Kashf Journal of Multidisciplinary Research
Vol: 02 - Issue 09 (2025)
P-ISSN: 3007-1992 E-ISSN: 3007-200X
https://kjmr.com.pk

A COMPARATIVE STUDY OF MOSQUITO BREEDING SITES WITHIN AND AROUND THE COLLEGE ENVIRONMENT: A CASE STUDY OF SULTAN ABDULRAHMAN COLLEGE OF HEALTH TECHNOLOGY, GWADABAWA, SOKOTO STATE, NIGERIA

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Article Info

Abstract

Mosquitoes remain a major public health concern globally, particularly in sub-Saharan Africa where mosquito-borne diseases such as malaria continue to contribute significantly to morbidity and mortality. This study aimed to conduct a comparative assessment of mosquito breeding sites within and around the premises of Sultan Abdulrahman College of Health Technology, Gwadabawa, and Sokoto State, Nigeria. The objective was to identify the types, distribution, and prevalence of mosquito breeding habitats and assess environmental and human-related factors that encourage their proliferation. A cross-sectional descriptive study design was adopted, using observational checklists and environmental assessment tools. Data were collected from stagnant water bodies, uncovered containers, blocked drainages, and bushy surroundings both within and outside the college premises. Findings revealed a higher prevalence of potential breeding sites around the college environment than within, attributed to poor waste disposal practices, lack of drainage systems, and uncovered water storage containers. The study also found that students and residents had limited awareness regarding the control of mosquito habitats. It concludes that intensified public health education, environmental sanitation, and enforcement of hygiene practices are critical to reducing mosquito breeding and, by extension, the incidence of vector-borne diseases. The study recommends regular inspection and larval source management within and around educational institutions.

Keywords:

- Mosquito breeding sites - Vector-borne diseases - Environmental sanitation - Public health - Malaria control - Waste disposal - Water storage - Larval source management - Health education - Sultan Abdulrahman College of Health Technology

INTRODUCTION

Mosquito-borne diseases remain a major public health challenge, particularly in tropical and subtropical regions such as Nigeria. Among the numerous species of mosquitoes, the Anopheles, Aedes, and Culex genera are the most significant in transmitting diseases such as malaria, dengue, yellow fever, and lymphatic filariasis (WHO, 2021). Nigeria bears a considerable burden of mosquito-borne diseases, especially malaria, which continues to be a leading cause of morbidity and mortality in both urban and rural communities (NMEP, 2020). Understanding the ecology of mosquito breeding sites is crucial in preventing and controlling the spread of these diseases.

Mosquitoes typically breed in stagnant or slow-moving water sources. These may include artificial containers, blocked drainages, open wells, pools, marshes, and any water-holding receptacles that provide suitable conditions for egg-laying and larval development (Service, 2012). The presence of these breeding sites is often linked to poor environmental sanitation, inadequate drainage systems, and lack of awareness or enforcement of vector control measures. Educational institutions, like other public settings, are not exempt from these environmental challenges. Students and staff living or working within such environments may unknowingly contribute to the proliferation of mosquito habitats due to improper waste disposal, uncovered water storage, or overgrown vegetation.

Sultan Abdulrahman College of Health Technology, Gwadabawa, Sokoto State, is one such institution located in a region where climatic and environmental conditions support mosquito breeding. The college accommodates hundreds of students and staff, making it a high-risk zone for potential mosquito bites and transmission of related illnesses. Yet, despite being a health training institution, there is limited data on the assessment of mosquito breeding environments within and around the college premises.

A comparative study of mosquito breeding sites within and around the college environment becomes relevant in identifying high-risk zones and gaps in environmental management. It also provides a scientific basis for implementing targeted control measures. Such a study is vital for promoting health and safety within the college, as well as for educating students particularly those in health-related fields about environmental vector control.

Moreover, with climate change and urbanization contributing to changes in mosquito habitats and behavior, localized research is essential to update existing intervention strategies (Tusting et al., 2015). This study, therefore, aims to assess and compare mosquito breeding sites within the school environment and its surroundings. It will highlight potential risks, contributing factors, and practical recommendations for integrated vector management in institutional settings.

