EXPLORING MOSQUITO LARVAL HABITATS
IN MOMBASA COUNTY - KENYA

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SUMMARY

Mosquito-borne diseases, such as malaria and dengue, continue to be a significant public health concern worldwide. In Mombasa, Kenya, these diseases pose a serious threat to human health. The aim of this research project is to explore mosquito larval habitats in Mombasa, Kenya, and identify the environmental and human factors that influence the breeding grounds of mosquitoes. The study explored the types of mosquito breeding places, how human activities influence the availability and suitability of mosquito larval habitats and the potential health risks associated with the presence of mosquito larvae in different types of habitats in Mombasa.

The project used different methods to gather data, including field studies, surveys and laboratory analysis. The study identified different breeding habitats of mosquitoes, their water sources, and surrounding environment. Water samples were collected and analyzed to determine their characteristics and the presence or absence of mosquito larvae. The data collected was then analyzed to determine the relationships among the variables under study. The results of the study provided valuable insights into the factors that affect mosquito habitat and the health risks associated with their presence in different types of habitats in Mombasa. The findings will be used to develop effective strategies for controlling these diseases and minimizing potential health risks.

Key words: breeding habitats, larvae, *Aedes* mosquitoes

RESEARCH QUESTIONS

1. What types of breeding places do mosquitoes lay their eggs in Mombasa?
2. How do human activities such as water storage practices and waste disposal influence the availability and suitability of mosquito's larval habitats in Mombasa?
3. What are the potential health risks associated with the presence of mosquito larvae in different types of habitats in Mombasa?

Location of the study area

The city of Mombasa is the second largest in Kenya. It lies along the coast of the Indian Ocean. Longitude: 39°39′48″ E and Latitude: 4°03′16″ S with an Elevation of 20 m above the sea level. Besides serving as the county's administrative center, it is also its transport and communication center and a major tourist attraction. There are two creeks that separate the city from the mainland; Tudor Creek on the west and Kilindini Harbour on the south. The Nyali Bridge connects the island to the mainland to the north, the Likoni Ferry to the south, and the Makupa Causeway to the west.
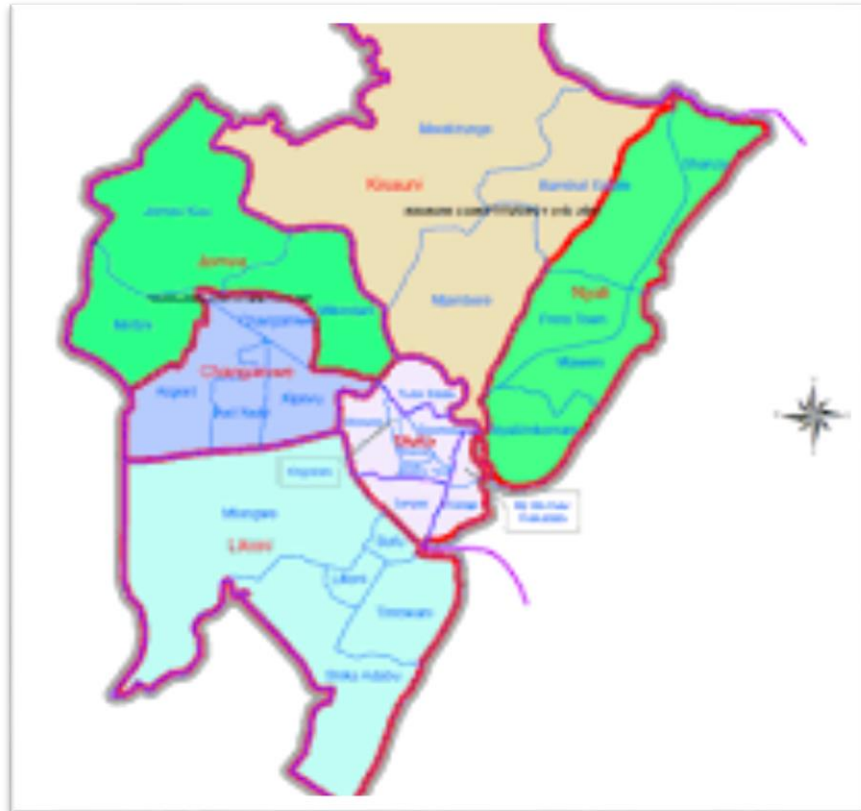
INTRODUCTION

