‘INVESTIGATION OF MAGADA STREAM WATER FOR PATHOGENIC MICROBES AND THE HEALTH RISK OF ITS CONTACT WITH PEOPLE OF MAGADA COMMUNITY’

BY

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CERTIFICATION

This is to certify that this project, Study of Public Health Risk of Magada Contaminated Stream Water in The People of Magada Community was carried out by me Obi Stephanie Ifechukwu, Matriculation number 15010101008 and duly supervised by Dr. Adeiga A.

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Dr Adeiga A. (Supervisor) Date

(Head of Department)

DEDICATION

This book is dedicated to God Almighty for his divine strength, wisdom and for his guidance and provision throughout my stay in the school.

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ABSTRACT

Contaminated stream water in a polluted environment has negative impact on both the people and the environment itself. Such is the situation of Magada stream water, which through sewage pollution has been contaminated especially with fecal contamination. The stream becomes a concern for the people of Magada community when they started complaining of symptoms of ill-health whenever they pass through the water. This brought the observation of the problem. An investigative study was now designed to know the pathogenic of microorganism that could be causing the symptoms of ill-health. Also an interview was conducted with the people of the community when passing through the water. The result revealed the bacterial organisms that are pathogenic in the water, such as *staphylococcus*, *Escherichia coli* etc. Many ill-health symptoms were reported in response to the questions from the questionnaire. Symptoms such as itching rashes, peeling of the skin that could be caused by probable staphylococcus species. The study was conducted as saying that the stream is containing the pathogenic organism and

should be treated from time to time. The people in the area should be educated in health awareness to manage the problem.

CHAPTER ONE

INTRODUCTION

BACKGROUND

Stream water is a surface water flowing on a land scape of an area. It either flows on its own or joins other streams to form a large river. It is either permanent or seasonal depending on source of water (John Misachi World Atlas.com).

The seasonal stream water usually flow when there is significant rainfall occurring. This is the characterization of Magada stream water. Its level is always high when there is high rainfall and can be low level of flowing or drying during the dry season (consulting with the community resident).

Storm water consisting of rain water flows over the landscape into stream water. This storm water carries contaminants which is called polluted runoff or non-point source pollutions when source of pollution is of diverse sources.(Adeogun et al 2011).

Human activities on land and water generate pollutants such as sediments, nutrients, toxics and pathogenic organisms. These pollutants threaten the health of our environment and the people in the environment. Contributing more to this problem is the influence of waste water from urban and peri urban where sewage system is either open to lead to the stream water or household water, water closet leakinginto septic tanks which often times break its hold and seeped into drainage that opens into the stream water flowing into the environment. Some owners of properties in some cases connect their water closets to street gutters or stream water. These are the sources of pollution of stream water observed in some parts of magada community.

Magada stream water is formed from a slow moving stream water from Mountain Top University to the outside of the University campus and later form a confluence with stream water from Makogi Oba community . Magada stream water is a seasonal stream water that is usually flowing when there is significant rainfall occurring. Most of the community'ssewage water tanks are observed to be at the bank of Magada stream water. Source of the waste water flowing into the stream water in the area are mostly a breakout of sewage tank water that are mostly faecally contaminated (observation of the environment). The resulting contamination seems to be a constant feature of water pollution and characterized by getting to the peak when rainfall intensities is at its peak. At this time, the water level of the stream water rises to high level. This magada stream water flows across the road path of the community which now makes people to be passing through it whenever they have to go out of the community.

Oftenly, people have to walk through the contaminated stream water of Magada to get to their places of work and businesses. Most of the time of passing through the water,

people have to put off their shoes and roll up their gowns and trousers which eventually expose their bodies to the stream water. The after effect of this may cause ill health (WHO Bulletin 2017).

STATEMENT OF PROBLEM

The report from the people in the community described the extent of the pollution of Magada stream water especially from the leaking of sewage system that are in the banks of the river. The contaminants from the sewage maybe containing pathogenic microorganisms that can cause ill health in the people of the community (George J.2001). The degree of ill health experienced maybe strongly related to the exposure of the people especially when they have to pass through the water as many times as possible everyday. The health risk due to this exposure need to be investigated.

RATIONALE OF THE STUDY

The health risk which the people is exposed to need to be investigated by conducting laboratory investigations of water samples from the contaminated stream water to establish pathogenic microbes in the polluted water. By this the microorganisms will be identified. Also an interview would be conducted with the people in the community and those walking through the water using a structured questionnaire to get the record of their experiences of how they have been affected and how they have been managing their situations.

AIM OF THE STUDY

The purpose of the study is to identify the pathogenic microbes polluting the stream water and the impact on the health of the people so as to determine the health risk among the

people living in the community. It is also to design the type of health education needed to manage the ill-health generated.

SPECIFIC OBJECTIVES

1. Identify the pathogenic microorganisms that can be of health hazard in the polluted stream water.
2. To establish the frequency of walking through the stream water to determine the exposure to the pathogenic microbes.
3. To establish the symptomsof ill-health experienced by the adult in Magada community.
4. Evaluate the knowledge of the people in managing the disease conditions.

SIGNIFICANCE OF STUDY

This is the establishment of the pathogenic organisms causing the ill health and the type of ill health experienced by the people. The response of the people to the disease conditions is also important as it contributes to the result of the study. The result will guide the measures to take in educating the people in the health awareness.

CHAPTER TWO

LITERATURE REVIEW

Stream is a body of water with surface water streaming inside the beds and banks of a channel. The stream envelops surface and groundwater fluxes that react to topographical, geomorphological, hydrological and biotic controls (Alexander et al., 2015). Streams typically derive most of their water from precipitation in the form of rain and snow. Most of this water re-enters the atmosphere by evaporation from soil and water bodies, or by the evapotranspiration of plants. Some of the water proceeds to sink into the earth by infiltration and becomes groundwater, much of which eventually enters streams. Some precipitated water is temporarily locked up in snow fields and glaciers, to be released later by evaporation or melting (Woodford, 2019). The rest of the water flows off the land as runoff, the proportion of which varies according to many factors, such as wind, humidity, vegetation, rock types, and relief. This runoff starts as a thin film called sheet

wash, combined with a network of tiny rills, together constituting sheet runoff; when this water is concentrated in a channel, a stream has its birth. (Wikipedia, 2019).

2.1 WATER POLLUTION

Water pollution can happen when undesirable materials enter into a water body and changes the quality of the water and makes it destructive to the environment and human wellbeing. Being a widespread dissolvable, water may be a major source of contamination. It is produced by industrial and commercial wastes, agricultural practices, everyday human activities and most notably, models of transportation. (Owa, 2014).

Discharge of domestic and industrial effluent wastes, leakage from water tanks, marine dumping, radioactive waste and atmospheric deposition are major causes of water pollution. Heavy metals that are disposed off and industrial waste can accumulate in lakes and river, proving harmful to humans and animals (Owa**,** 2014).. Toxins in industrial waste are the major cause of immune suppression, reproductive failure and acute poisoning. Infectious diseases, like cholera, typhoid fever and other diseases gastroenteritis, diarrhea, vomiting, skin and kidney problem are spreading through polluted water. Human health is affected by the direct damage of plants and animal nutrition. Water pollution can almost always means that some damage has been done to an ocean, river, lake, or other water source. (Woodford, 2019).