In conclusion, the relevance of this study lies in its contribution to disease prevention, promotion of environmental health, and reinforcement of public health education among students and staff of Sultan Abdulrahman College of Health Technology. By understanding local mosquito breeding dynamics, the institution can implement evidence-based strategies that safeguard the health of its community.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Mosquitoes remain one of the most significant vectors of disease globally, particularly in tropical regions like Nigeria. Their ability to breed in various aquatic environments, both natural and artificial, has made their control challenging. Understanding their breeding patterns and environmental influences is crucial, especially in institutional environments where large populations gather, such as colleges. This literature review provides an in-depth analysis of mosquito breeding ecology, preferred breeding habitats, environmental and human-related factors, and the implications of mosquito proliferation on public health.

2.2 Mosquito Breeding Ecology

Mosquitoes require water for breeding, and their life cycle from egg to adult occurs in aquatic habitats. According to WHO (2017), mosquitoes lay eggs in stagnant or slow-moving water bodies, which may be natural (like ponds and marshes) or artificial (like blocked drains, discarded containers, or even water tanks).

Anopheles mosquitoes, which are primary malaria vectors, prefer clean, sunlit water bodies, while Culex mosquitoes are more tolerant of polluted and organically rich waters (Oyewole et al., 2006). Aedes aegypti, the vector of dengue and yellow fever, typically breeds in clean, stagnant water found in containers and domestic environments (Akpan & Ekanem, 2013).

2.3 Preferred Breeding Sites

Several studies in Nigeria have documented the variety of mosquito breeding sites in both rural and urban environments. In a study conducted by Afolabi et al. (2016) in Sokoto State, Anopheles gambiae constituted 39.2% of the mosquito population, with earthen pots, discarded tires, and uncovered water storage tanks being the most common breeding sites.

Similarly, Eze and Nwankwo (2015) found that breeding sites within college environments included blocked drainage systems, overgrown grasses, and uncovered water containers, all of which support mosquito larvae development. The abundance and accessibility of these sites often correlate with poor sanitation and inadequate waste disposal systems.

2.4 Environmental and Climatic Factors

Aedes mosquitoes also pose a threat, particularly in environments with poor sanitation. Diseases such as yellow fever and dengue fever, although less prevalent in the northwestern region, have been recorded in outbreaks (WHO, 2020). The proximity of students to breeding sites increases the risk of infection, absenteeism, and academic disruption.

2.7 Importance of Localized Studies

Localized environmental assessments are crucial for understanding the specific mosquito species present and the conditions that support their breeding. A study by Sulaiman et al. (2019) in Kebbi

State showed that while Culex and Anopheles mosquitoes dominated rural areas, Aedes species were more prevalent in peri-urban college environments due to the availability of artificial containers and poor waste management.

In Sultan Abdulrahman College of Health Technology, where students live in hostels and classrooms are closely clustered, the risk of mosquito-borne diseases is elevated if the breeding environments are not controlled. Conducting a comparative study of mosquito breeding sites within and around the college can aid in developing targeted vector control strategies.

2.8 Strategies for Prevention and Control

Mosquito population dynamics are heavily influenced by climatic factors such as rainfall, temperature, and humidity. During the rainy season, there is a significant increase in breeding sites due to accumulated stagnant water in potholes, drains, and open containers (Okorie et al., 2011).

According to Noutcha and Anumdu (2009), temperature and relative humidity influence the development speed of mosquito larvae and the survival rate of adult mosquitoes. Optimal breeding occurs between 25°C and 30°C with high humidity levels.

Environmental degradation, such as deforestation and unregulated urbanization, also plays a role. As communities expand into previously forested areas, new breeding habitats are unintentionally created (Mara & Cairncross, 2010).

2.5 Human-Induced Factors

Human behavior significantly contributes to the increase in mosquito breeding. Improper solid waste disposal, poor drainage systems, and water storage without covers are common in educational institutions (Olaleye et al., 2018).

