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FACULTY OF SCIENCE AND EDUCATION

ASSESSMENT OF THE LEVEL OF FEACAL CONTAMINATION IN SELECTED OPEN WELLS IN NAGONGERA TOWN COUNCIL, TORORO DISTRICT.

BY

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BU/UP/2021/1700

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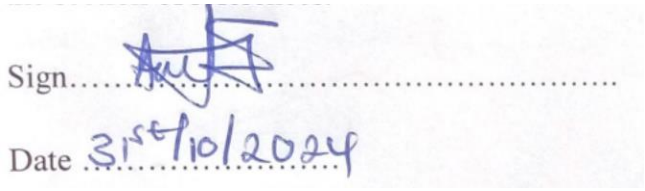
DEPARTMENT OF BIOLOGY

A RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE EDUCATION IN BIOLOGY DEPARTMENT OF BUSITEMA UNIVERSITY

DECLARATION.

I NGOBI ANDREW, hereby declare that this research report on the assessment of fecal contamination in selected open wells in Nagongera Town council, Tororo district, has been prepared and submitted to the department of biology. Faculty of science and education in the partial fulfilment of the requirement for the award of Bachelor's degree in science education at Busitema University, and is my own original and has been presented for any award in institution of learning.

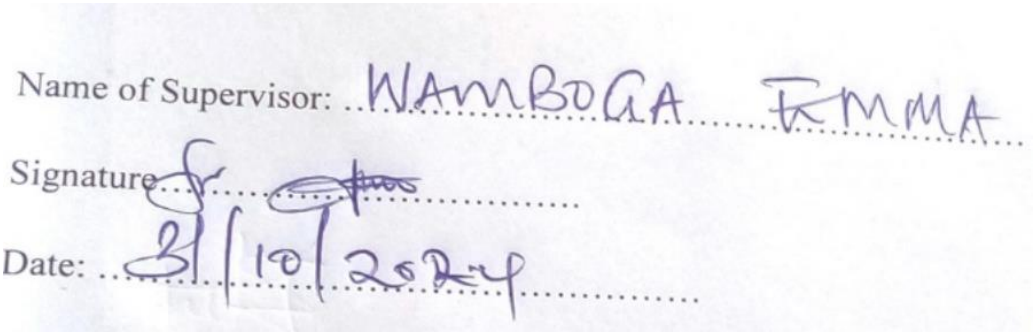
The contribution of other authors in addition to my work has been credited and fully included in the section of references.



NGOBI ANDREW (STUDENT

APPROVAL

This research report entitled "ASSESMENT OF FECAL CONTAMINATION IN OPEN WELLS IN NAGONGERA TOWN COUNCIL, TORORO DISTRICT." has been done under my supervision as the research supervisor.



DEDICATION

I dedicate this research project report to my beloved and dear parents Mr. Kintu James and Mrs. Nakiranda Betty, my elder sister Kambendha Patricia for their unwavering support offered to me throughout my academic journey

ACKNOWLEDGEMENT

I sincerely wish to extend my tremendous appreciation to my dear parents, my elder sister, the biology department of Busitema University including all lecturers and the laboratory technician Mr. Olowo Moses and the entire biology class for their support, cooperation.

But in a special way sincere appreciation goes to my friends, Edube John Bosco, Kitayi Solomon, Bwambale Lawrence ,Gwanala Fred, Opollot Henry Joseph, Nyongesa Philex, Kaaku Tom Arnold for their limitless courage ,motivation ,guidance given to me during my academic course as well as their contribution to my project research work .

ABSTRACT

Fecal indicator microorganisms such as Escherichia coli (E. coli) and coliform bacteria are widely used to assess the microbiological quality and safety of water, food, and the environment. These microorganisms serve as markers for the potential presence of pathogenic microorganisms that may pose a threat to human health (Edberg et al., 2000). Regulatory agencies establish standards and guidelines to establish acceptable

The aim of this study was to assess the level of fecal contamination in open wells in Nagongera Town Council where fecal coliforms specifically E. coli bacteria was used as a bio indicator for fecal contamination where samples of water were collected from three selected open wells and used as an inoculum on Eosin Methyl Blue agar (EMB), where four (4) replicates were made for each sample, cultures were made, incubated for 48 hours and the Colony Forming Units that were formed were counted.

The results of this study show a prevalence of fecal coliform bacteria, E. coli in each of the sampled wells for all of the replicates made therefore this being a representative sample of the whole open well population in Nagongera town council, it signals a potential health threat to the local inhabitants.

TABLE OF CONTENTS

ABBREVIATIONS

E. coli; Escherichia coli

WHO; World Health Organization

UNESCO; United Nations Education, Science and Cultural Organization

UNICEF; United Nations International Children's Emergency Fund

USAID; United States Agency for International Development

UNDP; United Nations Development Program

UBOS; Uganda Bureau Of Statistics

CFUs; Colony Forming Units

EMB; Eosin methyl blue

OPERATIONAL DEFINITIONS

Fecal contamination; is the presence of fecal coliform bacteria in water samples collected from open wells.

Open well; a water source that is uncovered and accessible for direct wat.er collection.

Water borne disease; refers to illness caused by consumption of water contaminated with pathogenic microorganisms.

Sanitation infrastructures; encompasses facilities and systems designed to safely collect transport treat and dispose of human waste to prevent contamination of open wells.

