FAECES, WASTEWATER MANAGEMENT AND PUBLIC HEALTH IN ILORIN METROPOLIS

BY

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CERTIFICATION

This thesis has been read and approved as meeting the requirements for the award of a postgraduate diploma in Environmental Management, Federal University of Technology, Minna.

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DATE

DEDICATION

This dissertation is dedicated to my wife, Bunmi and Esther, my little daughter.

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I wish to express my profound gratitude to all members of staff of Geography department of Federal University of Technology Minna in general and the Head of Department, Dr. M.T Usman in particular.

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To God be the glory, great thing he has done.

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ABSTRACT

Inspite of advance in technology, morbidity and mortality rate has being on the increase especially in developing countries of the world. Many factors is said to be responsible for this. This range from unhygienic environment to inadequate health care facilities.

Faeces and wastewater management constitutes a major public health problem in Ilorin metropolis. From available records, it is responsibility for high morbidity and mortality rate in the town.

In order to get to the root of this problem, this study examines the types of sanitary and drainage facilities which are available in the town, the present conditions of such facilities and the relationship between the present management system and public health. These has enable the author of this study to arrive at a logical conclusion which will help to reduce the attendant public health problems associated with faces and wastewater management.

CHAPTER ONE

1 INTRODUCTION

Modern technology is extending stress on the environment, breaking some vital k in the web of physical and biotic potential processes that maintain the ecological stem in which man lives. Faeces and wastewater generation and improper anagement however has got a serious and mostly damaging effects on man. aeces otherwise referred to as human waste is the by-product of metabolism and erefore a must for the continuous existence and survival of man. Wastewater on the her hand is equally a must if man should observe personal hygiene, prepare his eal and engage in certain labour as a source of livelihood. Both faeces and astewater constitute a nuisance in our environment causing discomfort and public ealth hazard. Man greatest undoing however is the improper management of these astes. This is as a result of economic, socio-cultural and technical factors.

he collection and disposal of faeces and wastewater has become a major public ealth issue of our time and needs some urgent attention if our environment is to be rotected. The problems of faeces and wastewater management in our cities have ecome one of the most intractable environmental problems facing us today.

he quantity of wastes in any society will depend on the population of the society is uestion socio-cultural and economic interaction. It therefore means that more opulation, more quantity of faeces and wastewater. If this is viewed against the ackground of continuous population growth and rural urban migration in most Nigeria owns and cities, the present situation of faeces, wastewater management and its mplication on public health is better imagined than experienced.

Outbreak excremental diseases like diarrhoea , Bacillary dysentery and worm infection

ow a common experience while malaria fever a disease with highest mobidity and tality rate in most developing countries develops as a result of improper tewater management. This situation is getting worst on a daily basis. However, the stion still remains which way forward?

STATEMENT OF PROBLEM

study provides answer to the following problems;

Economic and socio-cultural barriers that militate against adequate provision of t and drainage facilities.

Non compliance with town planning rules and regulations.

Ways of reducing the negative effects of improper faces and wastewater management on public health.

AIMS AND OBJECTIVE;

aims of this work titled "Faeces, Wastewater management and Public Health in n Metropolis" is to carry out a detail research into the present state of faces and stewater management in Ilorin metropolis and its public health implication. Within broad aim, the specific objectives are;

To determine the rate of waste generation.

To educate the masses on the need to dispose these wastes properly.

For future plan on environmental management and health hazard.

SCOPE OF STUDY;

is study covers the present states of faeces and wastewater management in Ilorin tropolis. For thorough study, data was collected on the economic status of the

ople, their educational status and cultural beliefs, the relationship between velopment of sanitary facilities and diseases distribution. All these were carried out y within and therefore limited to Ilorin Metropolis.

JUSTIFICATION OF STUDY:

e relationship between faeces, wastewater management and public health is ning prominence all over the world. Outbreak of diseases as a result of poor faeces wastewater disposal has led to high mortality rate in Ilorin metropolis. This makes need to provide workable solutions to be inevitable.

erefore, this study is highly justified as it helps to provide lasting solutions to the blem of faeces and wastewater management, thereby reducing its negative public lth effects on the people of Ilorin metropolis.

STRUCTURE OF THESIS

thesis is divided into six different but related chapters. The topic was introduced in first chapter while the second chapter examines the geography of the study area. pters three, four, five and six deals with the literature, methodology, data collection alysis and conclusion /recommendation respectively.

