigerians cannot afford for this failure to occur.

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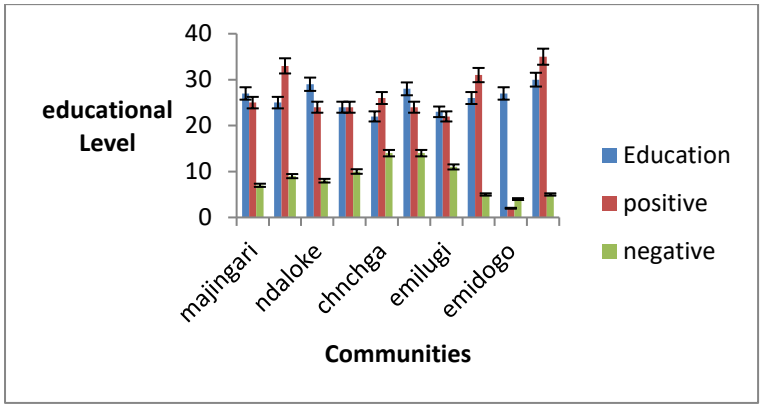

Figure 1: Educational level of the participants above Primary School and Malaria prevalence significantly higher (P = 0.01603) with heightened awareness of disease prevention measures and is a factor associated with malaria prevalence

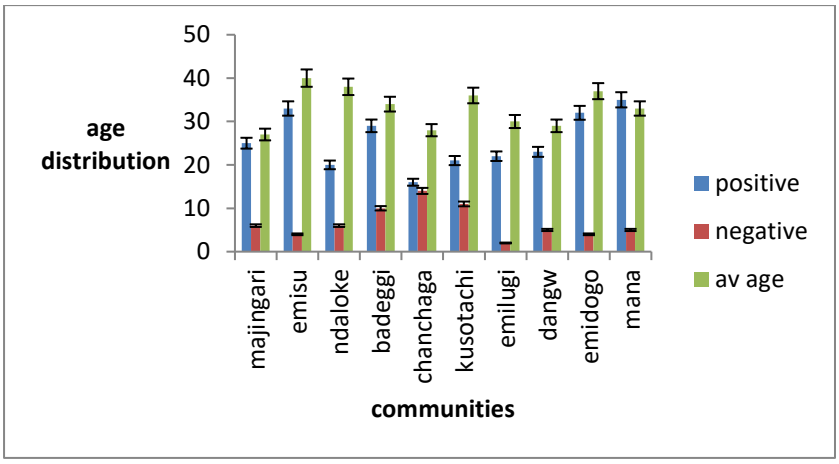

Figure 2: Age distribution of the participants in relation to malaria prevalence with no significant difference (P = 0.6393) not a factor associated with malaria status

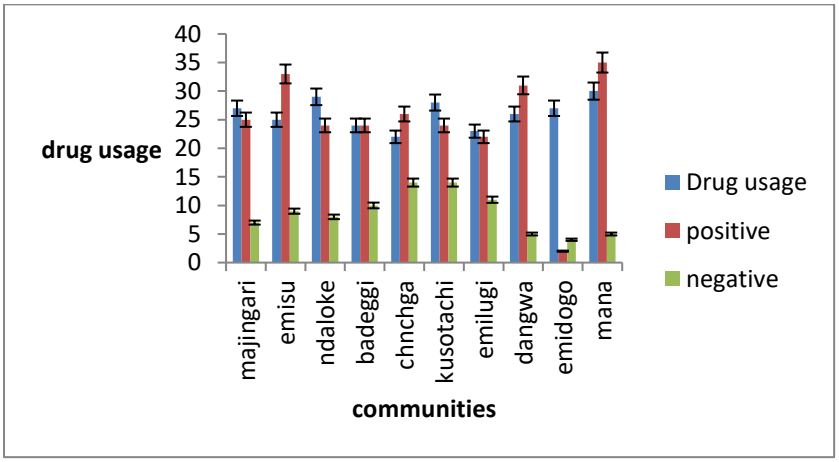

Figure 3: Indiscriminate use of ACT drugs among the rice farmers in the studied communities is not significantly different (P = 0.1210) and not a factor associated with malaria infectious status