Hygiene practices; refers to behaviors and actions undertaken to maintain personal and environmental cleanliness and prevent spread of pathogens.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter has introduced the reader to the study topic as it has explained the concepts in the research topic above and it includes the background of the study, statement of the problem, general objective, specific objective, research questions, and significance of the study and the scope.

1.1 Background to the study

Access to clean and safe drinking water is a fundamental human right crucial for sustaining life and promoting public health (WHO, 2017). However, in many parts of the world, including Uganda, ensuring reliable access to safe drinking water remains a significant challenge, particularly in rural areas (UNICEF & WHO, 2021). Open wells are susceptible to fecal contamination, primarily due to inadequate sanitation infrastructure and improper waste disposal practices (Abanyie et al., 2022). Fecal contamination of water sources poses serious health risks, including the transmission of waterborne diseases such as diarrhea, cholera, and typhoid fever (Shayo et al., 2023).

Globally, access to safe drinking water is recognized as a key determinant of public health and well-being, with the United Nations Sustainable Development Goals (SDGs) aiming to ensure universal access to safe and affordable drinking water for all by 2030 (UN, 2015). Despite progress made in improving water access and sanitation, disparities persist, particularly in rural and marginalized communities (WHO/UNICEF JMP, 2021).

At the continental level, the African continent faces numerous challenges related to water quality and sanitation, with many countries struggling to meet the basic needs of their populations (Vilakazi et al., 2019).

In the local context of Uganda, diarrheal diseases alone are responsible for a significant burden of morbidity and mortality, particularly among children under five years of age (Nantege et al., 2022).

Nagongera Town Council, located in the Eastern Region of Uganda, represents one such rural community where access to clean water is a pressing issue, with open wells serving as the primary source of water for domestic use.

The reliance on open wells for water supply exacerbates the risk of fecal contamination, as these wells are often located in close proximity to potential sources of pollution such as pit latrines, animal husbandry activities, and agricultural run-off (Viban et al., 2021). Additionally, limited access to improved sanitation facilities and poor hygiene practices further contribute to the contamination of water sources (Tseole et al., 2022).

Given the gravity of the situation, understanding the dynamics of fecal contamination in selected open wells within Nagongera Town Council is of utmost importance. This research aims to provide empirical data on water quality, identify sources of contamination, and propose evidence-based interventions to mitigate health risks and promote sustainable water management practices. By addressing these challenges at the local level, this study contributes to broader efforts to achieve the SDGs related to clean water and sanitation, ultimately improving the health and well-being of communities in Uganda and beyond.

1.2 Statement problem

Access to safe and clean drinking water is essential for public health. However, in rural areas like Nagongera Town Council, Uganda, open wells often suffer from fecal contamination, leading to waterborne diseases (WHO, 2017). Factors such as inadequate sanitation infrastructure and proximity to sources of contamination contribute to this problem (Mugabi et al., 2018). In Uganda, waterborne diseases are a significant burden, especially for vulnerable populations (Ministry of Health Uganda, 2020). Fecal contamination in open wells is a widespread issue in many rural communities, requiring urgent attention (UN Water, 2019). In Nagongera Town council ,local evidence of fecal contamination in the selected open wells is the Presence of animal feaces in the well water ,Unpleasant odors coming from the well water , Visible turbidity or cloudiness in the well water and the Presence of insects mostly house flies around the wells.Therefore, this research aims to assess fecal contamination in open wells in Nagongera Town Council, Uganda, and propose interventions to improve water quality and public health outcomes.

1.3 General objective

The general objective of this research was to assess the extent of fecal contamination in selected open wells within Nagongera Town Council, Uganda, and to propose interventions aimed at improving water quality and safeguarding public health.

1.4 Specific objective

To investigate the level of fecal contamination in selected open wells across Nagongera Town Council through micro biological analysis of water samples.

1. To identify possible sources of fecal contamination in selected open wells in Nagongera town council.

1.5 Research questions

1. What is the level of fecal contamination in selected open wells across Nagongera Town Council?
2. What are the possible sources of fecal contamination of the selected open wells in Nagongera town council?

1.6 Significance of the study

The study on feacal contamination in selected open wells in Nagongera Town council ,Tororo district is critical for global and national water and sanitation objectives.

It directly supports SDG 6, which seeks to guarantee universal access to and sustainable manage ment of water and sanitation.

The study provides critical data to local authorities and policymakers for implementing measures to improve water quality and sanitation infrastructure by quantifying fecal contamination levels and identifying contamination sources, such as proximity to latrines and agricultural runoff.

This is critical for ensuring universal access to safe and inexpensive drinking water, putting an en d to open defecation, and lowering water pollution, all of which promote healthier communities.

Additionally the study aligns with Uganda's national water policy which focuses on sustainable water resource management, improving water quality and ensuring equitable access to safe drinking water for all citizens. The findings highlight the impact of poor sanitation practices and agricultural runoff on water quality, advocating for sustainable water resource management practices. By providing insights into the contamination levels and sources in rural areas like Nagongera, the study helps guide targeted interventions that can enhance water safety and public health, ensuring that even underserved communities have access to clean and safe water.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter gave a review of the literature which was gotten from different scholars from different study areas with detailed information related with the specific objectives of this whole study topic.