Literature review

Mosquito-borne diseases continue to be a significant public health issue, particularly in tropical regions. According to Agha et al. (2017), malaria and dengue are just a few of the diseases transmitted by mosquitoes that pose a considerable threat to communities. One such region greatly affected by these diseases is Mombasa County in Kenya. Further, Lutomiah et al. (2016) argue that malaria and dengue cases are prevalent in many areas within the county, increasing concerns about the overall health and well-being of its residents. Understanding the breeding patterns and survival conditions of mosquitoes is important in fighting the occurrence and spread of these diseases. According to Ondiba et al. (2019), stagnant water serves as a breeding ground for mosquitoes, making the availability and suitability of mosquito larval habitats essential factors to consider. By identifying these habitats and examining their characteristics, researchers and public health officials can develop effective strategies to minimize mosquito populations and control the spread of diseases.

While previous studies have shed light on environmental and human factors that impact mosquito breeding and survival, Mombasa County's specific conditions and habitats require further investigation. In the study by Abílio et al. (2018), uncovering the unique factors at play in this region is vital for implementing targeted interventions and reducing the burden of mosquito-borne diseases. By determining the specific breeding sites, researchers can develop appropriate preventive measures that address the root causes of mosquito breeding. Moreover, understanding the environmental and human factors that contribute to mosquito breeding in Mombasa County can guide public health campaigns and educational initiatives. With this knowledge, authorities can target their efforts towards educating the community about minimizing stagnant water sources, using mosquito nets, and applying mosquito repellents. Equipping individuals with preventive measures empowers them to protect themselves and their communities from the devastating impact of mosquito-borne diseases.

One of the key factors under consideration is temperature. Mosquitoes are known to thrive in warm and humid environments, and Mombasa's tropical climate provides the perfect conditions

for their reproduction. By studying how temperature fluctuations affect mosquito breeding patterns, we can develop targeted interventions to disrupt their life cycle. Another crucial factor is water quality. Mosquitoes require stagnant water to lay their eggs, and Mombasa's diverse landscape provides a range of potential breeding grounds such as ponds, puddles, and even discarded containers. By analyzing the water quality in these different habitats, we can assess the suitability for mosquito breeding and implement measures to prevent their breeding.

According to Abílio et al. (2018), Human activities also play a significant role in creating and maintaining mosquito-breeding habitats. Water storage practices, including improper sealing of containers and inadequate maintenance of water tanks, can inadvertently provide mosquitoes with an ideal environment to lay eggs. Additionally, improper waste disposal practices, such as the accumulation of discarded tires or unmanaged garbage, can contribute to the formation of mosquito breeding sites. Understanding these human factors will allow us to develop targeted educational campaigns and interventions to promote responsible water management and waste disposal practices.

Description of the problem

Mombasa has experienced high increase in population attributed to natural growth and immigration, mostly of the labour force from other parts of the country. As the population of Mombasa grows, there has been an increased demand for housing and infrastructure. Leading to the expansion of settlements into previously undeveloped areas, including wetlands, marshes, and other natural habitats. These newly settled areas have become breeding grounds for mosquitoes since proper drainage and waste management systems are not in place. With more people living in the densely populated urban areas, there is a higher concentration of human activities and habitation. Overcrowded living conditions which has led to inadequate waste disposal practices, accumulation of stagnant water in containers, and the creation of artificial habitats suitable for mosquito breeding.

In many area like, Magongo, Bamburi, Kisauni and Likoni, lack of access to piped water has led to reliance on stored water in containers, which, if left uncovered or improperly stored, serves as breeding sites for mosquitoes. Poorly maintained drainage systems, improper solid waste disposal practices, and insufficient sewage treatment facilities noted in some areas like Bombolulu, Kisauni

and Bamburi area has contributed to the accumulation of stagnant water and organic matter, creating ideal breeding habitats for mosquitoes.