In a study by Bello et al. (2020), it was revealed that students' hostels and college environments often lack proper sanitation facilities, contributing to the presence of stagnant water and organic waste-ideal for mosquito larvae. Furthermore, the use of abandoned containers for domestic purposes and poor maintenance of toilets increase breeding opportunities for Aedes mosquitoes in particular.

Public awareness and community participation in sanitation have been found to be critical in reducing mosquito breeding grounds (Adebayo et al., 2013). However, in most tertiary institutions, environmental hygiene is not prioritized, allowing vectors to proliferate.

2.6 Health Implications

The presence of mosquitoes in institutional environments like colleges significantly increases the risk of disease transmission. Malaria remains the most common mosquito-borne disease in Nigeria, with Anopheles mosquitoes as the primary vectors. According to the Nigeria Malaria Indicator Survey (2021), Sokoto State records a high malaria burden, with college students being among the vulnerable groups.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study adopted a descriptive cross-sectional research design aimed at assessing and comparing mosquito breeding sites within and around the Sultan Abdulrahman College of Health Technology, Gwadabawa, Sokoto State. The design was chosen because it allows for data collection at a single point in time across different locations, enabling identification and comparison of breeding sites and mosquito species prevalent in both internal (college premises, hostels, toilets) and external environments (surrounding areas, nearby water bodies, and waste disposal sites). This approach provides a snapshot of the breeding ecology, environmental factors, and risk areas relevant to malaria and other mosquito-borne diseases in the study area.

3.2 Study Area

The study was conducted at Sultan Abdulrahman College of Health Technology, located in Gwadabawa Local Government Area, Sokoto State, Northwestern Nigeria. The college has several academic buildings, student hostels, and toilet facilities that provide potential breeding grounds for mosquitoes. Gwadabawa is characterized by a tropical climate with distinct wet and dry seasons, which influence mosquito breeding patterns. The study also included surrounding areas within a 2 km radius to assess external environmental factors contributing to mosquito proliferation.

3.3 Study Population

The study population comprised potential mosquito breeding sites within and around the college environment. These included stagnant water bodies, blocked drains, water storage containers, refuse dumps, and natural water collections such as ponds or puddles. In addition, students and college staff were indirectly involved as their activities and sanitation practices affect the breeding conditions.

3.4 Sampling Technique

A purposive sampling technique was used to select breeding sites within the college premises and the surrounding areas. Sites known or suspected to harbor mosquito larvae were identified through preliminary field visits and consultations with college staff and local environmental health officers. The study focused on both artificial breeding sites (containers, tanks, blocked drains) and natural sites (puddles, ponds, gutters).

A total of 60 breeding sites were sampled: 30 sites within the college environment (hostels, classrooms, toilets) and 30 from surrounding areas such as nearby refuse dumps, water bodies, and residential compounds. This sample size was deemed adequate to provide a comparative overview of breeding conditions and species diversity.

3.5 Data Collection Methods

3.5.1 Field Survey and Sample Collection

Field surveys were conducted over a period of three months, covering both the rainy and dry seasons to capture variation in breeding site availability and mosquito density.

At each selected breeding site, mosquito larvae were collected using standard dipping methods. A 350 ml dipper was used to scoop water samples from breeding habitats, with 5 to 10 dips taken depending on the size of the site. Collected larvae were transferred into labeled containers for identification.

Environmental parameters such as water temperature, pH, turbidity, and presence of vegetation were recorded at each site using portable meters and visual assessment checklists.

3.5.2 Larvae Identification

Collected larvae were transported to the college laboratory for identification. Using standard taxonomic keys by WHO (2017), larvae were classified to genus and species level under a dissecting microscope. Emphasis was placed on identifying Anopheles, Culex, and Aedes species due to their medical importance.

3.6 Data Analysis

Quantitative data from larval counts, environmental parameters, and breeding site characteristics were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics such as frequencies, percentages, means, and standard deviations were computed to summarize the data.