Large amount of domestic sewage is drained in to river and most of the sewage is untreated. Domestic sewage contains toxicants, solid waste, plastic litters and bacterial contaminants and these toxic materials causes water pollution (Haseena and Malik, 2017). Different industrial effluent that is drained in to river without treatment is the major cause of water pollution. Hazardous material discharged from these industries is

responsible for surface water and ground water contamination (Owa, 2014)..

Contaminant depends upon the nature of industries. Toxic metals enter in to water and reduced the quality of water. 25% pollution is caused by the industries and is more harmful. Increasing population is creating many issues but it also plays negative role in polluting the water. Increasing population leads to increase in solid waste generation. Solid and liquid waste is discharged in to rivers. Water is also contaminated by human excreta. In contaminated water, a large number of bacteria are also found which is harmful for human health. Government is incapable to supply essential needs to citizens because of increasing number of population. (Haseena and Malik, 2017).

2.2 TYPES OF POLLUTION

There are various types of water pollution, they include;

1. CHEMICAL POLLUTION

A large variation of inorganic chemicals find their way into regular water from municipal and industrial waste waters and urban run offs. Inorganic contamination of aquatic environments is caused by naturally occurring substances (fluoride, arsenic and boron), industrial waste (mercury, cadmium, chromium, cyanide and others), agricultural and domestic waste (nitrogen compounds), and systems for the distribution of drinking water (aluminum, copper, iron, lead and zinc). .(Thangamalathi and Anuradha, 2018). Naturally occurring inorganic materials mainly contaminate groundwater; industrial and agricultural waste, mainly surface water such as rivers, lakes and ponds; and pipes of distribution systems, mainly tap water. Each of the inorganic substances contaminating water has a characteristic nature, concentration in water and effect on human health. Each of the inorganic substances contaminating water has a characteristic nature, concentration

in water and effect on human health (Woodford, 2019). Chemicals created from human activities that increase the concentration of specific compounds above natural levels can cause pollution problems. Too many of a plant nutrient may lead to excessive plant growth, while synthetic organic compounds can cause physiological changes in aquatic organisms and can become lethal at high concentrations. (Water encyclopedia, 2017). Many inorganic substances are used for industrial manufacturing. Pollution of the water environment occurs from industrial manufacturing and the use of these products. Many kinds of metals contaminate water through waste water and sludge from industrial factories, mines or smelting stations. Metals connected to the contamination of water are as follows; antimony, arsenic, barium, beryllium copper, iron, zinc, cadmium, chromium, manganese, nickel, selenium etc (Gumpu et al., 2015).In a classic instance of transboundary pollution, traces of PCBs have even been found in birds and fish in the Arctic (Woodford, 2019). They were moved there via the oceans, thousands of miles from where they originally entered the environment (Rajakumar and Sampath, 2017).The food and farm processing sector can also be a significant producer of particularly organic wastewater with strong demand for biochemical oxygen resulting in low concentrations of oxygen or even anoxic conditions in natural waters (Greenfacts, 2019).

2. INDUSTRIAL POLLUTION

Industries cause huge water pollution with their activities. The common industrial pollutants responsible for causing water pollution are, sulfur, asbestos, poisonous solvents, polychlorinated biphenyl, lead, mercury, nitrates, phosphates, acids, alkalies, dyes, pesticides, benzene, chlorobenzene, carbon tetrachloride, toluene, and volatile biological chemicals (Shah, 2017). Chemicals like sulfur is harmful for marine life, while

asbestos is known to be a potential carcinogen (Parsa, 2012). Drinking water contaminated with asbestos may increase the risk for benign intestinal polyps. Numerous of the industries are situated along the banks of stream such as steel and paper industries for their prerequisite of gigantic sums of water in fabricating forms and finally their wastes containing acids, alkalies, colors and other chemicals are dumped and poured down into waterways as effluents.Oil does not dissolve in water, but on the surface of the water it forms a dense layer. This can prevent getting enough light for photosynthesis from marine plants. It is damaging to fish and sea birds as well (Shah, 2017).

3. RADIATION POLLUTION

Radiological defilement of water is due to the nearness of radionuclides, which are characterized as iotas with unsteady cores. In an exertion to end up more steady, a radionuclide emanates vitality within the shape of rays or high-speed particles. Typically called ionizing radiation since it uproots electrons, which makes particles. The three major sorts of ionizing radiation are alpha particles, beta particles and gamma beams.(University of Florida environment health and safety, 2017)

One of the greatest contrasts between these sorts of radiation is level of infiltration. Alpha particles, for illustration, are not able to enter human skin, beta particles can enter the best layer of skin, and gamma beams are effortlessly able to enter a few layers of human tissue. The estimate of each molecule too plays a portion (Shah, 2017). Radionuclides in water and nourishment can show a more prominent wellbeing hazard since the radiation is really ingested, meaning it can harm inside tissue. Radiation ionizes water, which

causes free radicals to make.Free radicals are ordinary cellular metabolism products (Phaniendra et al., 2014). Radiations are classified into two types, they are:

- Non-ionizing radiations: Electromagnetic waves of a longer wavelength which are close bright beams to radio waves are known as non-ionizing radiations.The kinetic energy of particles of non-ionizing radiation is too small to produce charged ions when passing through matter (Radiation Wikipedia, 2019). These radiations have sufficient sum of vitality to energize atoms and iotas of the medium by means of which they travel. They make particles to vibrate quicker and but does not have sufficient sum of vitality to ionize them (Shah, 2017).
- Ionizing radiations: These radiations are electromagnetic radiations that have tall vitality like gamma beams, x-rays, and brief wavelength bright radiations (Shah, 2017). These beams of vitality like alpha, beta, and gamma are produced in radioactive rot have the capacity to ionize atoms and iotas through which they travel. They moreover have capacity to alter particles and particles into charged particles. Radioactive rot could be prepared from which alpha, beta, and gamma radiations are created. (Sumit, 2017).

4. BIOLOGICAL CONTAMINANTS

When it comes to water contamination that not as it were makes water unusable, but too noxious, typically organic contamination. The sources can be both natural and man-made, but certainly the foremost common source is human waste (Sumit, 2017). Numerous

undeveloped parts of the world suffer from a need of water treatment alternatives and human wastes may be a breeding ground for microbes, infections and parasites. Illustrations incorporate E Coli, cholera, typhoid, and numerous others (Gemma 2017).

2.3 COMMON MICROORGANISMS IN STREAM WATER

Giardia lamblia

Giardia lamblia could be a common parasite that causes gastrointestinal sickness. Also called Giardia intestinalis, the tiny parasite is spread through human and animal feces. In case carried in a stream or other unfiltered water supply, downstream ingestion will spread the diarrhea-causing illness called Giardiasis (Sumit, 2017). It is additionally known as "beaver fever," since wild creatures living in and close water can be prime carriers of the malady, concurring to the Modern York State Department of Environmental Conservation. Solid grown-ups for the most part can get through a bout with no enduring harm (Singh and Gupta 2017).

Cryptosporidium

Cryptosporidium is a microrganism that burrows into the guts and is transmitted to others through feces defilement in water. Concurring to the Mayo Clinic, in most solid individuals a cryptosporidium disease will create a bout of watery diarrhea that goes absent in a week or two. Be that as it may, a compromised resistant framework can permit a cryptosporidium disease to be life-threatening. (CDC, 2016).