Water quality assessment, particularly concerning fecal contamination in open wells, is fundamental for safeguarding public health, especially in rural areas where access to safe drinking water is often precarious. This literature review explored various dimensions of fecal contamination in open wells, encompassing quantification of contamination levels, identification of contamination sources, understanding socio-economic factors influencing water quality, and interventions for improvement.

2.1 fecal contamination levels in open open wells

Fecal pollution of water sources is a worldwide public health issue with serious consequences for human health.

According to the World Health Organization (WHO), roughly 2 billion people worldwide

drink

Faecescontaminated water, which causes widespread diseases like diarrhea, cholera, and typhoid fever. Microbiological analysis ,namely the detection of fecal coliforms such as E. Coli, is critical for determining

waterquality.Studies in rural India and Latin America have regularly found high levels of fecal p ollution in open wells, indicating a widespread problem in areas lacking adequate sanitation facil ities.(Bain et al., 2014)

In Africa, the situation is equally severe, with many rural people reliant on contaminated groundwater.(UNICEF, 2023)."

In Nigeria, for example, a research found that 75% of open wells in rural regions had considerabl e fecal contamination, which was associated with high rates of waterborne illnesses (Okpasuo et al., 2020).

Research in Ghana has revealed similar difficulties, with many rural wells failing to fulfill WHO

microbiological safety requirements (Kulinkina et al., 2020).
These findings highlight the critical need for better water quality monitoring and sanitation meas ures throughout the continent.

Numerous investigations in east Africa have found fecal pollution in open wells.
In Kenya, researchers discovered that seasonal fluctuations greatly influenced contamination lev els, with greater fecal coliform concentrations during the rainy season due to increased surface ru noff (Munyasia et al., 2018).
In Tanzania, up to 60% of water samples from open wells were polluted with feces, which was fr equently linked to neighboring latrines and poor well maintenance practices (Mkude & Saria, 2012) (Mwangome et al. 2017).
These regional studies demonstrate the vital importance of tailored actions to improve water qual ity and public health.

In Uganda, the problem of fecal pollution in open wells is well established.
According to studies, more than half of open well water samples in rural regions had fecal colifor ms, posing major public health hazards (Agensi et al., 2019).

To address these difficulties, the Ministry of Water and Environment's yearly reports highlight the need for improved water quality monitoring and sanitary facilities (Ministry of Water and Environment, 2020;Ministry of Water and Environment, 2021).While precise research on Nagongera Town Council are scarce ,local health reports and anecdotal evidence point to comparable problems with fecal pollution in open wells.

Health officials have observed a high incidence of waterborne infections, indicating that drinking water sources may be contaminated.
This emphasizes the importance of targeted studies and initiatives in Nagongera to ensure safe dr inking water for the population.

2.2 Variations in fecal contamination in open wells

Globally, comparative studies have indicated significant variation in fecal contamination levels across open wells (Jalan et al., 2009).

In India, researchers discovered significant disparities in pollution levels between urban and rural wells, with rural wells being more contaminated due to inadequate sanitation infrastructure and proximity to open defecation sites (Biswas et al., 2022).
Similarly, studies in Latin America have found that wells in densely populated or agricultural are as are more likely to be contaminated with feces (Gómez et al. 2018).

In Africa, comparative studies have revealed varied amounts of fecal contamination in open wells across areas and seasons (O'Connor et al., 2022).

In Nigeria, wells in highly populated regions have greater contamination levels than those in spar sely populated areas, owing to insufficient sanitation and waste disposal procedures (Igboama et al., 2022).
Seasonal differences were also observed, with higher pollution during the rainy season due to inc reased surface runoff that carried fecal matter into wells.

Researching in East Africa has shown that fecal contamination levels vary greatly amongst wells.

Research in East Africa has shown that fecal contamination levels vary greatly amongst wells (Ouma et al., 2017).

In Kenya, a research discovered substantial disparities in contamination levels between wells nea r latrines and those further away, with wells closer to latrines exhibiting greater levels of fecal co liforms. (Lazaro et al., 2013) (Mwangome et al., 2017).

In Uganda, comparative investigations have revealed considerable variability in fecal contamination levels between wells (Kato et al., 2018).

A research in rural Uganda discovered that wells placed near latrines or in flood-prone areas had greater contamination levels than those in more protected places (Nayebare et al., 2019).
These findings emphasize the role of location and environmental factors in determining water qu ality.
Furthermore, the Uganda Bureau of Statistics has identified differences in water quality between districts, underlining the necessity for targeted interventions (Uganda Bureau of Statistics, 2020).

Local health reports from Nagongera Town Council indicate that fecal contamination levels vary amongst wells .Wells found near densely populated ares or agricultural grounds are thought to be more polluted .However, thorough comparison investigations are required to validate these findings and identify high-risk wells for targeted interventions. Preliminary findings suggest that wells in low-lying locations prone to flooding may have greater contamination levels due to runoff.

However the existing literature provides valuable insights into the assessment of fecal contamination in water sources, including open wells, there are still several knowledge gaps that require further investigation and research.