Comparative analysis between internal and external breeding sites was conducted using chi-square tests for categorical variables and t-tests for continuous variables to determine significant differences ($p < 0.05$) in mosquito species distribution and breeding site characteristics.

3.7 Ethical Considerations

Approval for the study was obtained from the Sultan Abdulrahman College Research Ethics Committee. Permission was also sought from college authorities and local community leaders for site access.

Participants, including college staff and students, were informed about the study objectives and assured of confidentiality. Although direct human involvement was minimal, ethical standards relating to environmental research were maintained throughout.

3.8 Limitations of the Study

The study was limited by its short duration and the seasonal variation in mosquito breeding which may affect the generalizability of the findings. Also, some breeding sites might have been

inaccessible due to security or environmental constraints, potentially leading to under-sampling in some areas.

3.9 Summary

In summary, this methodology combines field surveys, sample collection, and laboratory identification to provide a comprehensive assessment of mosquito breeding sites within and around Sultan Abdulrahman College of Health Technology. The comparative design allows for identification of key breeding hotspots and vector species, providing a basis for targeted environmental management and vector control strategies.

CHAPTER FOUR: RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the results obtained from the field survey and laboratory identification of mosquito larvae from breeding sites within and around Sultan Abdulrahman College of Health Technology, Gwadabawa. Data were analyzed to compare mosquito breeding patterns, species distribution, and environmental characteristics of the breeding sites. Tables and charts are used to summarize the key findings.

4.2 Distribution of Breeding Sites Sampled

A total of 60 breeding sites were sampled, with 30 sites located within the college premises (hostels, classrooms, toilets) and 30 sites in the surrounding environment (residential compounds, refuse dumps, natural water bodies).

Location	Number of Breeding Sites Sampled	Percentage (%)
Within College Premises	30	50
Surrounding Areas	30	50
Total	60	100

Source: field survey 2025

4.3 Mosquito Larvae Presence in Breeding Sites

Out of the 60 sites sampled, mosquito larvae were found in 48 (80%) of the sites, while 12 (20%) sites showed no evidence of breeding. The presence of larvae was slightly higher in surrounding areas compared to within the college.

Location	Breeding Sites Positive for Larvae	Percentage (%)
Within College Premises	22	73.3
Surrounding Areas	26	86.7
Total	48	80

Source: field survey 2025

4.4 Mosquito Species Identified

Three major genera of mosquito larvae were identified: Anopheles, Culex, andAedes. Their distribution varied between internal and external sites.

Species Within College Premises (n=22) | Surrounding Areas (n=26) | Total (n=48) | Percentage (%)|				
Anopheles	**12**	**15**	**27**	**56.3**
Turbidity (NTU)	**0.002**	**12.3 ± 3.5**	**18.7 ± 4.2**	
Vegetation (%)	**35%**	**60%**	**0.004**	

Source: field survey 2025

Significant at $p < 0.05$

Sites in surrounding areas had significantly higher water temperatures, turbidity, and vegetation cover compared to those within the college premises. These environmental factors may contribute to the increased presence of mosquito larvae in external sites.

4.6 Breeding Site Types

The types of breeding sites were classified into artificial (man-made) and natural habitats. Table 5 summarizes the distribution.

Breeding Site Total	Type Within College Premises	Surrounding	Areas
Artificial	18	10	28
Natural	12	20	32
Total	30	30	60

Natural breeding sites (ponds, puddles, gutters) were more common in surrounding areas, while artificial sites (water storage tanks, blocked drains) were predominant within the college.

4.7 Larvae Density

The average larvae density (number of larvae per dip) varied between locations and species.

Location	Anopheles Density	Culex Density	Aedes Density
Within College Premises	4.2 ± 1.5	3.5 ± 1.2	1.1±0.5
Surrounding Areas	5.6 ± 2.0	4.1 ± 1.6	1.3 ± 0.7

Source: field survey 2025

Larvae density was higher in surrounding areas for all species, especially *Anopheles*, confirming increased breeding activity outside the college environment.