E. coli

E. Coli are a big and varied bacteria group. Despite most E strains. Coli are harmless, individuals can get sick from others. Some sort of E. By creating a toxin called Shiga toxin, coli causes disease. "Shiga toxin-producing E" is the bacteria that create these toxins. Coli,' or briefly STEC. STEC bacteria are found in many animals ' intestines and are generally transferred to humans when bacteria contaminates foods. E. coli is transmitted through contaminated water or nourishment, such as crude vegetables and undercooked ground meat. In spite of the fact that sound adults can withstand a bout of the contamination, children and the elderly can encounter life-threatening kidney failure called hemolytic uremic disorder (HUS). (CDC, 2016)

Cholera

Cholera (Vibrio cholerae) is a microbe carried in contaminated water that produces a solid poison with dangerous impacts, called CTX. Infections are particularly common after ingesting contaminated water or food. Cholera is an acute, watery diarrhoeal disease caused by Vibrio cholerae of the O1 or O139 serogroups (Clemens, 2017).

Typhoid fever

Typhoid is a bacterial infection that can lead to a high fever, diarrhea, and vomiting. It can be fatal. It is caused by the bacteria Salmonella typhi (Newman, 2017). Human infections with Salmonella enterica results in two major groups of diseases: gastroenteritis and typhoid fever (Raffatellu et al.., 2008).

Bacillus

Bacillus species are rod-shaped, endospore-forming aerobic or facultatively anaerobic, Gram-positive bacteria; in some species cultures may turn Gram-negative with age. Individuals at risk for anthrax include those in contact with infected animals or animal products (Turnbull, 1996).

2.4 WHAT ARE THE SOURCES OF CONTAMINANTS

Water pollution can occur from two sources;

1. Point sources of contamination pollutants can come from a specific source such as a pipe that discharges used water or other materials from a factory into a water body. Such discharges can be harmful to the aquatic ecosystems and can affect the forest tree species surrounding the body of water (Viman et al., 2010). Point sources of contamination incorporate wastewater gushing (both civil and industrial) and storm sewer release and influence generally the zone close it. (Singh and Gupta 2018).

2. Non-point sources of contamination are those which arrive from diverse sources of root and number of ways by which contaminants enter into groundwater or surface water and arrive within the environment from diverse non identifiable sources. Cases are runoff from agrarian fields, urban squander etc. Some of the time contamination that enters the environment in one put has an effect hundreds or indeed thousands of miles

absent. This is known as trans-boundary contamination. Nitrogen and Phosphorous are two very important nonpoint source pollutants. Their sources and concentrations mainly depend on various land use pattern and agricultural activities (Alam et al., 2013).

- Organic water pollutants: They contain of insecticides and herbicides, organohalides and other shapes of chemicals; microscopic organisms from sewage and livestocks cultivating; nourishment processing wastes; pathogens; unstable natural compounds etc (Newman, 2017).
- Inorganic water pollutants: Besides the organic matter passed through sewage and industrial waste into the water body, the water is contaminated by elevated concentrations of heavy metals and other inorganic pollutants. These are non-biodegradable compounds that persist in the setting. These pollutants include mineral acids, inorganic salts, trace components, metals, metals, organic metal complexes, cyanides, sulphates, etc (Newman, 2017).

Urban Land Use

In our urban zones precipitation run-off as storm water is one of the major nonpoint sources of contamination affecting the water quality of our waterways and bays. The pollutants that happens in urban areas vary broadly, from common biological material to highly toxic metals (Water encyclopedia, 2017). Storm water from road surfaces is regularly contaminated with car oil, tidy and the defecation of creatures and soil and silt run-off from development destinations, and in mechanical ranges frequently contains more toxicants and chemicals The urban rivers or streams has always been the recipient of sewage water from various sources that have different types of the domestic, agricultural, and industrial foreign elements. (Hashim et al., 2015). Drainage and surface

run-off of septic tank effluents may too be shapes of non-point source contamination of streams in these ranges. (Victoria, 2018).

Forestry Land Use

Forestry operations may contribute to non-point source contamination of streams by expanding soil disintegration and silt run-off. Non-point source contamination is frequently more troublesome to control than point source contamination. In urban regions the arrangement of reticulated sewerage frameworks and satisfactory road cleaning are critical measures, whereas in cultivating and ranger service regions, soil preservation hones and the controlled application of pesticides and composts are fundamental on the off chance that contamination of conduits is to be avoided (Hashim et al., 2015).

2.5 SEWAGES

Sewage is water-carried waste, in either arrangement or suspension that's aiming to flow away from a community. It is known as waste water streams, sewage is the utilized water supply of the community. It is more than 99.9% immaculate water and is characterized by its volume or rate of stream, its physical condition, its chemical constituents, and the bacteriological life forms that it contains (Ibiam and Igewnyi, 2012). Depending on their root, wastewater can be classed as clean, commercial, industrial, agricultural or surface runoff. Surface runoff, also known as storm flow or overland flow, is that portion of precipitation that runs rapidly over the ground surface to a defined channel. Microorganisms found in sewage originate from two sources--soil and sanitary waste and

it contains a lot of microorganisms some are pathogenic, or disease-carrying, and pose a threat to public health (Tang, 2017).

2.6 WHAT ARE THE EFFECTS OF WATER POLLUTION

According to Hashim et al., (2015), there is greater relationship between pollution and health problem. Microorganisms causing disease are known to be pathogenic organisms and they are spreading diseases directly to humans and examples of diseases caused by them are;

BACTERIAL DISEASES

Contaminated drinking water and fecal contamination of water is the major source of diarrhea. *Campylobacter jejuni*spread diarrhea 4% to 15% worldwide. Abdominal pain, nausea, headache are major symptoms of diarrhea. Good hygiene and antibiotic usage can prevent these diseases. *VibrioCholerae* is responsible for this disease. This bacterium produces toxins in digestive tracts. The symptoms of this disease are watery diarrhea, nausea, vomiting and watery diarrhea leads to dehydration and renal failure. Anti-microbial treatment is used to get rid of this disease.

Shigellosis is a bacterial disease caused by *Shigella* bacteria (Hashim et al., 2015).

It affects the digestive tract of humans and damages the intestinal lining. Watery or bloody diarrhea, abdominal cramps, vomiting and nausea are symptoms and it can be cured with antibiotics and good hygienic practice. Salmonellosis infects the intestinal

tract. *Salmonella* bacteria are found in contaminated water and it results in inflammation of intestine and often death occurs. Antibiotics are prescribed for these diseases (Asha,2018)

VIRAL DISEASES

Hepatitis is a viral disease caused by polluted water and infects the liver. Jaundice, loss of appetite, fatigue, discomfort and high fever are signs of hepatitis. Vaccines are available for hepatitis and by adopting good hygienic practice one can get rid of this disease. Encephalitis is inflammatory disease spread by bite of infected mosquitoes (Asha, 2018). Culex mosquito lays their eggs in contaminated water. Most people don't show any symptoms but some symptoms are headache, high fever, muscle stiffness, convulsions however in severe cases coma and paralysis results. No vaccine is available for this disease. Gastroenteritis is caused by different viruses including rotaviruses, adenoviruses, calciviruses and Norwalk virus. Symptoms of gastroenteritis are vomiting, headache and fever. Symptoms appear 1 to 2 days after infecting. Sickness can be dangerous among infants, young children and disabled person (Hashim et al., 2015).