One of the key gaps identified in the literature is the limited understanding of the specific sources and pathways of fecal pollution in the context of Nagongera Town Council. Most of the available case studies and research have been conducted in geographically and socio-economically diverse settings andmay not fully capture the unique challenges and dynamics of local environments.Targeted studies to identify specific sources of fecal contamination, such as: For example, human waste, animal waste, or agricultural runoff and the mechanisms by which they enter open wells arevaluable fordeveloping more effective mitigation strategies (Bain et al., 2014). Furthermore,the literature review highlights the need for a more comprehensive assessment of the public health impacts associated with fecal contamination of open wells. While some studies have established a link between fecal contamination and the incidence of waterborne diseases, the specific health outcomes and the burden of disease in the local community of Nagongera Town Council remain largely unexplored. Epidemiological studies that examine the prevalence of diarrheal diseases, typhoid, and other fecal-borne illnesses, and their correlation with the water quality of open wells, would provide valuable evidence to guide public health interventions (Ercumen et al., 2017). Furthermore, the literature review suggests that there is a need for more research on the effectiveness and sustainability of various mitigation and prevention strategies in the context of Nagongera Town Council. While the literature has highlighted general approaches, such as improved sanitation, wastewater treatment, and best management practices in agriculture, the specific implementation challenges, community acceptance, and long-term impacts of these strategies in the local setting remain largely unknown. Pilot studies and action research projects that evaluate the feasibility, effectiveness, and

scalability of different interventions would be instrumental in informing the development of comprehensive and context-specific solutions (Onda et al., 2012). Finally, the literature review highlights the importance of incorporating community involvement and participatory approaches in future research on fecal contamination in open wells. Actively involving local stakeholders such as local residents, water and sanitation service providers, and local authorities helps ensure the relevance, acceptability and sustainability of research and its results (Whaley andCleaver, 2017)

2.3 Sources of fecal contamination in open wells

Globally, studies have discovered a number of sources of fecal pollution in open wells, including proximity to latrines (Bain et al., 2014), agricultural runoff (Ghosh et al., 2012), and poor well protection (Howard et al., 2003).

Wells in rural India near open defecation sites were found to be considerably more contaminated, showing the influence of inadequate sanitation practices on water quality (Malan et al., 2023). In Latin America, agricultural runoff has been recognized as a significant cause of fecal contami nation in rural wells, particularly in areas with intense livestock husbandry (Gómez et al., 2018).

In Africa, research has also identified several sources of fecal pollution in open wells (Thompson et al., 2016). In Malawi, a study discovered that wells near pit latrines had greater levels of fecal contamination, stressing the importance of adequate sanitation facilities (Chirwa et al., 2017).

In Nigeria, agricultural activities and inadequate waste disposal methods have been identified as major causes of fecal pollution in groundwater sources (Kolawole et al., 2024). Furthermore, inadequate well construction and maintenance, such as unsealed well covers and poor drainage systems, have been found as significant contributors influencing contamination levels (Smith et al., 2018)(Johnson & White, 2020).

In East Africa, investigations have identified many sources of fecal pollution in open wells (Mwanza et al.,2021).

In Kenya, researchers discovered that wells near livestock farms were more contaminated due to runoff from animal waste, which transfers feces into water sources (Hamzah et al., 2020).

In Tanzania, the proximity of wells to latrines and poor construction methods were found as maj or contributors to fecal contamination (Mwangome et al., 2017). Furthermore, studies have demonstrated the importance of seasonal changes, with higher contamination levels during the rainy season due to increased surface runoff (Nguyen et al., 2019).

In Uganda, research have found comparable sources of fecal pollution in open wells.

According to research conducted in rural Uganda, wells near latrines or in regions with poor drai nage systems are more likely to be contaminated with feces (Nakagiri et al., 2015).

The Ministry of Water and Environment in Uganda has also underlined the impact of poor sanita ry facilities and agricultural runoff on water quality.

These findings support national initiatives to improve water quality through better sanitation prac tices and infrastructural development.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter has shows the place where the research took place and different methods that were used and different ways in which data was collected to ensure quality results. This chapter include study design, study area, data collection method, data collection tools, data collection procedure, study variables, quality control, data analysis and presentation.

3.1 Data collection tools, apparatus and reagents

A phone was used to take photos during the study and micro pipette, test tubes and distilled water Eosin methyl blue agar sauce pan stirring rod, auto clave, Duran bottle, and colony counter for aiding in counting CFUs.

3.1 Study design

The study design was a cross sectional study because of its efficiency and effectiveness in providing a snapshot of the current status of fecal contamination in open wells across Nagongera Town Council. This design allows the collection of data at a single point in time, enabling researchers to assess contamination levels, sources, and associated risk factors within the community.