CHAPTER TWO

The relief of Ilorin is characterized by highland, plain land, mountains and valleys. Prominent mountains include that of Sobi, situated in the Northwestern part of three town with a very steep slope and Alagbede, situated in the South-eastern part of Ilorin. The central part of the town consist of mostly plain land while the valleys are situated by the side of two main rivers i.e River Asa and Aluko.

Ilorin was founded around 1600 - 1700 AD. This actually accounts for the pattern of settlement in the town. Areas like the Emir's palace/ market, Idi -Ape Okelele, Ajikobi , Balogun Fulani e.t.c constitutes the centre of the town. These areas consists of clustered ancient buildings are without facilities for the sanitary disposal of excreta and wastewater with its attendant health problems.

However, areas like Amilegbe, Fate, Ta nke, Taiwo, Muritala, G.R.A e.t.c are relatively planned areas of the town. Unfortunately, these areas are not without major distortions to its original master plan. This not withstanding, most of the modern building is provided with facilities for the disposal of excreta and wastewater.

Ilorin is served with a network of tarred and untarred roads. Some of the double-lane express roads include that of Taiwo, Muritala, Unity, Emir's and Fate roads. The town is also served by rail transport. The railway runs from the southern to the Northern part of the city. Furthermore, there is also the presence of an international Airport at the South -western part of the town. This makes both local and international travels possible.

Arable farming id not very common in Ilorin. However, surrounding villages like Apado, Oke - oyi and Iponrin are predominantly agricultural areas. Within Ilorin

township, arable farming is only practiced along the two major river valleys.

According to 1991 National Population Census figures, Ilorin town is having a total population figure of about five hundred and seventy-six thousand and, four hundred and seventy - nine people. All these people occupy a total of One hundred and twenty - three thousand, seven hundred and thirty five house holds. The population is further divided into male and female. The male population was two hundred and eight-eight thousand, one hundred and sixty while the fem ale population was two hundred and eighty - eight thousand, and two hundred and sixty - nine.

Ilorin metropolis can be said to have a good climate. With the maximum mean temperature of 31.6°C and the average daily relative humidity of 72.6°C centigrade, the climate of Ilorin is very conducive to plants, animal s and man. However, this varies from one part of the year to another. Moreover, Ilorin receives the highest number and volume of rainfall between the month of may and October of every year. As a result of this high volume, more wastewater is generated and the issue of management becomes relevant.

CHAPTER THREE

FAECES AND PUBLIC HEALTH

Faeces are defined as human excreta and urine. Many infections in excess of 50 ever if the different type of viruses and serotype of enteric bacteria are ignored, are transmitted from the faeces of an infected person to the mouth of another. The disease causing agent (pathogens) of these infections travel from anus (or, rarely, bladder) to mouth by a variety of routes - sometimes directly on contaminated fingers and sometimes on food, utensils, in water or by any other routes which allows minute amount of infected faeces to be injected. Some of these pathogens may reinfect, not only through the mouth, but by inhalation of dust or aerosol droplet. There are also a few infections (notable hookworms and schistosomiasis) that can penetrate through the skin.

Human faeces are the principal vehicle for the transmission and spread of a wide range of communicable diseases. Some of these diseases rank among the chief causes of sickness and death in society where poverty and malnutrition are ubiquitous. Diarrhoeas, for instance, are - together with respiratory disease and endemic malaria the main causes of death among small children and infants in developing countries. Cholera whether endemic or epidemic in form, is accompanied by numerous deaths in all age group - although under endemic conditions, it is children who suffer the most fatalities. Other disease, such as hookworm infection and schistosomiasis, causes chronic debilitating conditions that impair the quality of life (however defined) and make the individuals more liable to die from superimpose acute infections.

These diseases and many others start their journey from an infected individual

to a new victim when the causative agents is passed in the faeces. Therefore, the collection, transportation, treatment and disposal of human faeces are of the uttermost importance in the protection of the public health of any community. They become even more important in those society which recognise the value of human faeces in agriculture, aquaculture are gas production and therefore reuse, rather than dispose of, there raw or treated wastes. Such reuse system have a positive role in supporting economic activity and food production and are often cheaper than alternative methods of disposal. However, reuse system present a challenge to the public health engineer to design and develop technologies that will not pose unacceptable risk to public health.