4.8 Seasonal Variation

Although data collection was limited to three months, preliminary observations indicated increased mosquito breeding during the rainy season with more active sites and higher larvae density compared to the dry season. This seasonal trend is consistent with previous studies highlighting rainfall as a major factor influencing mosquito breeding (Omoloye et al., 2020).

4.9 Summary of Key Findings

-Majority (80%) of sampled sites supported mosquito breeding, with slightly higher. prevalence in the surrounding areas.

-Anopheles species were dominant, posing a malaria transmission risk.

-Surrounding areas had significantly higher water temperature, turbidity, and vegetation, which favor mosquito breeding.

-Artificial breeding sites were more common within the college, while natural sites predominated externally.

-Larvae density was higher in surrounding areas.

-Seasonal rainfall influences breeding activity, increasing mosquito populations during wet months.

CHAPTER FIVE: DISCUSSION

This chapter discusses the findings from the comparative study of mosquito breeding sites within and around Sultan Abdulrahman College of Health Technology. Gwadabawa, Sokoto State. The results provide important insights into the distribution, species composition, environmental factors, and potential implications for malaria and other mosquito-borne diseases in this setting.

5.1 Distribution and Prevalence of Breeding Sites

The study found a high prevalence (80%) of mosquito breeding sites in both the college premises and surrounding environments, confirming that mosquito breeding is a persistent problem in this area. The slightly higher prevalence of breeding sites in surrounding areas (86.7%) compared to within the college (73.3%) suggests that the external environment provides more favorable conditions for mosquito reproduction. This could be attributed to the abundance of natural water bodies, poor waste management, and stagnant water in refuse dumps often found outside institutional settings (Adebayo et al., 2019).

These findings align with previous studies such as by Omoloye et al. (2020), who reported that peri-urban and rural areas tend to harbor more mosquito breeding habitats due to less controlled environments. Within the college premises, although breeding sites were fewer, the presence of

artificial habitats like water storage containers and blocked drains still facilitated mosquito propagation. This highlights the need for improved water management and sanitation even within educational institutions to minimize mosquito breeding risks.

5.2 Mosquito Species Composition and Public Health Implications

The identification of three major mosquito genera Anopheles, Culex, and Aedes is consistent with the known ecology of the region. Notably, Anopheles larvae were the most abundant (56.3%) among collected samples, underscoring the ongoing risk of malaria transmission. Anopheles mosquitoes are the primary vectors of malaria, a major public health burden in Nigeria and sub-Saharan Africa (WHO, 2021). Their dominance in both internal and external breeding sites calls for urgent vector control interventions in and around the college.

Culex species, which accounted for about 31.3% of larvae, are known vectors of diseases such as lymphatic filariasis and various viral infections (Muturi et al., 2018). The moderate presence of Culex also suggests nuisance biting, which can reduce quality of life and productivity among students and staff. Aedes mosquitoes, although less frequent (12.5%), are responsible for dengue, chikungunya, and yellow fever transmission, diseases that are increasingly reported in Nigeria (Olajide et al., 2019). Their presence even in low numbers warrants preventive measures given their capacity to cause outbreaks.

5.3 Environmental Factors Influencing Breeding

Environmental analysis revealed significant differences between breeding sites inside and outside the college, with surrounding areas exhibiting higher water temperature, turbidity, and vegetation coverage. Elevated water temperatures accelerate mosquito larval development, leading to higher mosquito populations (Service, 2012). Similarly, higher turbidity and vegetation provide shelter and food sources for larvae, enhancing survival rates (Barrera et al., 2014).

The lower turbidity and vegetation within the college could be attributed to more regular cleaning and maintenance, but the presence of artificial water containers still supports mosquito breeding. These environmental conditions reinforce the concept that microhabitats with suitable physical and biological characteristics sustain mosquito populations (Githeko et al., 2018).

5.4 Types of Breeding Sites and Control Implications

The study revealed that natural breeding sites were more prevalent in the surrounding areas, while artificial sites dominated within the college. Natural sites such as puddles, ponds, and blocked gutters are difficult to eliminate, especially during the rainy season. In contrast, artificial breeding sites water storage containers, discarded tires, blocked drains can be controlled through environmental management and community participation (Fillinger & Lindsay, 2011).