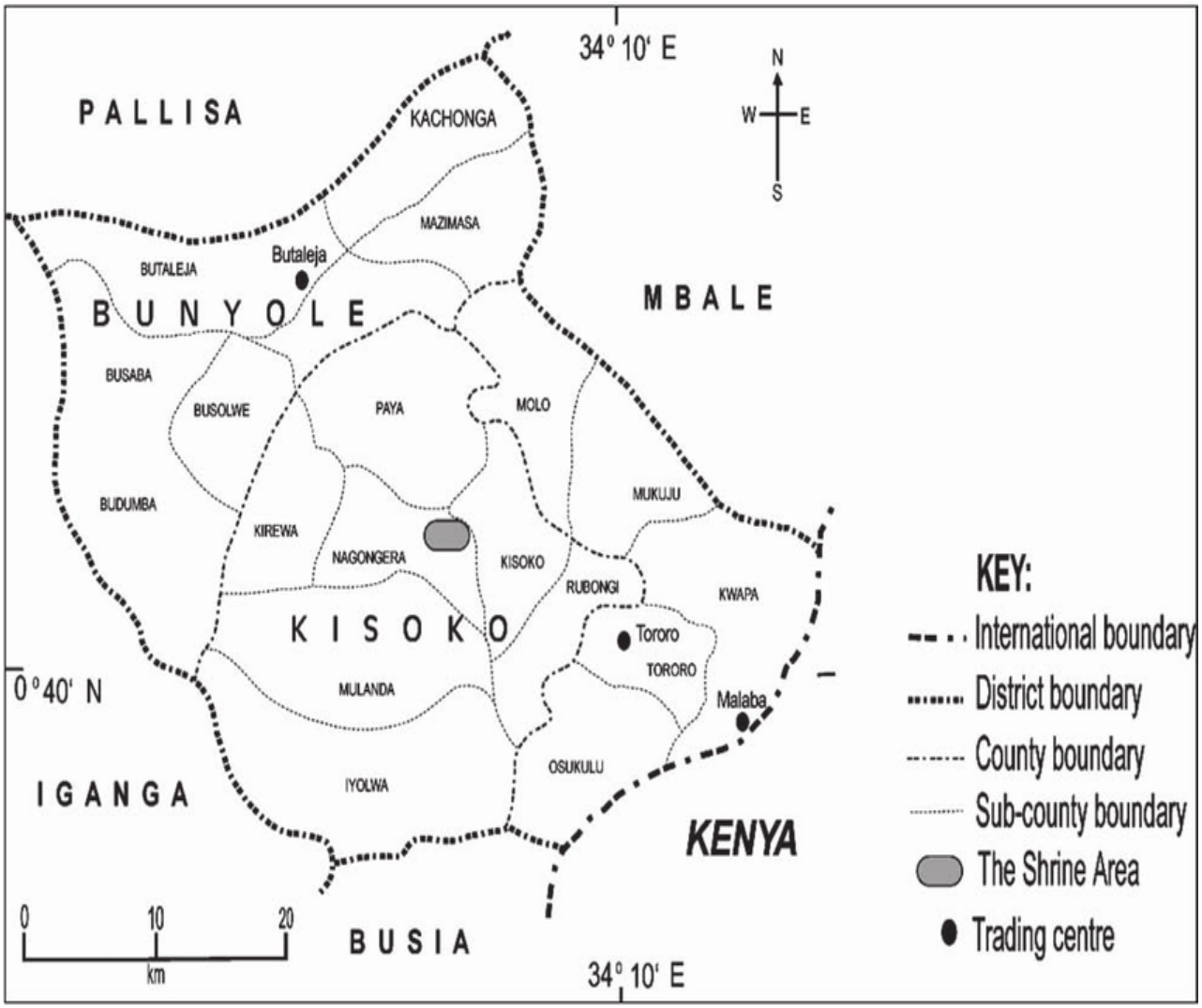
3.2 Study area

This Nagongera Town Council is located in the Eastern Region of Uganda. It is situated in the Tororo District, which is bordered by the Busia District to the east, the Bugiri District to the north, the Butaleja District to the west, and the Kenya-Uganda inborder to the south.

The exact size of Nagongera Town Council in square kilometers may vary, as administrative boundaries can change over time. However, as of the most recent data available, Nagongera Town Council covers an approximate area of 24.68 square kilometers.According to the data from Citypopulation.de (2021)

Nagongera Town Council is predominantly rural, with a mix of agricultural land, residential areas, and small-scale commercial activities. The community relies heavily on agriculture for livelihoods, with crops such as maize, beans, cassava, and bananas being commonly cultivated.

Access to clean water and sanitation facilities remains a significant challenge in Nagongera Town Council, with many residents depending on open wells for their water needs. The town council's location in a rural setting underscores the importance of addressing water quality issues to protect public health and promote sustainable development in the community.



(https://www.researchgate.net/figure/Map-of-the-Tororo-District-showing-the-shrine-area_fig1_287779996 on 2rd August 2024 at 4:20pm)

Fig 1.0 a sketch map showing Nagongera Town Council, it's neighbouring counties and sub counties and Tororo district at large with it's neighbouring districts

3.3 Site description (open well description)

The open wells that were selected are those with a high degree of susceptibility to fecal contamination like those that were having a shorter proximity to sources of fecal contamination like nearness to latrines, livestock houses or at dumping points for surface run off water

3.4 Sampling technique

The study employed a simple random procedure to select the study sample where a few open wells were selected from the many for the study and these were selected based on susceptibility to fecal contamination like proximity to sources of contamination like latrines, livestock houses and at dumping points of surface run off and these wells were selected after conducting a pilot study to assess their susceptibility to fecal contamination. This has given a representative sample of the whole making the study give representative data of the whole.

3.5 Water sample collection from the selected wells

Water samples were collected from the wells into sterile sample bottles which were properly labelled with well identifiers for example A, B, C, as well as taking samples to the laboratory for fecal analysis.