Around the world, and in most countries, there are millions of people who lack any hygienic and acceptable method of faeces disposal. There are also government and international agencies spending, or preparing to spend large sums of money to improve this situation. If these governments and agencies could arrange, by massive investment and miraculous social and economic transformation, that everyone be provided with a modern house with water and sewage connections, the public health dimensions discussed in this project would be less relevant but change will not come in this way. Change will come slowly and unevenly, and resources of money, manpower and institutions will often be very scarce. The recipients of new faeces disposal technologies may be unable to ay completely for them, or lack the necessary experience and education to use them effectively. Always there will be constraints and with these constraints will come difficult choices.

Choices need to be about all aspect of faeces disposal. There will be choices about technology, about ultimate disposal, about refuse, about sullage, about

payment, about management, and about all other elements that make up a situation system. A number of factors will influence there these choices, but one central factor is health. Since a primary motivation for investing in faeces disposal is improved health, decision makers will need to understand the health implications of the various choices. The more limited are the resources, the more difficult the choices and decision becomes and the more it is necessary to understand precisely and in detail the relationship between faeces and health.

CHARACTERISTIC OF FAECES

Faeces are not only malodorous and considered aesthetically offensive most ocieties, but they many contain, an array of pathogens viruses, bacteria, cysts of rotozoa, and egg of helminths (the collective term for worms parasitic to man) that ay cause disease in a new host. Faeces are therefore the beginning of the ansmission routes of many diseases; the objective of improving faeces disposal cilities is to intercept these routes at their point of origin.

ualities;

There are marked differences in the volumes of faeces and sewages produced different communities. Volume, composition and constituency of faeces depend on ch factors as diet, climate, and state of health. Individual wet faecal weight varies n 20 grams per day to 1.5 kilograms per day.

The water content of faeces varies with faecal weight. In a community with an rage wet faecal weight of 100 – 150 grams per day for instance the water content be around 75 percent. As faecal weight increases, so does the proposition of er: at a faecal weight of 500 grams per day, the water content of the stool may be

about 90 percent. The frequency of defecation also varies with faecal weight. In Europe and North America, where faecal weights are generally less than 200 grams per day, the average frequency is one stool daily. In rural areas of developing countries especially where diet is vegetarian and faecal weights are high, a daily frequency of two or three stools is common.

Chemical composition:

Faeces are of complex and variable composition. Typical figures of some constituents are given in the table 1

Table 1.1: composition of human faeces ands urine

Constituent	Approximate composition (percent of day weight)	
	Faeces	Urine
Calcium	4.5	4.5 – 6.0
Carbon	44 – 55	11 – 17
Nitrogen	5.0 – 7.0	15 – 19
Organic Matter	88 – 97	65 - 85
Phosphorus	3.0 – 5.4	2.5 – 5 .0
Potassium	1.0 – 2.5	3.0 – 4.5

Source: Adopted from Gotaas (1956)

of particular interest

PATHOGENS IN EXCRETA

Virus in faeces

Numerous viruses may infect the intestinal track and be passed in the faeces, where upon they may infect new human host by ingestion or inhalation. One gram of faeces may contain 109 infectious virus particles, regardless of whether the individual is experiencing any discernible illness. Although they cannot multiply outside a suitable host cell, the excreted virus may survive for many weeks in the environment, especially in the temperatures are cool (< 15°C). Different type of viruses are shown in table 2.2

Table 1.2: Viral Pathogens Excreted in faeces

Virus	Disease	can symptom less Infection occur?	Reservoir
denoviruses	Numerous conditions	Yes	man
nterovirus			
oliovirus	Poliomyelitis, Paralysis And other condition	Yes	Man
choviruses	Numerous condition	Yes	Man
xsackie viruses	Numerous conditions	Yes	Man
patitis A virus	infectious hepatitis	Yes	Man
oviruses	Numerous conditions	Yes	Man and animals
tavirus, Norwalk			
nts and other viruses	Diarrhoea	Yes	Man

Bacteria in faeces

The faeces of a healthy person contain large numbers of commensal bacteria of many species. The species of bacteria found in the normal stool, and the relative number of different species, will vary among communities. The most widely used indicator as being the user faecal coliformes cherichia coli, but enterococci (or, more generally, faecal streptococci), another widespread commensal group, are also used as indicators.