PARASITIC DISEASES

Cryptosporidiosis is a parasitic disease caused by the cryptosporidium parvum. It is worldwide disease and symptoms are diarrhea, loose or watery bowls, stomach cramps and upset stomach. Cryptosporidium is resistant to disinfection and affects immune system and it is the cause of diarrhoea and vomiting in humans (Shan, 2017). Galloping amoeba is caused by the Entamoebahistolytica and affect stomach lining. This parasite undergoes cyst and non-cyst form. Infection occurs when cyst found in contaminated

water and it is swallowed. Symptoms are fever, chills and watery diarrhea (Hashim et al., 2015).

2.7.1 PUBLIC HEALTH RISK

More than 3 million people die each year of waterborne diseases worldwide including more than 2 million children die from diarrhea CDC, 2016). The urban population in developing countries are mostly vulnerable to the negative health impact of water pollutants and it brings about ill health to the population. Therefore, the cost medicines are significant.

The breaking down of water resources reduces social security. This can lead to poverty intensification and greater social inequity especially where poverty already affects a great part of the population. Eutrophication reduces the availability of oxygen dissolved in water and releases ammonium which is poisonous to fishes. (Bonn, 2001).

2.8 PREVENTIVE MEASURES FOR WATER POLLUTION

- ✓ There should be no littering of waste material into the river, streams, ponds etc.
- ✓ Take care not to overuse pesticides and fertilizers to avoid run off of such materials into water bodies.
- ✓ Avoid littering the drains with waste materials.
- ✓ Sewages or wastewater should be treated before discharged.
- ✓ Sewages has to be treated by primary or secondary treatment to get at least 80% purity.

- ✓ Paint brushes should not be washed into sinks to avoid run off into water bodies. (akinwale .o. coker). (CDC,2016).

CHAPTER THREE

METHODOLOGY

STUDY SITE

The study site is magada community suburb area of Ibafo Local Council Development Area(lying between 3.4125^{O}N and 6.7335^{o} E) where a seasonal stream water flowing through Mountaain Top University into magada community to form a confluence with another big stream water which flow through the canal of Lagos Ibadan express way. This magada stream water is of high level during the raining season and it covers the path road through which the people in the community pass through on daily basis.

STUDY DESIGN

This was a descriptive study of the cross-section of people of the magada community, observed to be passing or walking through contaminated magada stream water, and also describing the symptoms of ill-health experienced when they passed through the polluted water. The study also described the investigation of pathogenic organisms that probably presumed to be in the polluted water.

3.1 SAMPLE COLLECTION PROCEDURE

The stream water was obtained using a sterile 20ml capacity McCartney bottle and analysis of the water sample was carried out in the Microbiology laboratory of Mountain Top University for identification of possible pathogenic micro-organism in the water body

3.2 ISOLATION OF MICROORGANISM

Isolation of the organism was done by serial dilution then each dilution using the spread plate method and this method was done by incubation of the plates in an inverted position for 24hours at 37^0C. The colonies that emerged was counted. Colonies were sub cultured to obtain a pure culture which were stored in bottles for further test.

3.3 SUB-CULTURING OF ISOLATES

Distinct colonies of interest were picked from the heterotrophic colony in the media used and transferred into a new culture medium and allowed to grow and multiply for proper identification of a bacterium. The purpose of sub-culturing is to isolate a colony from various colonies inside a medium and plate it inside a fresh nutrient medium so it can grow without being restricted by the presence of other micro-organisms and multiply for further microbiological analysis on the isolate. The sub-cultured colonies were viewed after 24hrs for colonies standing distinct not clustered and these pure colonies were sub-cultured again. The pure isolates were transferred onto agar slant in McCartney, inoculated for 14-18hrs before transferred into a refrigerator at 4°C to serve as stock culture for subsequent test during identification. The sub-culturing process was carried

out aseptically to prevent contamination. The Petri dishes were inverted and transferred into the incubator at 37^{o}C for 24hrs.

3.4 IDENTIFICATION AND CHARACTERIZATION OF THE ISOLATES

This was all done based on their cultural, biochemical and morphological characteristics of the isolates obtained and were compared with the criteria in Bergey's manual of Determinative Bacteriology. The biochemical tests carried out for the identification and characterization of the isolates includes; motility, coagulase, gram staining, methyl red-vogesProskauer, oxidase, indole production, citrate utilization, catalase and sugar fermentation tests.

3.4.1 GRAM STAINING

A smear of the isolate was prepared on a glass slide, it was placed on a staining rack then flooded with crystal for a minute which was washed under tap water and then it was flooded again with Lugol's iodine for a minute and then washed under water and flooded with a mixture of ethanol and water(70% alcohol) for 10 minutes and also washed under water and then lastly, was flooded with Safranin for 30seconds and then washed under water, then it was then dried using absorbent paper and examined under the microscope the oil immersion objective.

3.4.2 MOTILITY TEST

A semisolid agar medium was prepared in a test tube and inoculated the isolate with a straight wire loop, making a single stab down the center of the tube to about half the depth of the medium.It was inoculated under normal conditions which favors motility.

Then the test tube was incubated at 37°C and examined at intervals (depending on generation time of bacterium).The tube was held to the light and looked at the stab line to determine motility.

3.4.3 OXIDASE TEST

A filter paper paper soaked with oxidase reagent and then moistened the paper with a sterile distilled water and picked the colony to be tested with an inoculating loop and smear in the filter paper. The inoculated area of filter paper was observed for a color change to deep blue or purple within 10-30 seconds.

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3.4.4 METHYL RED (MR)

This test is used to determine two things. The methyl red (MR) test detects the production of sufficient acid during the fermentation of glucose and the maintenance of conditions. Prior to inoculation the medium was allowed to equilibrate to room temperature using organisms taken from an 18-24 hour pure culture the medium lightly inoculated the medium. Then the medium was incubated aerobically at 37˚c for 24 hours. Following 24 hours of incubation, an aliquot of 1ml of the broth was transferred to a clean test tube . The remaining broth was incubated for an additional 24 hours. Yellow colour indicates negative test result, that is, glucose is converted into neutral end product while red colour indicates positive test result, and i.e. glucose can be converted into acids and products.

3.4.5 VOGES-PROSKAUER TEST (VP)

The VP portion (Voges- Proskauer) is used to determine if glucose can be converted to acetone. Prior to inoculation, the medium was allowed to equilibrate to room temperature

using organisms taken from an 18-24 hour pure culture, The medium was lightly inoculated. Then this was incubated aerobically at 37˚c for 24 hours. Following 24 hours of incubation, an aliquot of 1ml of the broth was transferred into a clean test tube. The remaining broth was re-incubated for an additional 24 hours .Barritt's reagent A and the Barritt's reagent B were added to the VP tube. The culture was allowed to stay for about 15min for colour development to occur. If culture turns red colour, it indicates a positive result. If culture appears yellow to copper in colour, it means a negative result.

3.4.6 INDOLE TEST

The tryptophan broth was inoculated with broth culture or emulsify isolated colony of the test organism in tryptophan broth. Then incubated at 37°C for 24-28 hours in ambient air. Then i added 0.5 ml of Kovac's reagent to the broth culture.Positive result is shown by the presence of a red or red-violent colour in the surface alcohol layer of the broth, while negative result appears yellow.

3.4.7 COAGULASE TEST

A suspension of isolate colony was mixed with a drop of human plasma on a glass slide using an inoculating loop. If bound coagulase is present in the bacterial cells, then the presence of plasma will cause the bacterial cells to clot. The clumping will occur because the clumping factor is an adhesion, which causes the cells to bind to fibrinogen in the plasma which will result in visible clumping of bacterial cells on the microscope slide.