Fig ; 1.1 collected water samples from the different open wells identified as A, B, C

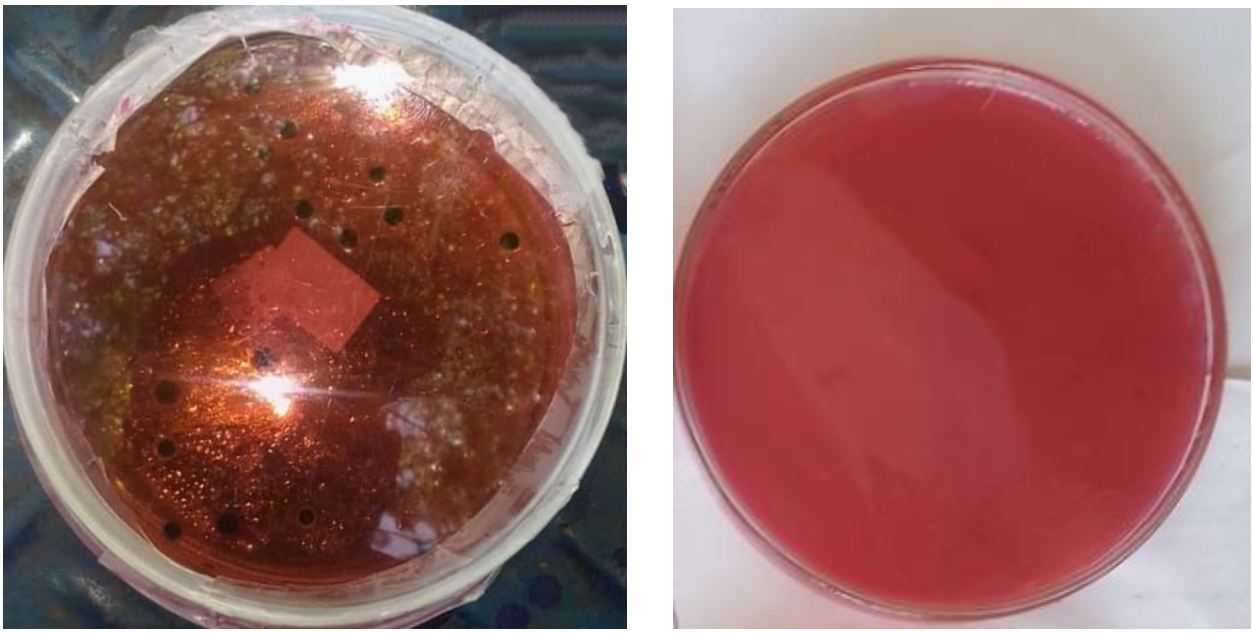
3.6 culturing of Fecal coliform (E. coli bacteria)

The collected water samples were used as the source of E. coli (inoculum), fecal coliform E. coli bacteria was cultured on an Eosin methyl blue agar medium. The medium will be prepared by following instructions as on its container i.e. 47g of the agar will be weighed ,placed into a 1litre beaker ,dissolved in 1000ml of sterile water by stirring ,poured in a sauce pan and boiled while stirring until when medium begins to boil then removed from the heat source ,allowed to slightly cool later poured into a Duran bottle ,sterilized in an autoclave at 121°C for 15 minutes after the medium is removed, allowed to cool and poured into petri dishes and allowed to solidify awaiting culturing(Wamyil et al., 2023) .

Fig;1.2 Medium poured in the petri dishes to solidify awaiting culturing

For quality control blanks were set up using sterile water.

Fecal coliform bacteria CFUs that grew on the medium were counted and their number noted down.



fig;1.3 showing E.coli CFUs that grew on the agar plates and one of the blanks where sterile water was used and no CFUs grew .

3.7 Data analysis and presentation

The collected data was analyzed using statistical software such as Microsoft Excel. Descriptive statistics such as averages have been used to summarize the data.

The results of the study have been presented in tables and graphs. The tables provide a summary of the study variables.

