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Research Article

Assessment of Environmental Sanitation Practice on Mosquito Control and Larvae Distribution in Dutse Local Government Area, Jigawa State, Nigeria

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ABSTRACT
Mosquitoes are among the vectors that transmit diseases, posing a major health burden in endemic countries. This situation requires the use of multiple control methods. Effective mosquito surveillance and active community participation in sanitation can significantly help in controlling mosquito proliferation. This study was conducted to determine Larvae abundance and assessed environmental sanitation in Dutse Local Government Area. A cross-sectional study was conducted in three communities, Gurungu, Baranda and Warwade from April to October, 2022. Structured questionnaires were used to collect information from the respondents on participation on environmental sanitation and larvae were collected using dipping method. Twenty-eight (93.3%) of the respondents were male and 2 (6.6%) of the respondents were female. Majority of the respondents are in the age group 46 years above,17(56.6%), followed by age group 26-35 years 6 (56.6%) and the least are respondents in the age group 36-45 years 2(6.6%). Respondents with informal education level was significantly ($P<0.05$) highest, followed by respondents with Secondary educational level 6(20%). Only (26.8%) of the respondents were participating in environmental community sanitation. The larvae of *Culex* species were significantly ($P<0.05$) recorded highest in Gurungu (149) and Baranda (106) recorded the highest larvae of *Anopheles* species. The abundance of mosquito larvae is not significant ($P>0.05$) with breeding sites. Temporary pools recorded the highest abundance of mosquito larvae (70.25%), followed by tap/borehole (16.56%). Fumigation in the identified breeding site is recommended this will help to control the population of the mosquitoes.

Keywords: *Anopheles*; *Culex*; Larvae; Mosquito; Sanitation

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INTRODUCTION

Mosquitoes are under the phylum arthropoda belonging to class insecta and family culicidae. They have ability to flight, reproduction capacity and can adapt wide range of environmental condition, these are among the reasons are distributed widely (Kilpatrick *et al*., 2008).

There are mainly three most dominate genera of mosquitoes that are medically important. *Anopheles* species transmits malaria infection that results to high mortality, miscarriage and economic loss (Sadiq 2023). *Culex* species is known to transmit filarial worm (Muhammad et al., 2021). *Aedes* species is a vector of viral infection like yellow fever and zika virus

(Iyiola *et al*., 2021). Many other pathogens are being transmitted by mosquitoes in these genera.

Despite decades of control effort mosquito borne diseases remain the major public health threat especially in sub-Saharan Africa, Nigeria inclusive. For instance, in 2020, WHO reported that there were an estimated 241 million malaria cases and 627000 malaria deaths worldwide, this represents about 14 million more cases in 2020 compared to 2019, and 69000 more deaths (WHO,2021). Additionally, over 97% of Nigerian population is at risk of malaria, while the remaining 3% live within high altitude, with 60% of the hospital outpatient visit and 30% of hospitalization among children under five years and pregnant women (Nigeria Malaria Report, 2019). Moreso, frequent monitoring and surveillance of mosquitoes is a step toward controlling the mosquito borne diseases such data can be to design control measures.

Mosquito breeding sites are the habitat in which vital life cycle stages of the mosquitoes take place like laying of eggs, larval development, and emergence to adult and mating is taking place (Mwangangi *et al*., 2009).

Environmental sanitation plays a role in controlling the mosquito by reducing breeding sites thereby decreasing the population of mosquito. Proper waste management and filing holes help to prevent mosquitoes from breeding in temporary pools. More so, maintaining clean environment, eliminating of stagnant water around the communities and maintaining proper water drainage can also reduce mosquito breeding sites (Charle, 2021). Members of the community can play a vital role to control mosquito proliferation in their society through participating in environmental sanitation. A study on evaluation of alternative mosquito control measures on malaria in southern Ghana conducted by Charle (2021) and reported used of bed net is associated with lower malaria among respondents.

A study on larvae distribution was conducted by Fagbohum *et al*. (2020) at Lagos and reported five different species of mosquito belonging three genera *Aedes*, *Culex*, and *Anopheles*. Umar and Zakariyya (2017) also reported three genera of *Aedes*, *Culex*, and *Anopheles* in Kafin Hausa Local Government Area of Jigawa State and reported following breeding sites of mosquitoes which are ponds, temporary pool, puddles, and water collection containers

This study assessed mosquito control measures and identified mosquitoes's larvae with respect to breeding habitat in Dutse L.G. A., Jigawa State, Nigeria.