3.4.8 CATALASE TEST

On a clean microscopic glass slide a small amount of the culture from the nutrient agar slant with a sterilized and cooled inoculating loop was mixed and emulsified. With a Pasteur pipette, a drop of hydrogen peroxide was placed over the test smear. The fluid

was observed over the smears for the appearance of gas bubbles, if bubbles were formed then the organism is catalase positive and if there was no bubbles formed then the organism cannot produce catalase enzyme.

3.4.9 CITRATE UTILIZATION TEST

The test was carried out by using 10ml Simmons citrate medium distributed into test tubes. It was sterilized by autoclaving at 121°C for 15 min and cooled. Inoculated into Simmons citrate agar lightly on the slant by stabbing the tip of a needle to a colony that is 18 to 24 hours old and incubated at 37°C for 24 hrs, utilization of citrate was indicated by a change of color of the medium from green to deep blue.

3.4.10 CARBOHYDRATE FERMENTATION TEST

Bacteria produce acidic products when they ferment certain carbohydrates signified with change in pH of the medium. If gas is produced as a by-product of fermentation, then the Durham tube will have a bubble in it. The carbohydrate tests conducted include glucose test, maltose test, galactose and fructose test.

3.4.11 OXIDATIVE FERMENTATIVE TEST

10ml of glucose was measured into a durham bottle and 100ml of distilled water and labeled. Oxidative Fermentative medium was prepared and homogenized; 10ml the prepared Oxidative Fermentative medium was aseptically measured into test tubes and properly corked. Oxidative-Fermentative media were sterilized using the autoclave at 121oC for 15min and 1ml of the glucose solution was added to each test-tube aseptically and allowed to cool after which the organisms were inoculated and colour change from green to orange was observed.

3.4.12 STARCH HYDROLYSIS

Starch agar media was prepared and sterilized using autoclave at 121oC for 15 minutes. The media was poured into Petri dish plate and allowed to solidify and the isolates were inoculated on to the plate with a sterile transfer loop. The plate was incubated at 35°C for 48hrs, after which the incubated plates were flooded with Gram's iodine and the plates were observed for clear zone around the test organism.

3.4.13 UREASE TEST

Urease agar medium was prepared and sterilized using autoclave, the medium was allowed to solidify in the slanting position to form a slope, the slants were inoculated with the isolate, the tubes were incubated at 37°C for 24 to 48hrs, and the slants were observed for colour change.

3.5 PHYSICO-CHEMICAL ANALYSIS

Few Physico-chemical analyses of water-body were carried out and they include pH, Temperature, Turbidity Conductivity, Salinity, and Dissolved oxygen.

3.5.1 pH

The pH of the water samples collected at each station was done in-situ using a probe by dipping the probe into a beaker containing the water samples and left for 2-3 minutes before readings were taken. This process was repeated three times.

3.5.2 Temperature

Using a probe, the air and water temperatures were taken at each station where by the probe was dipped into a beaker containing the water samples and left for 2-3 minutes before readings were taking. For air temperature, the probe was left in the air and left for 2-3 minutes before readings were taken.

3.5.3 Turbidity

Turbidity was done with the aid of a turbidimeter, where the water samples were placed in a sample compartment and the result was read.

3.5.4 Conductivity

The samples were measured using a conductivity meter which was calibrated by dipping the conductivity probe into a beaker that contains the water samples and the readings were taken.

3.5.5 Salinity

Salinity was carried out by using a calibrated salinity probe. The probe was dipped into a beaker containing the water samples. This was left for 2-3 minutes before readings were taken.

3.5.6 Dissolved Oxygen

A reagent bottle was immersed beneath the water surface, to exclude air bubbles, the cover was opened beneath the water and it was stoppered tightly. The samples were then placed in a cell and put in a sample compartment and then recorded after 1-2 minutes.

CHAPTER FOUR

RESULTS

4.1 SOCIAL DEMOGRAPHY OF COMMUNITY

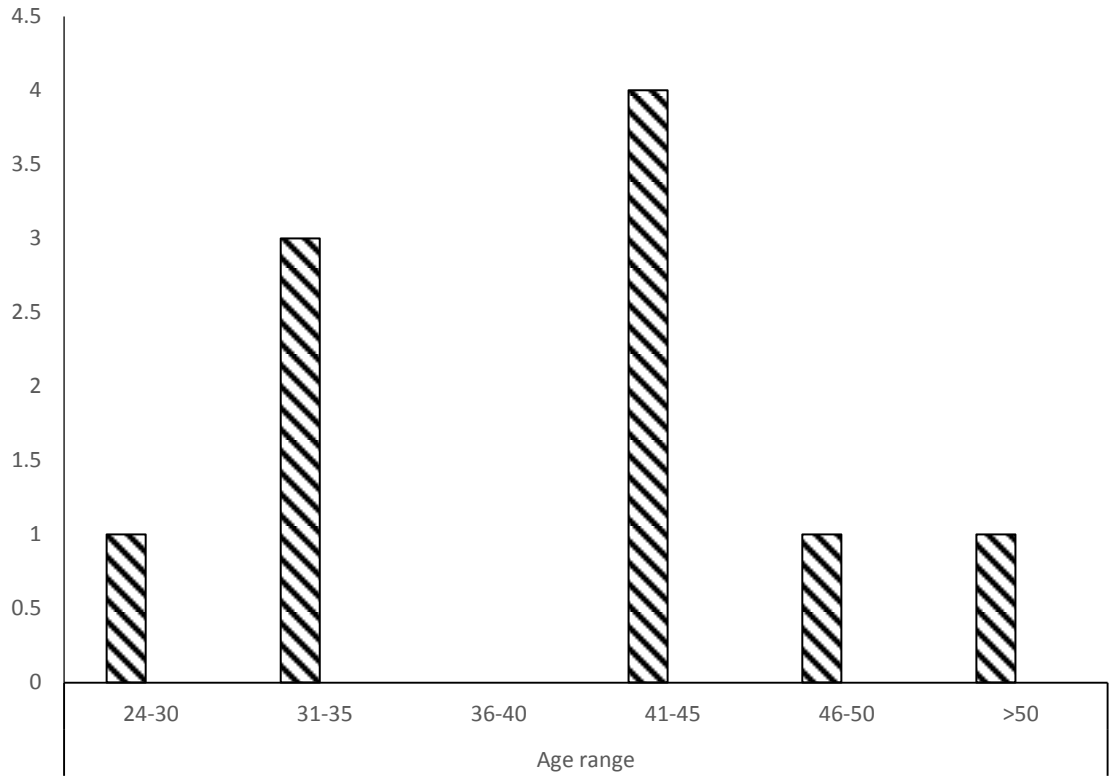

Figure 4.1: Age range of adults

Age range of the adult Interviewed.

Figure 4.1 shows the age range of adults interviewed in Magada community and it explains that those between the age of 41-45 were higher, followed by those between the age of 31-35 and youths between the age of 24-30 were few compared to the ones between the ages of 31-35. Adults between the ages of 46-50 and those above 50 were the same number of people.