This difference in breeding site types suggests that targeted interventions are necessary. Within the college, educating students and staff about covering water containers and regular clearing of drains

can significantly reduce mosquito breeding. In surrounding areas, community-based environmental sanitation and drainage improvement are crucial.

5.5 Larval Density and Risk Assessment

Higher larval densities observed in the surrounding areas suggest increased mosquito populations and potentially higher transmission risk for mosquito-borne diseases. The relatively lower larval densities within the college indicate some level of environmental control, yet the presence of breeding sites still poses a threat.

High larval densities of Anopheles mosquitoes, in particular, are directly correlated with increased malaria incidence, as shown in studies by Tchouassi et al. (2012). This reinforces the need for integrated vector management strategies combining larval source management, insecticide-treated nets, and indoor residual spraying in the study area.

5.6 Seasonal Variations and Their Effects

Though limited by the study period, preliminary evidence showed that mosquito breeding intensifies during the rainy season. Increased rainfall leads to the formation

of more breeding habitats and extends the lifespan of larvae due to higher humidity (Mutuku et al., 2006). This seasonal trend highlights the importance of timing vector control efforts before and during the rainy season to maximize impact.

5.7 Strengths and Limitations of the Study

This study offers valuable data on mosquito breeding ecology within an educational institution and its environs, a setting often overlooked in vector research. The comparative approach provides practical insights for targeted control.

However, limitations include the short duration of data collection and the lack of adult mosquito surveillance to directly link breeding sites with adult mosquito populations and disease transmission. Future research should incorporate longitudinal studies spanning dry and wet seasons and include epidemiological data on mosquito-borne diseases among students and residents.

5.8 Recommendations

Based on the findings, several recommendations are proposed:

1. Environmental Sanitation: Both the college and surrounding communities should enhance waste management and drainage maintenance to reduce stagnant water.
2. Community Awareness: Educational campaigns targeting students and local residents about mosquito breeding prevention and health risks.
3. Larval Source Management: Regular inspection and elimination of artificial breeding sites within the college.
4. Vector Control: Collaboration with public health authorities to implement larviciding and distribution of insecticide-treated nets, especially before rainy seasons.

5. Further Research: Conduct longitudinal entomological and epidemiological studies to monitor mosquito populations and disease incidence over time.

5.9 Conclusion

In conclusion, the study confirms that mosquito breeding is widespread within and around Sultan Abdulrahman College of Health Technology, with significant differences in site types and environmental factors influencing larvae distribution. The predominance of Anopheles mosquitoes underscores the ongoing malaria risk, necessitating integrated control measures tailored to both institutional and community settings. Coordinated efforts involving environmental management, education, and vector control can substantially reduce mosquito populations and improve health outcomes in the region.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study assessed the mosquito breeding sites within and around Sultan Abdulrahman College of Health Technology, Gwadabawa, Sokoto State, with the aim of understanding the prevalence, distribution, species composition, and environmental factors influencing mosquito breeding. The findings reveal that mosquito breeding is widespread both inside the college premises and in the surrounding environment, with a higher prevalence observed outside the college. The presence of three major mosquito genera Anopheles, Culex, and Aedes highlights the persistent threat of multiple mosquito-borne diseases including malaria, lymphatic filariasis, dengue, and yellow fever in the area.

In conclusion, mosquito control remains an urgent and complex public health priority in this region. Effective vector management must be multifaceted and involve both the institution and the surrounding community to reduce breeding sites and consequently lower disease risk. The findings of this study contribute valuable baseline data for planning sustainable mosquito control interventions and highlight the need for continued research and community engagement.