MATERIALS AND METHODS

Study Area

This study was carried out in some communities of Dutse Local Government Area, Jigawa State. Dutse Situated between $11^0$42''04' N and $9^0$20''31'E.It has more than 152800 population according to 2006 census. Dutse was characterized by Sudan savannah with two seasons dry and rainy. Majority of the people are farmers. The average during the rainfall daily temperature was 31^0C while in dry season the temperature was 20^0C. August normally recorded the highest relative humidity with about 94% and lowest was normally recorded in January with about 16%. The rainfall is ranging from 1000mm to 599mm (Zangina, 2015).

Gurungu, Baranda and Warwade were purposively chosen because Baranda and Warwade irrigation farming and fishing is main activities while Gurungu no irrigation farming and fishing activities.

Determination of Environmental sanitation participation among the respondents

A cross-sectional study was conducted. The study involved different of set people of varying sex, age and occupation, and thirty structured questionnaires were distributed in three communities. In each community, ten questionnaires were randomly shared and captured information on socio demographic characteristics, participation in environmental sanitation and possible way to control mosquito proliferation. Each house was selected randomly, firstly houses were selected by given an identical number. The number of the houses were written on papers, folded and put in a container, then shuffled among which ten folded papers were picked randomly. The houses whose number picked were selected for the study. A rapport and consent of the respondents were sought prior to the study.