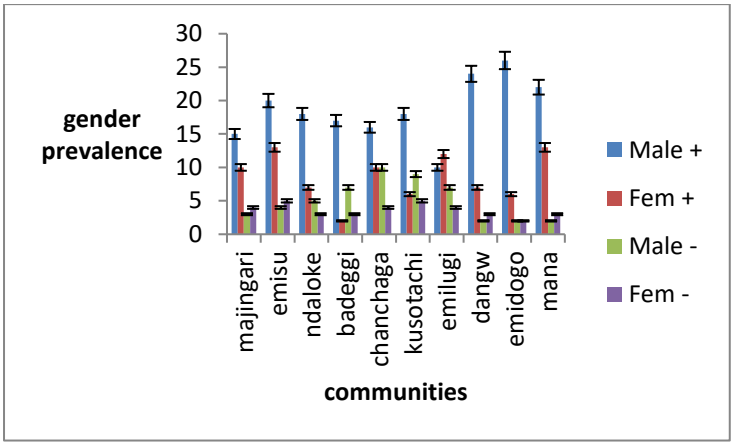

Figure 4: Prevalence of Gender based malaria infection status in the ten communities is significantly different (P = 0.011) and is a factor associated with malaria prevalence

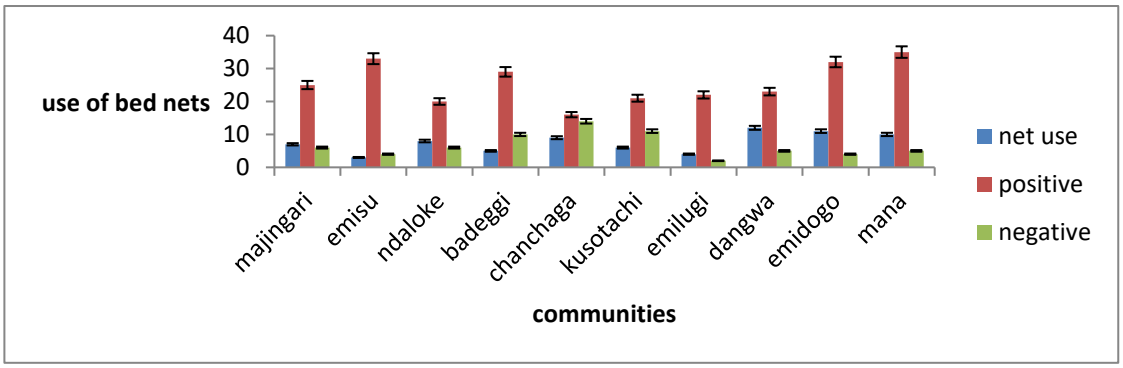

Figure 5: Prevalence of infection status and use of mosquito nets is significantly different (P = 0.003) among net users and is a factor associated with malaria infection status

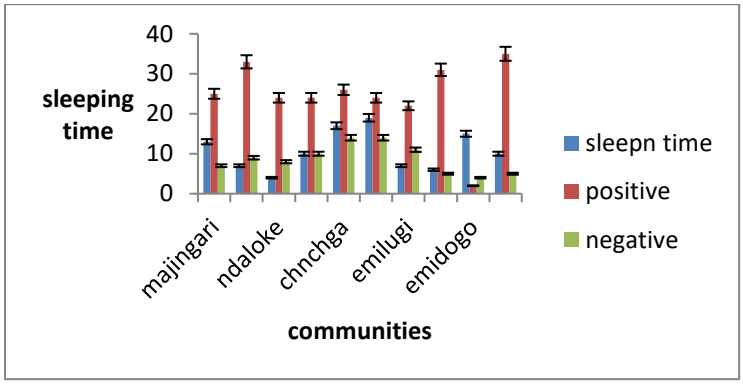

Figure 6: Malaria prevalence in relation to sleeping time is not significantly different (P = 0.2221) and therefore not a factor associated with infection risk

Table 1: Malaria prevalence in relation to Proximity of Communities to waterlogged farmlands

Community	Proximity of houses to waterlogged farmlands (M)	Infection status	
		Positive	Negative
Majingari	250	25	7
Emisu	500	33	9
Ndaloke	450	25	8
Badeggi	1000	19	10
Chanchaga	750	26	14
Kusotachi	490	24	14
Emilugi	900	22	11
Dangwa	875	31	5
Emidogo	690	32	4
Mana	370	35	5
Total		272(75.77%)	87(24.23%)