CHAPTER FOUR: RESULTS

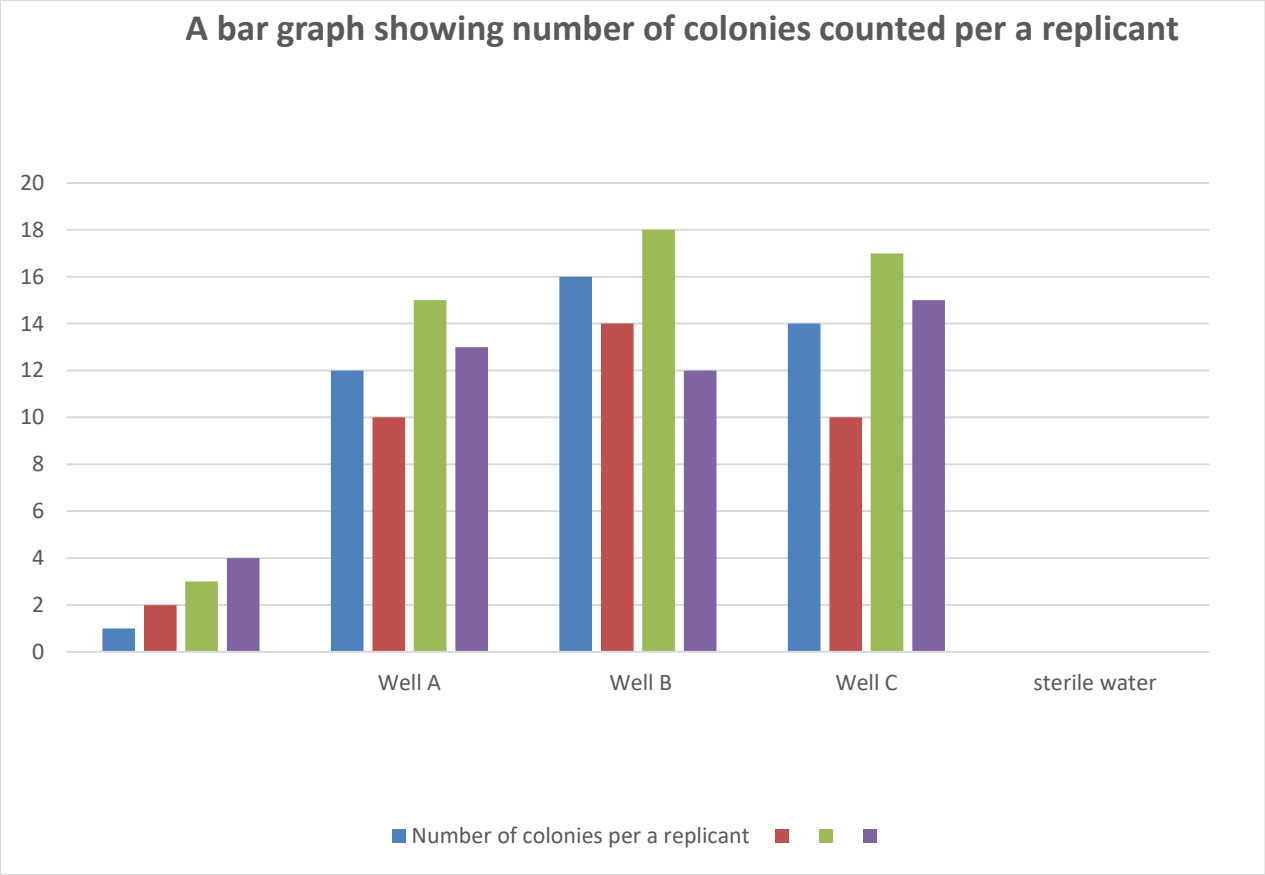
water samples from the wells were used as an inoculum for the E. coli bacteria on well prepared EMB agar which E. coli bacteria is a bio indicator for fecal contamination and later the culture was incubated for 48hours to allow growth of the bacterial colonies, these colonies were counted for each of the four petri dishes or replicates made from the collected water sample per as well as well as replicates for the blank or sterile water and results are in the table below

4.1 Table1.0 a table of results of the counts of colonies per a replicate

Open Well	Number of colonies per a replicate			
	1	2	3	4
Well A	12	10	15	13
Well B	16	14	18	12
Well C	14	10	17	15
Blank (sterile water)	0	0	0	0

4.2 Data analysis

Fecal coliforms specifically E. coli bacteria were cultured using samples of water from randomly selected open wells on EMB agar, incubated and counted to establish their presence in the well water .Averages of the number of colonies per replicate of the culture were calculated from the formula; total number of colonies divide by four and later bar graphs drawn for both the number of colonies per a replicate and the averages of the colonies per a well.



fig; 1.4 a bar graph showing the number of colonies per a replicate.

4.20 Calculating of average number of colonies per a well

From formula,

Average = Total number of colonies per a replicate / Number of replicates

For Well A Total number of colonies = 12+ 10+15+13 = 50

Average = 50/4 = 12.5 colonies

For Well B Total number of colonies = 16+14+18+12= 60

Average =60/4= 15.0 colonies

For Well C Total number of colonies = 14 + 10+17+15 =56

Average =56/4= 14.0 colonies

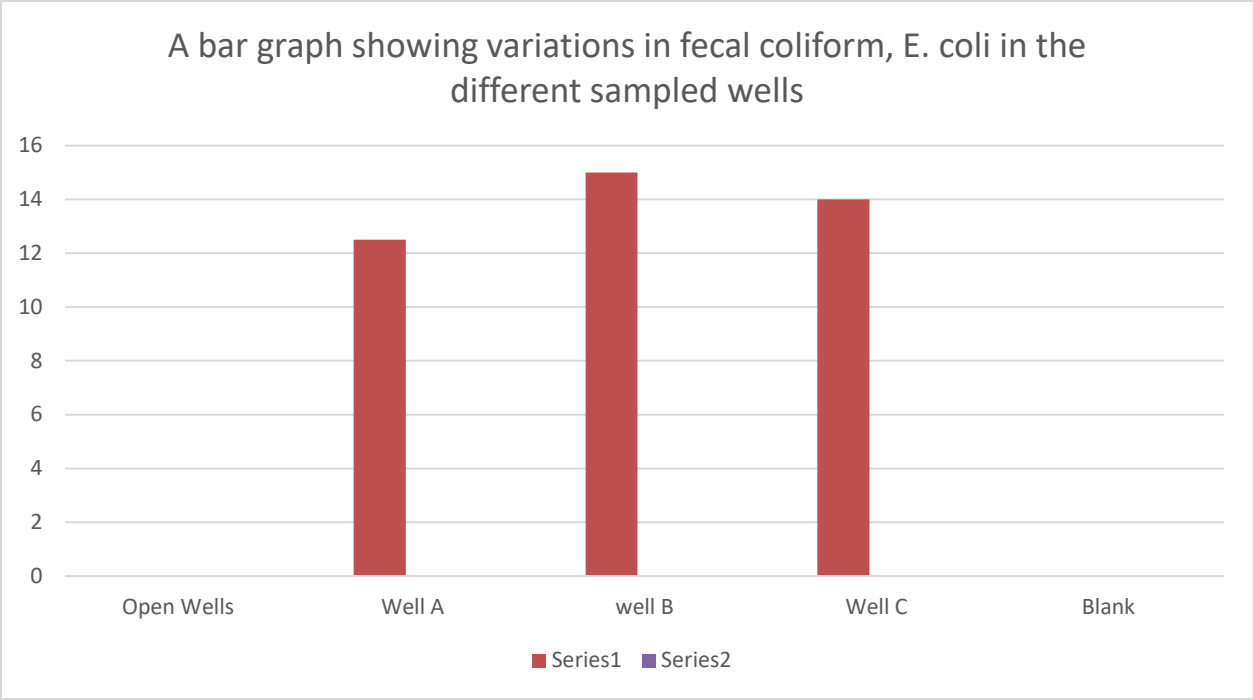
For Blank (sterile water) Total number of colonies = 0 + 0+0+0=0