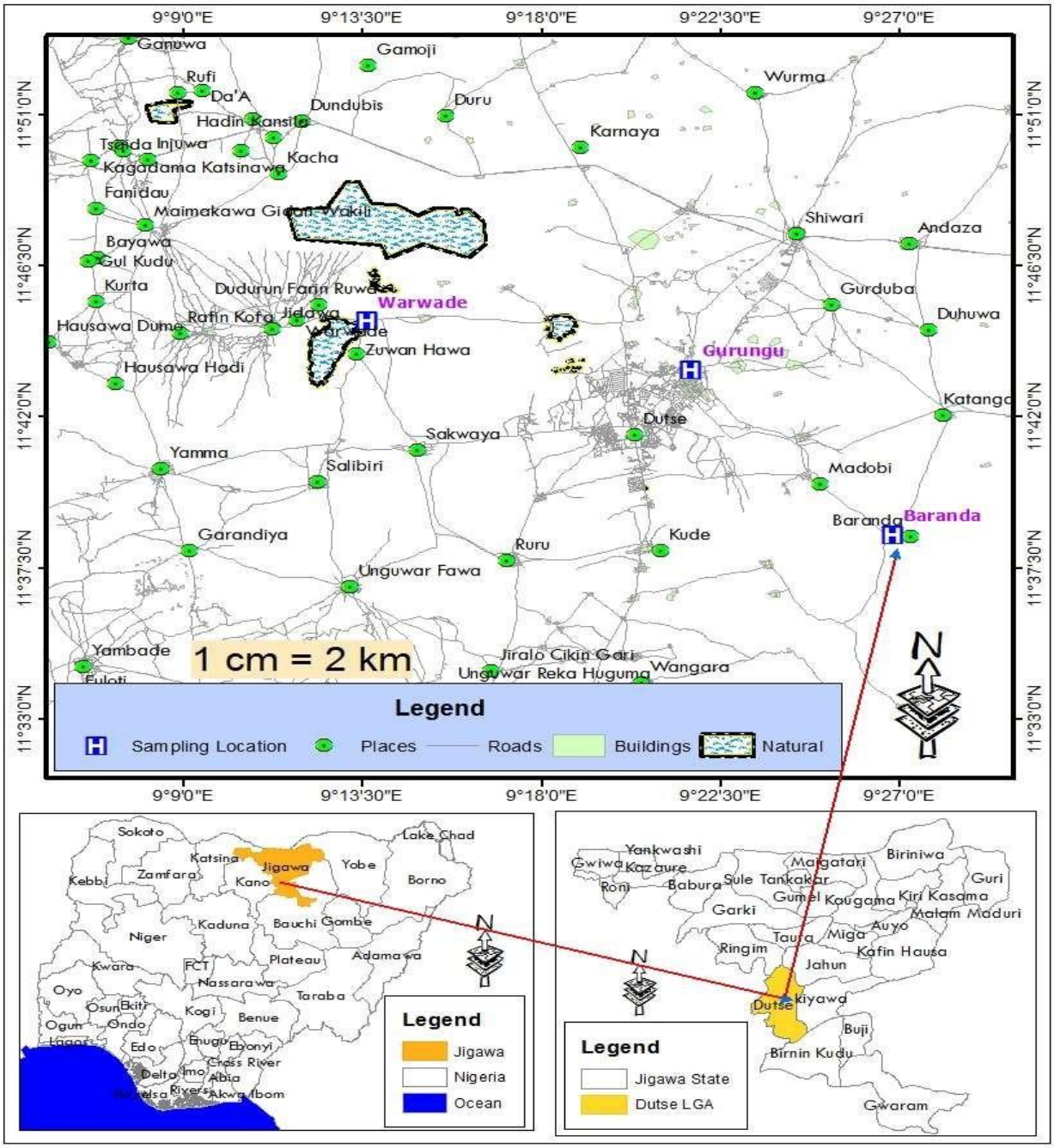

Figure 1: Map of Dutse Local Government Area Jigawa State Showing Sampling Locations

Source: Sadiq *et al*. (2024)

Collection and count of Mosquitoes larvae

A survey in three communities was conducted for the collection of mosquito larvae, each of the community was thoroughly searched and larvae were collected in each identified breeding sites. Larvae were collected from different breeding habitat using dipping method with dipper plastic (Sufi *et al*., 2019). Three dips were taken from each breeding sites. The number of larvae was calculated using formula (Afolabi *et al*., 2019). Mosquito larvae were identified and classified based on their morphological feature according Sufi *et al*., (2019).

$$No.of\ larve = \frac{\text{Total volume of the water (ml) x number of larve in one scoop (220ml)}}{\text{Volume of the scoop (220ml)}}$$

Data analysis

Data are expressed in percentage. Breeding site and Abundance of mosquito larvae significant difference was tested using ANOVA. Non parametric chi square was used to determine the significant differences between the respondents' variables and crosstabs was used to determine the association between the relevant variables using SPSS version 20th. All the statistically tests were considered significant differences when P≤0.05.

RESULTS

Socio-Demographic Characteristics of the respondents in Dutse Local Government Area

The result of socio-demographic characteristics of the respondents in Dutse L.G.A. is presented in Table 1.0 Out of the thirty respondents, 28 (93.3%) were male and 2 (6.6%) were female. Majority of the respondents are in the age group 46 years above,17(56.6%), followed by age group 26-35 years 6 (56.6%) and the least are respondents in the age group 36-45 years 2(6.6%). Respondents with informal education level was significantly (P<0.05) highest, followed by respondents with Secondary educational level 6(20%), then respondents with primary educational level 2(23.4%) and the least are those with other form of education 1(3.3%). Majority of the respondents were farmers 11(36.7%), followed by teachers 9(30%) and the least among the respondents were traders 2 (6.6%). There was no significant (P>0.05) difference in the respondents' occupation. With regard to household characteristics, respondents living in the mud houses was significantly (P>0.05) higher than those living in others form of houses.

Community Preventive Practices for Mosquito control

The result of community preventive practice for mosquito control is presented in Table 2. Only (26.7%) of the respondents were participating in community sanitation. There was significant (P<0.05) difference in the respondents view on participating in community sanitation. Clearing of refuse/waste disposal was most cited as possible ways of controlling mosquito proliferation by the respondents, followed by filling of the breeding sites (20%) and the least mentioned possible ways to control mosquito proliferation by the respondents was clearing of canals and vegetation (6.6%).

Distribution and Abundance of Mosquito larvae in relation to breeding sites

The result of distribution and abundance of mosquitoes' larvae in relation to breeding sites is presented in Table 3. Temporary pools recorded the highest abundance of mosquito larvae (70.25%), followed by tap/borehole (16.56%) and the least are river (0) and open containers (0). The abundance of mosquito larva is not significant (P>0.05) with breeding sites. The larvae of *Culex* species were significantly (P<0.05) recorded highest in Gurungu (149) and Baranda (106) recorded the highest larvae of *Anopheles* species.

Table 1: Social-Demographic Characteristics of the respondents in Dutse Local Government Area

Characteristics	Frequency	Percentage	P-value
Gender			
Female	2	6.7	0.00
Male	28	93.3	
Total	30	100	
χ2	22.53		
Ages (Years)			
15-25	5	16.7	0.001
26-35	6	20	
36-45	2	6.7	
46 and above	7	56.6	
Total	30	100	
χ2	17.26		
Educational level			
Primary	7	23.4	0.001
Secondary	6	20	
Tertiary	1	3.3	
Informal	15	50	
Others	1	3.3	
Total	30	100	
χ2	15.6		
Occupation			
Farmer	11	36.7	0.198
Trader	2	6.7	
Teacher	9	30	
Others	8	26.6	
Total	30	100	
χ2	4.667		
Households			
Mud	23	76.7	0.001
Cement	5	16.7	
Others	2	6.6	
Total	30	100	
χ2 28.8			