Diarrhoea is a major symptom of bacteria intestinal infection. The bacteria may also invade the body from the gut and cause either generalised or localised infections. This innovation is characteristic of typhoid infections and other enteric fevers caused by salmonallae. Fungi infection restricted to the gut, bacteria will passed only in the faeces. When invasion has occurred bacteria may be passed in the urine as well and will also be found in the blood stream at some stage.

Some of the pathogens are excreted entirely (or almost entirely) by man, but a wide range of animals excretes others. This facts limits diseases control through improvement in human faeces disposal alone, because any changes made will likely not affect transmission of pathogens from animal faeces to humans. Table 2.3 shows different type of bacteria.

Table 1.3: Bacteria Pathogen Excreted in Faeces

Bacterium	Disease	can Symptom less Infection Occur?	Reservoir
Campyhobacter fetus ssp. Jejuni	Diarhoea	Yes	Animals and Man
Salmonella			
S. Typhi	Typhoid fever	Yes	Man
S. paratyphi	Paratyphoid fever	Yes	Man
Other Salmonellae	Food poisoning And other Salmonelloses	Yes	Animals and man
Shigella spp			
Vibro			
V. Cholerae	Cholera	Yes	Man
Other Vibros	Diarrhoea	Yes	Man

Protozoa In Faeces

Many species of the protozoa can infect man and cause disease. Among them are several species that are harboured in the intestinal track of man and other animals, where they may cause diarrhoea or dysentery. Infective forms of these protozoa are often passed as cysts in the faeces, and man is infected when he ingest them. Only three species of human intestinal protozoa are considered to be frequently pathogenic; giardialamblia, balantidum coils, and entamoeba histolytica, is careers who are primarily responsible for continued transmission.

Helminths in Faeces

Many species of parasitic worms or helmiths have human hosts. Some can cause serious illness, but a number generate few symptoms. only those helminths whose egg or larvae forms are passed in the faeces are of concern to this study. Only schistosoma heamatobium (the agent of urinary schistosomiaisi) is wided in the urine, 'the other examined are all excreted in the faeces. Table 2.4 shows different types of helminths

Table 1.4: Helminths Pathogens Excreta in faeces

Helminth	Common name	Disease	Transmission
Ancylostoma Duodenale	Hook worm	Hook worm	man – soil – man
Ascaries Lumbricoides	Roundworm	Ascaries	man – soil - man
Clonorchis Sinansis	Chinese liver fluke	Chlonorchasis	man or animal -copepode fish – man
Schistosoma S. Japonicum S. Mansoni	Schistosoma	Schistosomasis, billarziasis	man – aquatic snail - man
Taenia Saginata	Beef tapeworm	Taeniasis	man – cow - man
T. Solium	Pork tapeworm	Taeniasis	man – pig - man
Trichonis Trichiura	whipworm	Trichuniasis	man – soil – man

FAECES AND NIGHT SOIL TREATMENT

The effectiveness of treatment methods for faeces and night soil depends greatly upon their time - temperature characteristics. The effective processes are those that retain the excreta for long time (> 1 year), or make it warm (> 55°C), or effectively combine adequate retention time and high temperature.

Pit latrines have a useful life of a few years, when one becomes full, a second is dug, and the contents of the first are left undisturbed while the second is in use. Because of the time interval there are no health hazards associated with digging out the contents of previously filled and covered pit latrines. Provided the squatting plate is regularly cleaned, pit latrines pose no greater risks to health than do flush toilets.

GROUND WATER POLLUTION;

Pollution of this kind is examine hazard in areas where pit latrines are widely used and where the ground water is high and is used as a water source.

Composting toilets are of two types; batch and continuous. If the composting period is over 1 year, only a few ascaris eggs will be present in the product. With composting periods of less than 1 year, varying numbers of other excreted pathogens will be present. Composting toilets thus have definite health risks that, although slight, should be recognised by the designers and users of these systems. In strict economic terms the value of the compost must be greater than the possible cost to health from its use.

Composting has been thoroughly reviewed by Gotaas (1956), and more recent accounts are provided by Haug (1979), Polprasert, (1980), and Shuval, (1981). A wide range of faecal composting technologies is available. they all incorporate the mixing of night soil or sludge with a carbon source (such as refuse or sawdust) to achieve a C:N

ratio of approximately 20-30. Moisture content (20-60 percent) must also be regulated for optimal performance, with wetting or turning (for drying) at appropriate intervals.