Average=0/4= 0.0colonies

4.21 Table 1.1a table showing average number of fecal coliform (E.coli) colonies from the different sampled wells.

Open well	Average number of colonies for all replicates made
Well A	12.5
Well B	15.0
Well C	14.0
Blank (Sterile water)	0.0

Fig;1.5


A bar graph showing variations in fecal coliform, E. coli in the different sampled wells
16
14
12
10
8
6
4
2
0
Open Wells
Well A
well B
Well C
Blank
Series1
Series2

CHAPTER FIVE: DISCUSSION

From the results the E. coli colony forming units that grew on the medium in the petri dishes are an empirical indicator of fecal contamination in the water samples collected from the open wells signifying fecal contamination in these wells. The results of this study suggest that there is a significant level of fecal contamination in the open wells in Nagongera town council and this poses a serious health risk to the local inhabitants of the area. However, these results positively correlate with some study that was conducted in rural Ethiopia investigating the prevalence of fecal contamination in domestic water sources, including open wells (Gebre-Mariam, 2015). The researchers found that 68% of the open wells sampled were contaminated with E. coli, indicating the presence of fecal matter. This study highlighted the need to improve sanitation and water treatment toad dress high levels of fecal contamination in the region. The results of this study also positively correlate with a similar study in Kenya, researchers examined water quality in open wells in peri-urban areas (Okotto-Okotto et al., 2015). The results showed that 60% of open wells were contaminated with E. coli, with the highest levels observed during the rainy season. This study highlighted the importance of protecting water sources from surface runoff and the need for community-based water quality monitoring and management.

From the comparison of the results, statistical analysis shows that well B has the highest level of fecal contamination since it has the highest average number of colonies followed by well C, Well A and the blank (sterile water) with no fecal contamination.

For water to be considered risk free to human use, the total bacteria and E. coli water sample should be zero (WHO, 2004).This study has revealed that there is a high Fecal coliforms in all the samples obtained from the open wells with varying numbers and this high coliform content of the open wells poses a serious health risk and renders the water unsuitable for human consumption. The presence of these fecal indicators in the water could beat tribute to pit latrine in the vicinity that extent their influents to these water sources since they are located close to them.

The ground water flow is either lateral or vertical. During lateral flow, filtration does not occur and could carry fecal pollution for much longer distance (Cair cross, 1987). In a similar work done by Umar (2008), in Asamankese in the Eastern Region of Ghana he found high microbial indicators in the wells. The study related the level of contamination of water to the lateral

distance between pit latrine and wells. This corroborates the high counts of microbial loads obtained in the open wells in this study.

The above factors account for the variations of fecal coliform, E. Coli in the different water samples collected from the different open wells in Nagongera Town Council.

5.1 Conclusion

The results indicate the presence of E. coli bacteria in the sampled open wells in Nagongera town council which bacteria are a bio indicator of fecal contamination therefore it can be concluded that there is fecal contamination in open wells in Nagongera town council since the sampled open wells are a representative of the whole open well population in the area and this poses a health threat to the natives of the area.

5.2 Recommendations

I recommend that regular water quality testing should be conducted to monitor the level of fecal contamination in the wells, proper sanitation and hygiene should be implemented to reduce the risk of fecal contamination and the use of appropriate water treatment technologies should be considered to remove fecal contaminants from the water.

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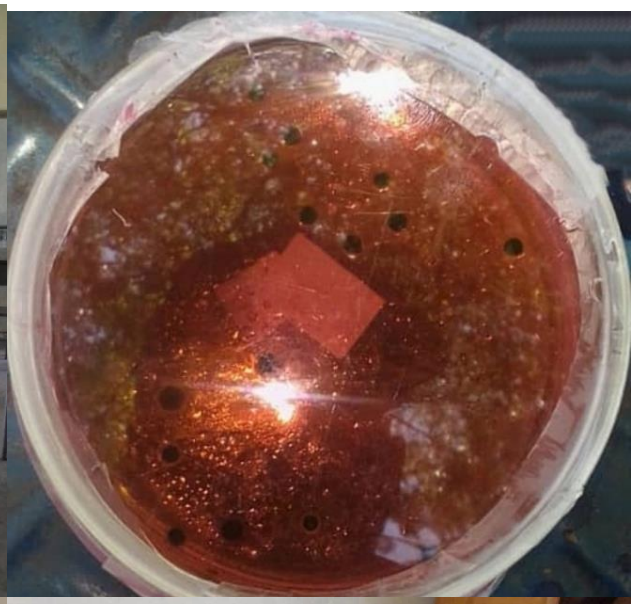

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