The prevalence of mosquito-borne diseases in Mombasa thus poses a significant public health risk to the residents. In order to implement effective measures to control the spread of these diseases, it is essential to understand the breeding habits and habitats of mosquitoes in the area. This research will focus on the types of breeding places mosquitoes lay their eggs, human activities such as water storage practices and waste disposal that influence the availability and suitability of mosquito's larval habitats and the potential health risks associated with the presence of mosquito larvae. Identifying the specific breeding grounds of mosquitoes in Mombasa will allow for more efficient surveillance and control measures to be implemented.

There is a need to examine the role of human activities such as water storage practices and waste disposal in shaping the availability and suitability of mosquito larval habitats in order to design interventions that minimize mosquito breeding sites in populated areas. Lastly, identifying the health risks associated with the presence of mosquito larvae in various habitats will lead to approaches that lessen these risks and protect public health. The findings of this study will be useful to local authorities and health practitioners in developing targeted and effective mosquito control strategies.

Impact of the project to the community

The project's impact on the community is significant as it focuses on reducing the incidence of mosquito-borne diseases in Mombasa. Mosquito-borne diseases such as malaria and dengue fever have a major impact on the health and well-being of the population. By identifying the breeding habits, the project's findings will be utilized by local authorities and health organizations to implement effective control measures and reduce the incidence of these diseases.

Understanding how human activities affect mosquito breeding sites will help create interventions and strategies to manipulate these factors for effective mosquito control. For example, the project could inform the development of a public education campaign on proper waste management and water storage practices, limiting the availability of standing water, which is a potential breeding ground for mosquitoes. Such an approach will not only reduce the incidence of mosquito-borne diseases but also promote a cleaner and healthier environment for the community.

The study will also influence the community by providing information on the health risks associated with the presence of mosquito larvae in various habitats. The findings of the study will lead to strategies that lessen these risks and protect public health. For example, health authorities could conduct targeted mosquito control campaigns in areas with high levels of mosquito populations, ultimately reducing the incidence of mosquito-borne diseases in the community.

METHODOLOGY

Equipment and materials

1. Dropper
2. Paper towels
3. Bucket
4. Forceps
5. Magnifier / Hand lens
6. Macro pipette
7. Mobile device with GLOBE Observer Mosquito Habitat Mapper
8. A clip-on Macro lens (60-100x)

Procedure

To carry out this project, we used different methods to collect data from the breeding places on human activities, and health risks associated with mosquito larvae in Mombasa.

Meeting with County Officials

We engaged in a discussion with county officials to create a better understanding of the distribution of mosquito breeding grounds and the environmental factors influencing mosquito populations. With this information gathered we identified our main region and performed four different field studies. We further identified potential breeding spots and gathered water samples containing mosquito larvae. Using the GLOBE Observer Mosquito Habitat Mapper, we determined the prevalent mosquito species in the area.

Survey of the area of study

Household surveys were conducted to understand the impact of human activities on mosquito breeding and larvae presence. We observed and collected data on the residents' waste management practices, sanitation practices, and use of mosquito control methods.

Students carrying out household survey

Identification mosquito larvae

The students collected water samples from the different breeding sites and the larvae were observed in the lab using the micro lenses.

Students identifying mosquito larvae collected

RESULTS

Findings from our field study

The findings from our field study revealed that there was evidence numerous breeding sites of mosquitoes. Uncovered water storage jericans were observed in most of the residential areas visited. In some areas like Bombolulu and Kisauni, clogged drainage system provided a conducive area for breeding of mosquitoes. The plastic containers left in the waste collection points especially in Tudor Moroto also provided conducive sites for mosquito breeding.