POUR FLUSH (WATER SEAL) LATRINE.

Pour flush latrine is also called water seal latrine. It consists of an ordinary concrete slab into which a specially made bowl is incorporated. Such a slab may be installed directly over or at a close distance to a pit. That of sitting type is usually installed in the room. The bowl is usually attached with cover, which makes it non accessible to flies, cockroaches and rats. It is made in such a way to retain small quantity of water after flushing. The water seal in the closet makes it impossible for odour to emanate into the room and keeps away remains from reaching the contents. The bowl is connected to the tank by means of a short pipe. About four litres of water is sufficient to flush the content into the pit.

If properly operated, latrine equipped with water seal fulfils all sanitary requirements and may be placed inside dwelling houses.

SPECIFIC LAWS, REGULATIONS, GUIDELINES AND STANDARDS THAT GOVERNS EXCRETA AND WASTEWATER MANAGEMENT.

There are many laws, regulations, guidelines and standards governing the management of faeces and wastewater in the country. This ranges from the Northern Nigeria Public Health law of 1963 to guidelines and standards for environmental pollution control in Nigeria (FEPA 1991) and Kwara State Environmental Protection Edict of 1984.

Section seven, sub-section one of 1963 Northern Nigeria Public Health law says that any premises in such a condition as to be injurious to health shall be

deemed to be a nuisance. In sub-section four, it further to explain this as any pool, ditch, gutter, watercourse, cesspool, drain, ashpit, refuse pit, latrine, dustbin, washing place, well, water tank, barrel, sink, collection of sullage water receptacle containing stagnant water, or other thing in such a state or condition as to be injurious to health. Sub-section eight also classify nuisance as any noxious matter or water flowing or discharged from any premises into any public street or any gutter or side channel of any street. Therefore, the Northern Nigeria public health law of 1963 adequately provides for the proper disposal of faeces and wastewater by individuals and organisations.

Non-compliance with this law may be punished by law courts by imposing fines, term of important on both. The court may also impose ' closing orders'. According to section nine sub-section six of the law, a closing order may prohibit any premise from being used for human habitation. Sub-section seven further states that a closing order shall only be made where it is proved to the satisfaction of the court that, by reason of a nuisance, premises are unfit for human habitation, and, if such proof is given, the court shall make a closing order, and may also impose a fine.

Moreover, Federal Environmental Protection agency (FEPA) Guidelines and Standards for Environmental Pollution control in Nigeria (1991), provides for the proper wastewater management by industries in the country. The second part of chapter two of the regulation states "It is important that industries monitored their effluents in – house while FEPA will also cross check the effluent characteristics to ascertain the degree of compliance with the proposed guidelines. Analytical methods are conventionally prescribed for all parties to be involved in the monitoring exercise...."

There are therefore adequate laws, guidelines and standards that governs proper faeces and wastewater management in the country. These laws cut across the three tiers of government that makes up the federation i.e. federal, states, and local government.

CHARACTERISTICS OF WASTEWATER.

Sullage, also known as grey-water, is domestic wastewater not containing excreta. The water discarded from bath, sinks, basins and the like that may be expected to contain considerably fewer amount of pathogenic micro organisms than sewage. Interest and research in the handling of sullage has increased in recent years, both in developing and affluent countries. In affluent countries there is growing interest in the use of sewerless chemical toilets and separate sullge disposal as way of overcoming environmental problems associated the disposal of large volumes of heavily contaminated sewage from urban areas. There is also interest In chemical toilets and on-site sullage disposal for use in nature parks, where environmental considerations are permanent (winneberger 1974).

There is also a growing realisation in developing counties of the financial and other difficulties associated with providing waterborne sewerage systems, and consequent increased interest in dry or on- site techniques such as improves pit latrines, composting toilets or cartage systems (kalbermattem et al 1982) Some of these sewerless technologies require the separate disposal of sullage when the volume of domestic wastewater becomes too great simply to drain away in the yard. Furthermore, a worldwide awareness is dawning that it is extravagant to use up to half of a household's high quality drinking water just to flush excreta among sewers. The need to design a sullage disposal system accompanies the development of any toilet

not flushed by water.