Recommendations

Based on the findings of this research, the following recommendations are proposed to effectively reduce mosquito breeding and mitigate the associated health risks within Sultan Abdulrahman College of Health Technology and its environs:

1. Enhance Environmental Sanitation and Drainage Management

Both the college management and surrounding communities should prioritize regular environmental sanitation to eliminate stagnant water bodies and refuse that serve as mosquito breeding habitats. Proper drainage systems must be maintained and cleared regularly to prevent water accumulation. Waste disposal should be improved to reduce artificial breeding sites such as discarded containers, tires, and blocked gutters.

2. Implement Targeted Larval Source Management (LSM)

Regular surveillance and elimination of mosquito breeding sites should be conducted by trained personnel. Within the college, emphasis should be placed on covering water storage containers, repairing leaking taps, and clearing blocked drainage channels. In the community, larviciding of natural and artificial water bodies can be employed as a complementary measure, especially before and during the rainy season.

3. Community and Student Awareness Programs

Awareness campaigns are crucial for educating students, staff, and local residents about the risks associated with mosquito breeding and how to prevent it. Workshops, posters, and social media can be used to disseminate information on personal protective measures such as the use of insecticide-treated nets (ITNs), wearing protective clothing, and proper waste management.

4. Collaboration with Public Health Authorities

The college should collaborate with local government health departments and malaria control programs to integrate institutional efforts into broader community-based vector control initiatives. This partnership can facilitate access to resources such as insecticides, training, and technical support.

5. Monitoring and Evaluation

Regular monitoring of mosquito breeding sites and larval densities should be institutionalized to assess the effectiveness of control measures and adapt strategies accordingly. Entomological surveys should be conducted periodically to track seasonal changes and emerging breeding sites.

6. Research and Data Collection

Further research is needed to explore the link between mosquito breeding habitats and actual disease incidence among students and residents. Longitudinal studies covering multiple seasons would provide more comprehensive data on mosquito population dynamics and facilitate evidence-based intervention planning.

7. Infrastructure Improvements

Investments in improved water and sanitation infrastructure within the college will reduce reliance on open water containers and minimize stagnant water accumulation. Proper maintenance of hostels, classrooms, and recreational areas should be prioritized to reduce mosquito-friendly environments.

Final Thoughts

The predominance of Anopheles larvae, the primary malaria vectors, within both settings confirms a significant risk of malaria transmission, which remains a major public health challenge in Nigeria. The environmental factors such as water temperature, turbidity, and vegetation density were found to play crucial roles in mosquito larval development and survival. Artificial breeding sites

predominated within the college, while natural breeding habitats were more common in the surrounding areas, indicating that different control strategies are required for these environments.

The study also showed that mosquito breeding intensifies during the rainy season due to increased water accumulation, which forms numerous breeding habitats. The larval density data suggest that although the college environment exhibits some level of sanitation, mosquito breeding persists and could negatively affect students' health and academic performance.

The battle against mosquito-borne diseases is ongoing, and understanding local mosquito ecology is key to effective control. The present study highlights the urgency of integrated vector management at both institutional and community levels in Sokoto State. By adopting the recommendations above, Sultan Abdulrahman College of Health Technology and its environs can significantly reduce mosquito breeding, thereby improving public health, enhancing students' well-being, and supporting academic achievement. Collective responsibility, sustained commitment, and collaboration among stakeholders remain essential to achieving lasting success in mosquito control.

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Appendix A: Questionnaire Used for Data Collection

Comparative Study of Mosquito Breeding Sites in Sultan Abdulrahman College of Health Technology, Gwadabawa

Section 1: Respondent's Demographics

1. Age: _____

2. Gender: Male / Female

3. Department: _____

4. Residence (on-campus/off-campus): _____

Section 2: Mosquito Breeding Site Awareness

5. Are you aware of common mosquito breeding sites around the college?

- Yes / No

6. If yes, please list them: _____

Section 3: Environmental Factors

7. How often do you observe stagnant water around your environment?

- Always / Often / Sometimes / Rarely / Never

8. What are the common sources of stagnant water?

- Drainage / Containers / Ponds / Others: _____

Section 4: Preventive Measures

9. Do you use any measures to prevent mosquito breeding in your environment?

- Yes / No

10. If yes, specify the measures: _____