Clogged drainage and plastic containers with water

Uncovered Jerricans

Manholes

Tree Hole

Discarded tyres

Identification of Larvae collected

The water samples collected from stagnant water, storage jericans, tyres, manholes, and clogged sewers had many mosquito larvae. The table below shows the number of larvae collected in the different visits and those positively identified. All the identified mosquito larvae were *Aedes* mosquito. There was no evidence of any other types of mosquitoes within the area.

Breeding Sites	*Samples count*	*Positively identified larvae*	*Others / Unknown*
Tyres	30	10	20
Man holes	96	82	14
Clogged drainage	213	196	17
Tree holes	25	18	7
Storage jericans	52	34	18
TOTAL	**416**	**340**	**76**

The study found that Aedes mosquitoes largely breed within Mombasa County, and there were 266 positive cases of dengue recorded between January 2022 and February 2024 in the Tudor County Hospital only.

Features of the identified larvae
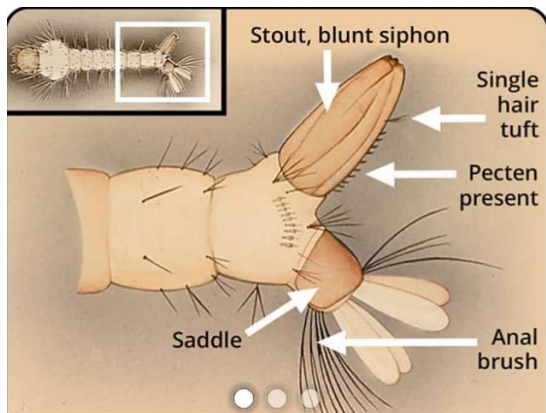
Larva identification using Mosquito habitat mapper

School: Shree Swaminnarayan Academy
Site: 37MER796548

| Measurements | Data Counts | Sc |

Data Date Range: 2019-04-30 to 2023-10-12

Measurement: 3

Data Source: **GLOBE Observer App**
Measured At: **2024-03-05 12:42:00**
Mosquito Habitats: **container: artificial**
Water Source: **tire**
Larvae Count: **36**
Mosquito Eggs: **False**
Mosquito Pupae: **False**
Mosquito Adults: **True**
Mosquito Genera: **Aedes**
Breeding Ground Eliminated: **True**
Extra Data: **LarvaeVisibleYes**
Location Method: **automatic**
Location Accuracy M: **27**
Mv Updated At: **2024-03-05 14:35:03.150663+00**
Elevation: **0.00 m**

School: Shree Swaminnarayan Academy
Site: 37MER796548

| Measurements | Data Counts | S |

Data Date Range: 2019-04-30 to 2023-10-12

Measurement: 2

Data Source: **GLOBE Observer App**
Measured At: **2024-03-05 12:56:00**
Mosquito Habitats: **container: natural**
Water Source: **tree holes**
Larvae Count: **21**
Mosquito Eggs: **False**
Mosquito Pupae: **False**
Mosquito Adults: **False**
Mosquito Genera: **Aedes**
Breeding Ground Eliminated: **True**
Extra Data: **LarvaeVisibleYes**
Location Method: **automatic**
Location Accuracy M: **20**
Mv Updated At: **2024-03-05 14:35:04.370414+00**
Elevation: **0.00 m**

School: Shree Swaminnarayan Academy
Site: 37MER796548

| Measurements | Data Counts | School |

Data Date Range: 2019-04-30 to 2023-10-12

Measurement: 1

Data Source: **GLOBE Observer App**
Measured At: **2024-03-05 13:03:00**
Mosquito Habitats: **still: lake/pond/swamp**
Water Source: **ditch**
Larvae Count: **11**
Mosquito Eggs: **False**
Mosquito Pupae: **False**
Mosquito Adults: **False**
Mosquito Genera: **Aedes**
Breeding Ground Eliminated: **True**
Extra Data: **LarvaeVisibleYes**
Location Method: **automatic**
Location Accuracy M: **22**
Mv Updated At: **2024-03-05 14:40:02.451606+00**
Elevation: **0.00 m**

DISCUSSION

The research project focused on exploring mosquito breeding habitats in Mombasa has the potential to make a significant impact on public health and the well-being of the local community. By understanding the preferences and human activities that contribute to mosquito breeding, the project aimed to identify targeted interventions to control the spread of mosquito-borne diseases. Through field surveys and laboratory analysis, the study provided valuable insights into the specific locations and conditions that are conducive to mosquito breeding in Mombasa. This knowledge will enable local authorities to implement effective measures to reduce breeding sites, thus reducing the incidence of diseases such as malaria and dengue fever.