QUANTITIES:

SULLAGE volumes depend upon domestic water use. Where people use public taps, daily domestic water use may be as low as 10 litres per capital (white 1977) in affluent households with full plumbing, daily water use may be 200 or more litres per capital, and all water not used for following toilets may be classified as sullage. Bennet et. al (1974), studying homes in the United States, found that the toilet was used 3.6 times daily per capital, that the average flush used 15 litres and that toilet flushing accounted for 33 percent of domestic water used. Reviewing data from several studies, witt and colleagues found that water from toilet flushing was between 22 and 45 percent of the total domestic water usage. Laak (1974) reviewed data from Canada, Sweden and the United States that shows the following percentage allocation of water use in houses with full plumbing:

Table 1.5

	Mean	Range
Bathroom	26	12 - 40
Kitchen	9	5 – 16
Laundry	18	4 – 22
Toilet Flushing	47	41 – 65

COMPOSITION:

The sullage contributes about 53 percent of the sewage flow, 52 percent of the BOD's, 43 percent of the chemical oxygen demand, about 15 percent of the Nitrogen, and 45 percent of the phosphate. If the ratio of chemical oxygen demanded to BODs is used as the criterion, toilet water are more resistance to biodegradation than

sullage.

Witt, et. al (1974) examined the bacterial content of sullage in the United States. Their results show that water used for bathing and showering becomes less contaminated with faecal bacteria than water used in washing clothes. Furthermore, 38 percent of the faecal streptococcal isolates were enterococci (streptococcus faecal is, s. faecium and s.durans); the majority of the bath water enterococci were S.faecalis var.liquefaciences (in contrast, only a few enterococci isolated from the clothing waters were of this species, now widely regarded as being nonfecal in origin). S. Boris, a primary non-human species, accounted for 22 percent of all streptococcal isolates. These findings suggest that under half of the streptococci isolated were from human faeces, and tat the bath water was even less contaminated relative to the clothing water than the total counts suggested.

Available information on the microbiological quality of sullage is very limited. A more recent study in the United States reports lower bacterial counts in clothing wash water (215 total coliforms, 107 faecal coliforms and 77 faecal streptococci per 100 millilitres), and higher counts in both water (1,810 total coliforms, 1,210 faecal coliforms and 326 faecal streptococci per 100 millilitres).

Although data are lacking, it may be assumed that sullage from bathrooms and laundries will contain small numbers of any pathogenic viruses, bacteria, protozoa, or helminth eggs being excreted by the people who use them. The washing of babies and their soiled clothing may substantially raised the pathogen content of suitable medium for multiplication.

SULLAGE DISPOSAL AND PUBLIC HEALTH

There are five kinds of sullage disposal: casual disposal by tipping wastewater

receptacles in the yard; garden watering; on site disposal by soak way; drainage into open drains; and drainage into cover drains or sewers. Each of these has different health implications.

Tipping in the yard may create breeding sites for insect such as culex pipiens as well as muddy and unsanitary conditions close to the dwellings. Because it does not offer concealment, a clean, dry yard is less likely to be used by children for defecation, and any worm eggs their faeces might contain will be less likely to mature (nematode eggs require a most environment to develop). Sullage containing pathogens from babies" bath water or adults' ablution water may also infect children playing in the yard. In well – draining soils, where sullage production or housing density is low, tipping of sullage outside the home is unlikely to be a major health hazard. Where soils are less permeable and where water use or housing density is high, however, an adequate method of sullage disposal is essential. (it should be noted that high housing densities are generally associated with poverty and thus with low water use and sullage production).

Sullage disposal by watering vegetable gardens near the house is likely to create few if any health hazards , provided that prolonged ponding of water is prevented (to discourage mosquito breeding) and that children are discouraged from defecting in or near the gardens,. Sullage disposal by soak away provides a low risk of groundwater contamination; the risk of microbiological groundwater pollution is much lower with sullage than it is sewage. The same is true of high nitrate pollution.

Drainage of wastewater into open drains, perhaps into storm drains, provides the most readily identifiable health risk, namely that of promoting the breeding of C piens and other mosquitoes. In areas of year – round rainfall, storm drains will

contain water continuously. If they are kept free of garbage and are well designed, the drains will flow freely and provide few sites for mosquitoes breeding, and the presence or absence of sullage will not affect community health. But in areas of several rainfall, and where the drains are liable to blockage and ponding, the addition of sullage will create year – round standing water and thus year –round culex breeding where only seasonal breeding may previously have occurred. It is not, therefor, the quality of the sullage that pose a health risk, since ponded stormwater will also be sufficiently polluted to allow culex breeding, but the continuous addition of sullage to storm drains subject to ponding that covers wet season breeding into year – round breeding. In this case, the rise in culex populations may lead to increased filariasis transmission and thus to more and heavier infections and so more diseases.