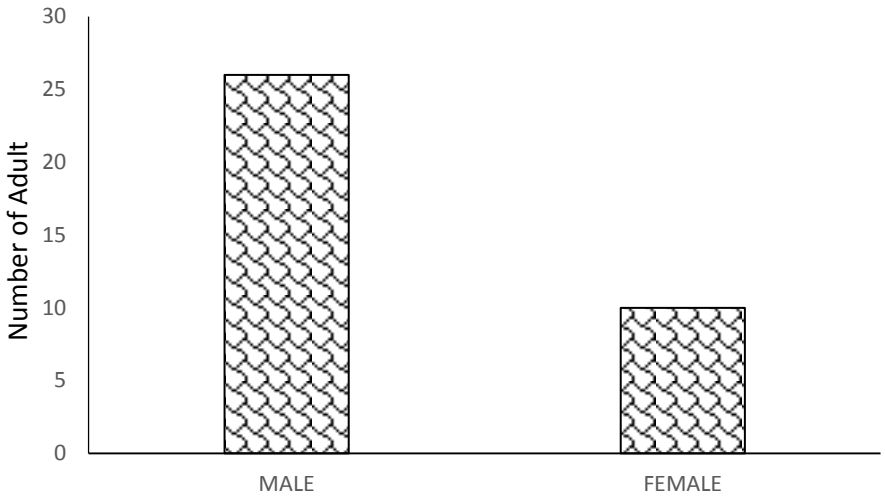

Figure 4.2 Number of male and female

Gender of the Adults Interviewed

Figure 4.2 explains that the number of males are more than the number of females interviewed in Magada community. This is indicative that more men pass through the stream area more frequently than the females.

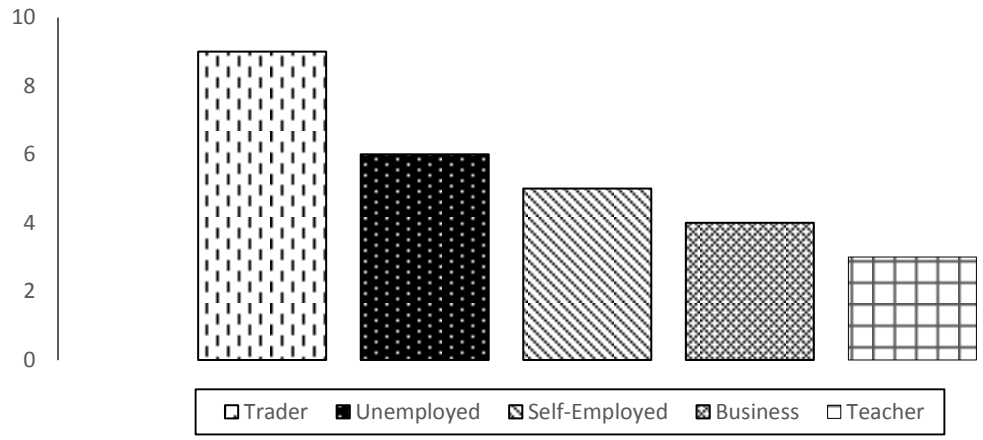

Figure 4.3: Occupation of Adults

Occupation of the Adults Interviewed.

Figure 4.3 explains that the numbers of traders in Magada community is higher than other occupations in Magada community. The number of unemployed in Magada community is higher than the number of the self-employed in the community while people that are into business are higher than the teachers in Magada community. This interview shows that trading could be the highest occupation taken up in the community and teaching is the least occupation taken up by the people of Magada community.

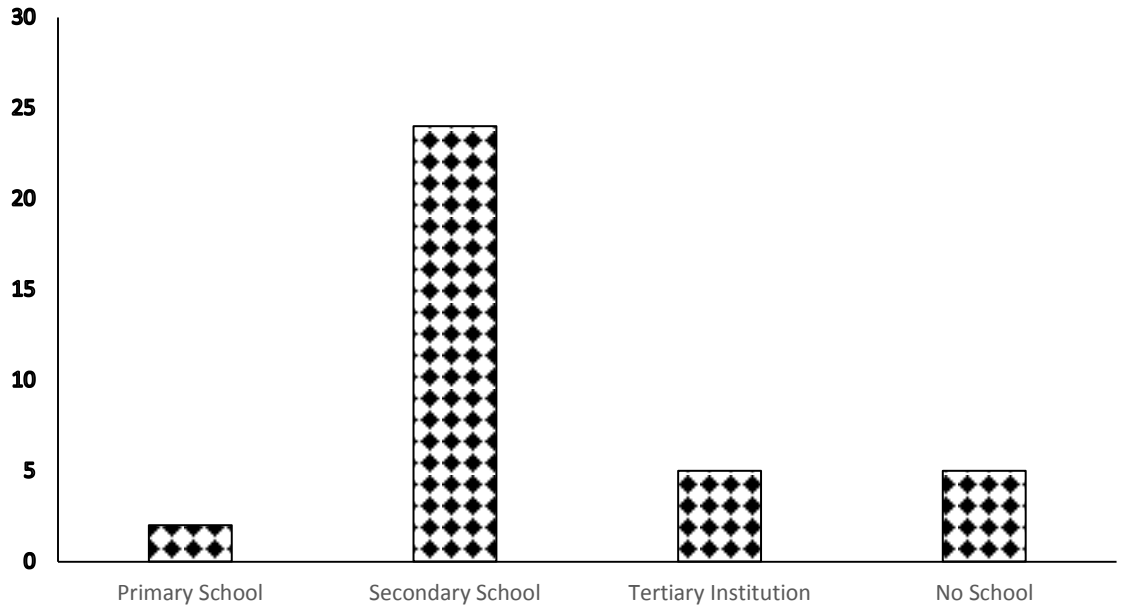

Figure 4.4: Literacy of Adults

Literacy of the Adults Interviewed.

Figure 4.4 shows that the number of adults that attended secondary school is higher than all other forms of academic background of the adults in Magada community followed by adults that attended tertiary institution and those with no academic background and those that attended primary school being the least of them all.