The research project also places emphasis on engaging the community and raising awareness about mosquito breeding and prevention. Surveys were conducted to understand the community's practices related to water storage, waste disposal, and their level of knowledge on mosquito breeding. By involving the local community in the research process, the project aimed to empower them with knowledge about proper waste management, water storage practices, and the consequences of mosquito breeding. Through targeted public education campaigns, the community will become active participants in mosquito control efforts, leading to improved health outcomes.

The potential impact of the research project extends beyond public health to the environment. By studying mosquito breeding habitats, the project uncover environmental factors such as stagnant water sources and inadequate waste management practices that contribute to mosquito breeding. This knowledge can drive positive changes in environmental management practices, leading to the reduction of stagnant water sources and improved waste disposal methods. Consequently, the research project not only contribute to reducing the incidence of mosquito-borne diseases but also fosters a cleaner and healthier environment for the residents of Mombasa. Ultimately, the project aims to improve the community's overall well-being, resulting in reduced healthcare costs and increased productivity.

CONCLUSION

In conclusion, the research project exploring mosquito breeding habitats in Mombasa holds immense potential for addressing the public health challenges posed by mosquito-borne diseases. By understanding the preferences and environmental factors that contribute to mosquito breeding, the project aims to provide valuable insights for targeted interventions and control measures. Through community engagement and education, the project strives to empower the local population with knowledge on mosquito prevention, waste management, and water storage practices. This research not only has implications for public health but also has the potential to improve the well-being of the community and the environment. By reducing the prevalence of mosquito-borne diseases and fostering a cleaner environment, the research project contributes to a healthier and more productive community in Mombasa.

The study found that Aedes mosquitoes largely breed within Mombasa County, and there were 266 positive cases of dengue recorded between January 2022 and February 2024 in the Tudor County Hospital only.

RECOMMENDATIONS

From our research findings, we drew the following recommendations to help reduce the impact of mosquito breeding and prevent the spread of mosquito-borne diseases

The research project will inform the implementation of targeted interventions to control mosquito breeding. This will include targeted mosquito larvae control efforts, such as regular monitoring and treatment of stagnant water sources, implementing larvicide treatments, and promoting the use of mosquito nets or screens to limit human-mosquito contact.

The research also emphasized the importance of engaging the local community in mosquito control efforts. The county government should launch intensive public education campaigns to raise awareness about mosquito breeding sites, prevention methods, and the risks associated with mosquito-borne diseases. To promote sense of ownership and encourage sustained behavior, the county government should implement community-led initiatives, such as clean-up drives and awareness programs.

The research highlighted it is essential to improve water management practices, including proper disposal of waste and reducing stagnant water sources. Collaboration between local authorities, community leaders, and environmental agencies can help develop and enforce effective waste management policies, ensure safe water storage, and eliminate potential breeding grounds for mosquitoes.

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BADGE DESCRIPTIONS

I AM A DATA SCIENTIST

We were able to design experiments, generate extensive data and conducted an in-depth analysis of the data in order to draw our conclusions.

I AM A COLLABORATOR

The team members involved in this study collaborated through every step to ensure this project reaches the finish line. Students involved collaborated with respective teachers in terms of research.

I AM A STUDENT RESEARCHER

We were able to carry out the research by collecting data from different sources to investigate the mosquito habitats in Mombasa, Kenya.

I MAKE AN IMPACT

The findings of this study will greatly make an impact on the policies developed by local authority to reduce mosquito breeding sites. It will also create awareness to community members on potential breeding sites and prevalent diseases caused by mosquitoes.

ACKNOWLEDGEMENT