Table 2: Community preventive practices for mosquito control

Characteristic	Frequency	Percentage (%)	P-value
Are you Participation in community sanitation?			
Yes	8	26.7	0.00
No	21	70	
No response	1	3.3	
Total	30	100	
What are the Possible ways to control mosquito proliferation			
Clearing refuse/waste disposal	21	70	0.00
Clearing of grasses/ vegetation	6	20	
Other	3	10	
Total	30	100	

Table 3: Abundance of Mosquitoes larva in relation to breeding sites

Variables	Gurungu		Baranda		Warwade		Total (%)
	Anopheles **species**	***Culex*** **species**	***Anopheles*** **species**	***Culex*** **species**	***Anopheles*** **Species**	***Culex*** **species**	
Tap/borehole Leakages	44	0	10	0	4	0	54(16.56)
River	0	0	0	0	0	0	0(0)
Temporary pools	0	131	17	0	81	0	227(70.24)
Abandoned tires	0	18	0	0	0	0	18(5.52)
Open container	0		0	0	0	0	0(0)
Dam	0	0	0	0	6	0	6(1.8)
Rice puddles	0	0	0	0	19	0	19(5.83)
Total (%)	44	149	27	0	106	0	326(100)

P = 0.032 across the species, P= 0.395 across the habitat types, significant P≤0.05

DISCUSSIONS

With regard to participation in sanitation only few of the respondents were participating in community sanitation and 70% of the respondent were not participating, this may be as a result of unawareness on the importance of community sanitation toward mosquito control in the study sites. This is in line with finding of Inah *et a*l. (2017) reported 62.9 % of respondents exhibited poor environmental sanitation practice.

The highest mentioned control of mosquito proliferation was clearing of refuse/waste disposal, followed by filling of the breeding sites. This is contrary to the finding of Bamidele *et al.* (2021), reported that respondents mentioned control measures like clearing of bush, drainage of gutters and clearing of refuse dumps in sourthern Nigeria.

Temporary pools, rivers, Rice puddles, abandoned tires, open containers were the habitat for mosquitoes breeding sites and served as evident anthropogenic drivers of mosquito abundance recorded in this study. This is contrary to the finding of Dhimal *et al.* (2014) who recorded streams, Tree holes, water tank and discharge tires as the breeding sites in Nepal and Sufi *et al.* (2019) who observed gutters, drainage and discarded tires at Federal University Dutse. More so, Dalhatu *et al.* (2016) identified breeding habitats such as footprints, open containers, stagnant pool, domestic run-off at Azare, Bauchi State.

Larvae of the mosquitoes were collected in three communities of Dutse L.G.A., as evident that induce mosquito abundance in Dutse L.G.A., Jigawa State. In this study Warwade has the highest number of *Anopheles* larvae. This may not be surprise as *Anopheles* mosquito is selective breeder that prepare clean or less polluted water. Due to this warwade may have the highest suitable breeding sites for *Anopheles*. This is similar to the finding of Abdullahi *et al.* (2018) reported *Anopheles* sp. have the higher density than *Culex* and *Aedes* sp. and relates the highest density with nature of the houses, types of the animals in the house and number of the breeding sites could be the reason behind the higher densities at Usman Danfodiyo University, Sokoto, Nigeria. The finding of this study is also contrary to that of Umar *et al.* (2017), recorded higher density of *Culex* sp in Kafin Hausa Local Government Area, Jigawa State. Highest abundance of *Culex* larvae were recorded by Sufi *et al.* (2019) in Federal University Dutse, Dalhatu *et al.* (2016) in Azare, Bauchi State, and Yayock *et al.* (2015) in Kaduna Metropolis, Nigeria.

Gurungu recorded highest *Culex* larvae. This may not be surprise, as the Gurungu is characterized by improper waste disposal, lack of drainage, electricity and other social amenities. This is in line with findings of Fagbohum *et al.* (2020) and relates the higher densities of *Culex* larvae with anthropogenic activities like agriculture and urbanization.Afolabi *et al.* (2019), conducted a study in Ondo State and relate the higher density of larvae of mosquitoes with anthropogenic activities like school and market where there is high density of peridomestic containers, cans, and styroform. These containers serve as habitat for

mosquito breeding sites especially during the rainy season and also relates the area with low relatives' abundance of mosquito was characterized by good drainage system and good sanitation.

CONCLUSION

(26.6%) of the respondents are participated in community sanitation

Temporary pools recorded the highest abundance of mosquito larvae (70.25%)

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