An example of this effect can be found in the recent resurgence of Bancrotian filariasis as a major public health problem in Egypt (Southgate 1979). Since approximately 1965 a complex of factors – including major changes in irrigation practice, a proliferation of poorly maintained water supplies, and inadequate excreta – disposal facilities contaminating surface water - has increased C. pipiens breeding in parts of the Nile Delta. Consequently, the prevalence, intensity and geographic spread of Bancroftain filariasis have increased. It has also contributed to explosive epidemics of Rift valley fever in Egypt during 1977 and 1978 (Hoogtraal et. al 1979).

Urban areas can suffer similar health risks when large – scale sullage disposal is into open drains and no formally defined drainage system exists. The solution to these problems is either to use an alternative method of sullage disposal or to prevent drains from blocking by covering them or by vigorous efforts to keep them clear. The latter approach is the more realistic and labour intensive and can be implemented by

the employment of municipal workers, by subtracting the job to the private sector, or by organising and motivation continuity effort on a neighbourhood basis.

Finally, sullage may be disposed into a sewage system, as is sewage, except that smaller – bore pipes are used. This means of disposal raises no special health problems and conventional treatment before discharge or reuse should be highly effective. The load of pathogenic micro organisms in sullage will be small, so that discharge or reuse can take place without tertiary treatment.

CHAPTER FOUR

Methodological issues have been taken seriously in this study. Attempt was made to collect and critically examine the likely factors that may either encourage or discourage sanitary faeces and wastewater management.

Questionnaire was used in order to gather relevant information needed in getting to the root of the problem. This was done in conjunction with random house to house inspection.

Electronic and non-electronic media like television, radio, newspaper, was very useful program and column that deals with general sanitation, faeces and wastewater were closely monitored while relevant information and knowledge were widely used in this study.

Oral interviews were randomly conducted. This was with the aim of knowing the present state of faeces and wastewater management, the likely economics socio-cultural and educational obstacle and their important measures.

Furthermore, relevant literatures and textbooks were consulted and important points were used in this work. This further enhanced the quality of this study.

Data was also collected from relevant organisations like Kwara State Ministry of Health and Kwara State Environmental Protection Agency.

In conclusion, with the types of methodology employed, it is believed that all these efforts has contributed in no small measure to the general standard, quantity and acceptability of this work. It has makes its application reliant in solving the problem of faeces and wastewater management in Ilorin metropolis, thereby reducing its public health implication.

CHAPTER FIVE

DISCUSION OF RESULT

TABLE 2.1: Average daily maximum temperature

	CENTIGRADE												
YEAR	MONTHS												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1991	33.6	33.5	34.6	32.3	30.8	31.1	28.8	27.9	29.1	30.3	33.2	32.9	31.5
1992	32.5	36.1	36.5	35.0	32.1	29.9	28.9	27.7	28.2	30.9	31.8	33.8	32.0
1993	32.8	35.7	24.0	XX	XX	27.6	29.8	28.5	29.3	31.2	32.2	33.3	30.3
1994	33.1	35.5	36.3	33.3	31.5	30.2	28.2	28.2	29.6	30.3	33.1	32.8	31.8
1995	33.5	35.8	35.6	34.4	31.5	30.5	28.8	28.6	29.5	30.2	32.4	33.4	32.0
MEAN	33.1	35.3	33.4	33.8	31.5	29.9	28.7	28.2	29.1	30.6	32.5	33.2	31.6

Note: XX No figure for maximum temperature.

SOURCE: Meteorological Department, Airport, Ilorin

The above table shows the average daily maximum temperature in Ilorin metropolis by month and year 1991 - 1995. From the table, the mean temperature (maximum) for the five years is 31.6^{o}C. this temperature is very suitable for the development and substance of different types of pathogenic organisms.