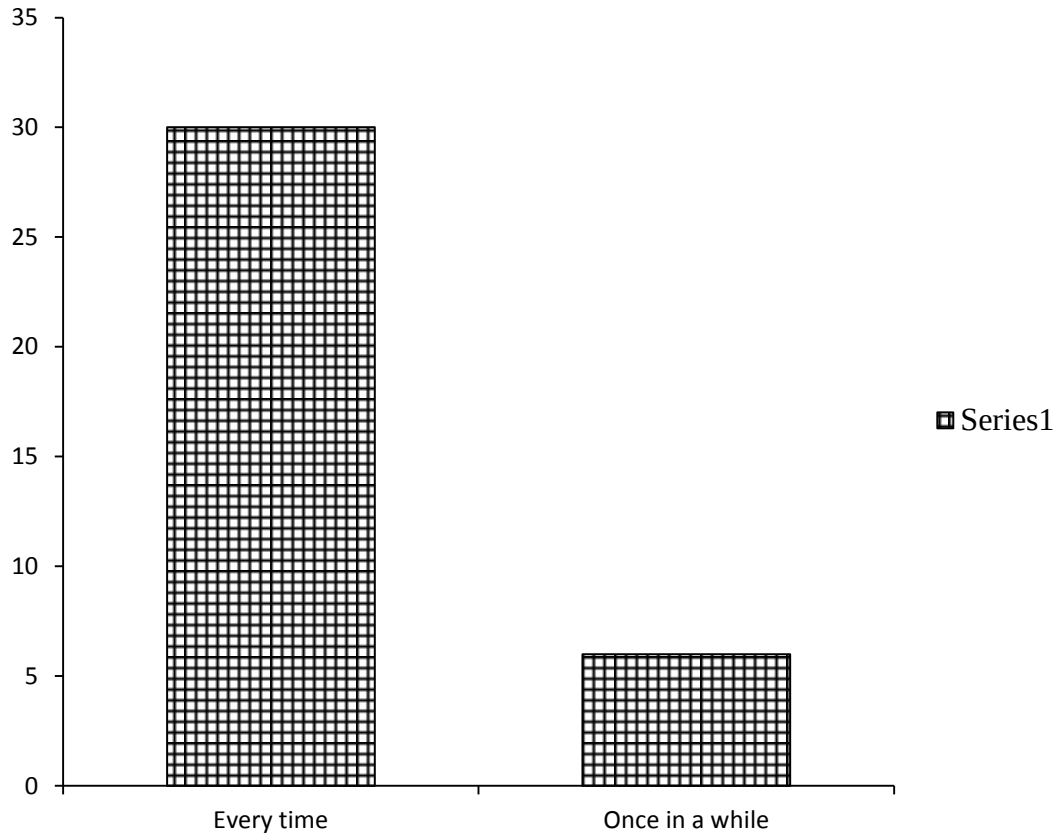

Figure: 4.5: Contact with water

Adults that had contact with polluted stream water.

Figure 4.5 shows the frequent contact the adults of Magada community have with the stream water, most adults has to pass through the stream water daily to get to their destinations. This figure shows that the most of the population of the community has contact with the water every time and only few comes in contact with the water once in a while.

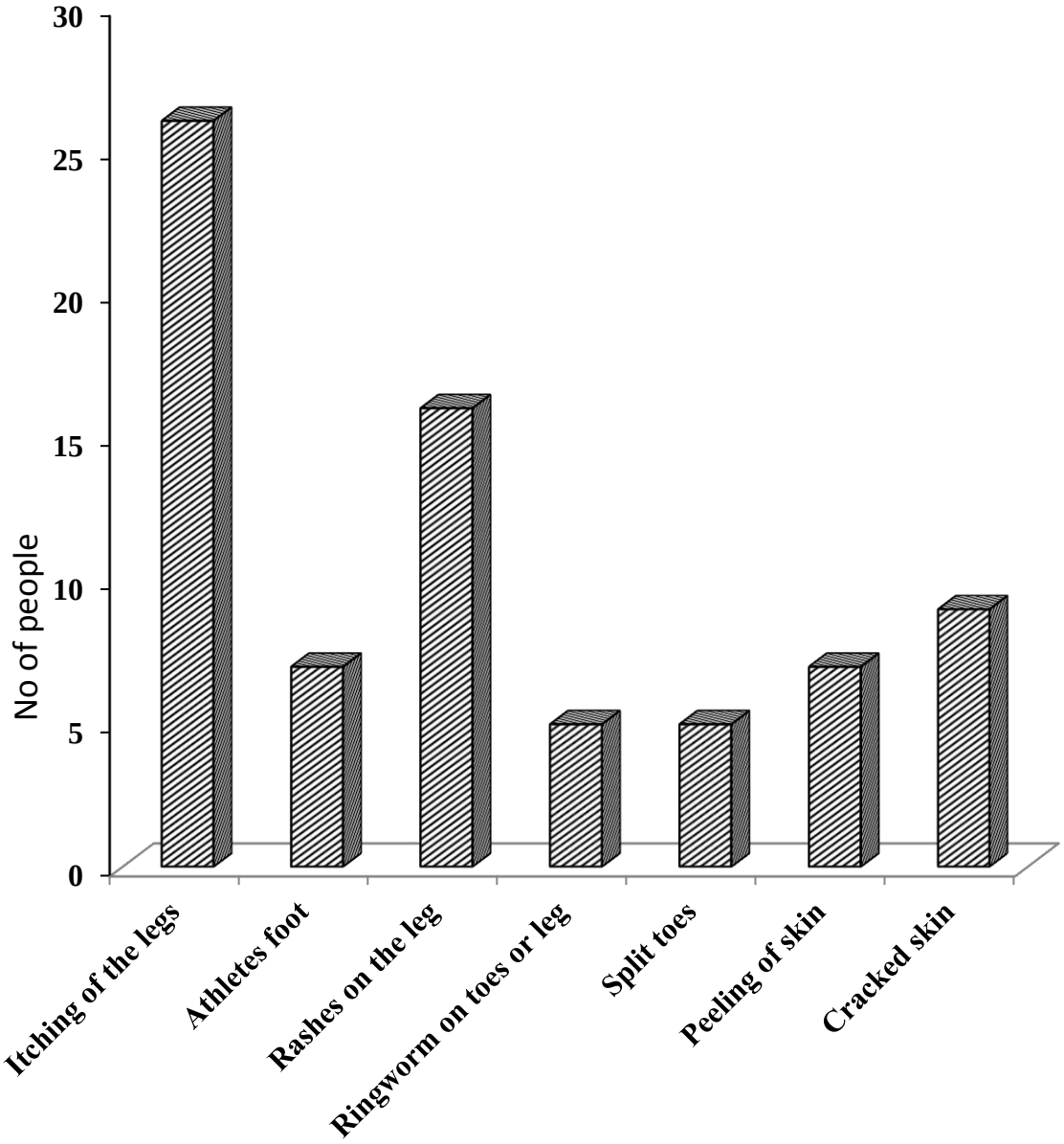

Figure 4.6: Symptoms of ill health

Symptoms of ill-health shown in Adults that had contact with stream water.

Figure 4.6 shows the symptoms of illness observed by the people of Magada community. This figure shows that itching of the legs is the most common sign of illness observed by

the people once they come in contact with the stream water while split toes and ringworm is the least sign of illness observed by the people.

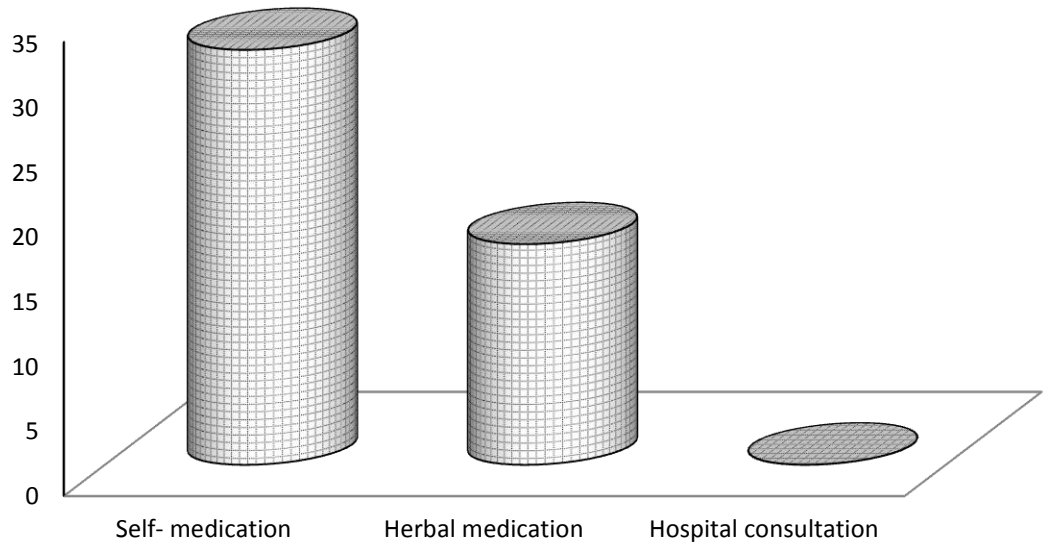

Figure 4.7: Actions taken after ill health

Actions taken by Adults after seeing symptoms of ill-health

Figure 4.7 shows the actions taken after the ill health is observed in the people of Magada community. Most of the populations went for self-medication while others went for herbal medicine and none went for hospital consultation and this could be as a result of their belief.

4.2 PHYSICO CHEMICAL TEST

Table 1.0: Physicochemical properties of stream water

Physico-chemical properties	**Result**
Temperature	26.4^{o}C
pH	7.6
Conductivity	0.28
Salinity	204
Turbidity	36.18
Dissolved oxygen	0.9

Physico-chemical properties of the magada stream water

The physico-chemical properties of the stream water favoured the growth of the pathogenic microorganisms which was indicated by the high colony count of bacteria.

Table 1.1: Bacterial count of stream water sources on media.

MEDIA	**$1O^{0}$**	**10^{-2}**	**10^{-4}**	**10^{-5}**
N.A	TNTC	60	28	10
EMB	178	43	8	3
S.S	92	39	3	0
sMAC	102	51	8	5
PDA	68	34	5	2

N.A- Nutrient Agar, E.M.B- Eosine methylene blue agar, S.S- Salmonella Shigella Agar, sMAC-sorbitol MacConkey agar, P.D.A-Potato dextrose agar,

Bacterial count of stream water sources on media.

The observation of bacterial count on media showing high count in EMB and sMAC is indicative of high probable pathogenic organisms in the water. The effect of this must have shown on the bodies of the victims as symptoms.

Characterization of probable micro-organisms identified in the stream water

Table 3.1 showed the probable organisms detected in the stream water which were mostly pathogenic and staphylococcus species ad E.coli species were predominant.

	Catalase	Gram staining	VP	Starch	Oxidase test	Simon citrate	MR	Glucose	Glucose gas	Maltose	Maltose gas	O.F	Fructose	Fructose gas	Galactose	Galactose gas	Indole	Probable Organism
IS 1	+	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	***Stenotrophomonass pp***
IS 2	+	-	+	+	-	-	-	-	-	-	-	+	+	-	-	-	-	***Bacillus spp***
IS 3	+	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	+	***Bacillus spp***
IS 4	+	+	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	*Streptococcus spp*
IS 5	+	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	***Klebsiellaspp***
IS 6	+	-	+	-	-	-	+	+	-	+	-	-	-	-	-	-	-	***Enterobacterspp***
IS 7	+	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	***Staphylococcus spp***
IS 8	+	-	+	-	-	+	+	p a p	-	+	+	+	p a p	+	+	-	-	***Staphylococcus spp***
IS 9	+	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	***Eschericha coli***
IS 10	+	-	-	-	-	+	+	+	+	-	-	+	-	-	-	-	-	***Staphylococcus spp***
IS 11	-	-	-	-	-	+	+	+	+	p a p	+	+	+	+	+	+	-	***Staphylococcus spp***
IS 12	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	***Pseudomonas spp***
IS 13	+	-	+	-	-	+	+	+	-	+	-	+	+	+	+	+	+	***Streptococcus spp***

IS	+	-	-	-	+	+	+	p	+	+	-	+	+	+	-	-	-	***Klebsiellaspp***
14								a										
								p										
IS	+	-	+	-	-	+	+	p	-	+	-	+	p	-	-	-	-	***Klebsiellaspp***
15								a					a					
								p					p					
IS	+	-	-	-	+	+	-	-	-	-	-	+	-	-	-	-	-	***Enterobacterspp***
16																		
IS	+	-	-	+	+	+	-	+	-	p	-	+	+	-	-	-	+	***Staphylococcus spp***
17										a								
										p								
IS	+	-	-	-	+	+	-	-	-	-	-	+	-	-	-	-	-	***Pseudomonas spp***
18																		
IS	+	-	-	-	+	+	-	+	+	-	-	+	-	-	-	-	-	***Klebsiellaspp***
19																		
IS	-	-	-	+	+	-	+	+	-	+	-	+	+	-	+	+	+	***Eschericha coli***
20																		
IS	+	-	+	-	-	+	+	+	+	+	+	+	+	+	+	+	-	***Eschericha coli***
21																		
IS	+	-	+	-	-	+	+	+	+	+	+	+	+	+	+	+	-	***Salmonella spp***
22																		

IS	-	-	+	-	-	+	-	p	-	+	-	+	+	+	+	+	-	***Streptococcus spp***
23								a										
								p										
IS	+	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	***Eschericha coli***
24																		
IS	-	-	+	+	+	+	+		-	+	-	+	+	-	-	-	+	***Enterobacterspp***
25																		
IS	+	-	-	-	+	+	+	+	-	-	-	+	+	-	-	-	+	***Salmonella spp***
26																		
IS	+	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	***Eschericha coli***
27																		
IS	+	-	-	+	-	+	-	-	-	+	+	+	+	-	-	-	-	***Salmonella spp***
28																		
IS	+	+	+	-	-	-	+	p	+	+	+	+	+	+	+	+	-	***Staphylococcus spp***
29								a										
								p										

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 DISCUSSION

This study has revealed that there are probable pathogenic microorganisms in Megada stream water. The microbes probably identified using the available biochemical characteristics are *E. Coli, Staphylococcus, Bacillus, Salmonella Spp, Websiella,*etc. Most of these microorganisms cause various symptoms of ill health established by the adults having body contact with the contaminated Megada stream water (Prof.). *Staphylococcus Spp* probably identified are known to cause severe itching, rashes, peeling of skin and cracked skin.

The physiochemical properties of the stream favoured the growth of the microorganisms in the water. This could explain the high bacterial count observed in the media used to grow the organisms. It is observed in the result that the majority of the people interviewed have high body contact with the contaminated water which expose many of them to the pathogenic organisms in the water.

Also noted is that most of the people in the community are traders which makes them go out everyday and thereby having contacts with the stream water as many times as possible. This frequent daily contact probably explained how many of them are exposed to organisms and reporting itching and rashes among the symptoms reported by the people in the community.

Also reported by the people are other signs such as cracked skin, peeling of skin, split toes, ringworm on toes and legs, athletes foot which could be caused by the microorganisms in the stream (Prof). The report given by the people on the management of the symptoms showed that many of them were using self medications such as washing of legs with soap and using antiseptic creams. Some were using herbal medicine to control the infection.

However, it was observed that the level of education of the people has no effect on the decision of what they have to do after experiencing itching. Only few of them go to the hospital even when they reported that there were sometimes the situation could be beyond what they could manage. This could be due to lack of fund.

5.2 CONCLUSION

This study has shown that contaminated water could contain many pathogens and having contact with such polluted water where there is high bacterial count as seen in Megada stream water could generate many symptoms of ill health. Managing such symptoms was limited to local treatments with only few people going to the hospital.

5.3 RECOMMENDATION

Government should introduce environmental studies to schools and it should be compulsory. The government should also set up agencies to monitor the environment for each local government area so they would be able to help in making the environment free from refuge dumps and industrial pollution. Industries should be monitored especially when it comes to disposing their wastes and they should develop the act of recycling their

wastes instead of dumping them for rain water to sweep them into our our water bodies such as rivers, streams etc.

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