TABLE 2.2 Average Daily Relative Humidity

CENTIGRADE													
YEAR	MONTHS												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1991	64	73	75	77	82	83	86	87	84	83	75	55	70.0
1992	42	45	83	69	78	78	83	83	85	81	60	61	70.9
1993	43	60	65	70	79	82	86	85	86	82	75	64	72.3
1994	57	63	69	77	79	81	84	82	83	83	63	69	71.7
1995	37	45	72	73	81	84	74	87	85	82	64	70	71.2
MEAN	48.6	57.2	72.8	78.2	79.8	81.6	82.6	84.8	84.6	82.2	48.6	55.8	72.6

SOURCE: Meteorological Department, Airport, Ilorin

The above table shows the average daily relative humidity in Ilorin metropolis. As could be seen, the average humidity of 72.6 centigrade actually favour the Ilorin multiplication of pathogenic organisms in the faeces and wastewater. The presence and multiplication in turn makes their spread and transmission.

TABLE 2.3 Number Of Raining Days

YEAR	MONTHS											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1991	1	2	3	11	18	17	19	11	14	9	1	0
1992	0	0	0	0	14	10	12	7	20	10	1	0
1993	0	1	3	5	12	14	13	20	20	13	2	0
1994	1	0	2	10	12	11	11	12	17	20	0	0
1995	0	1	5	5	13	15	17	14	15	12	5	2

SOURCE: Meteorological Department, Airport, Ilorin

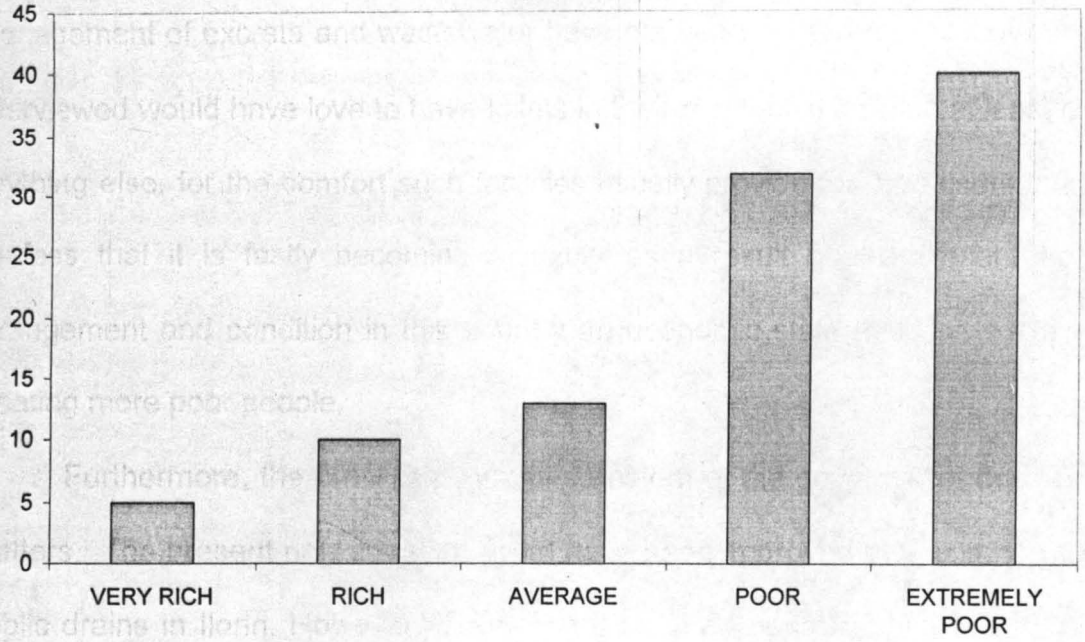
Table 2.3 shows the number of raining days in Ilorin. The situation in Ilorin is above average. This is reflected in the type of vegetation that is present in the town, which lies within Guinea Savanna Zone of the vegetation belt. The number of raining days varies from one year to the other. It however attains its peak between the month of May and October of every year. The relevance of this data is the importance of water supply to the quality of wastewater generation.

TABLE 2.4 GENERAL ECONOMIC STATUS OF THE PEOPLE

Economic Status	Very Rich	Rich	Average	Poor	Extremely Poor
percentage	5	10	13	32	40

Source: Questionnaire.

GENERAL ECONOMIC STATUS OF PEOPLE



The table on general economic status of the people i.e tables 5.4 show a progressive trend from the very rich to extremely poor. While only five percent of the people could by classified as very rich, then 10 percent are classified as rich and 13 percent are within the average bracket. A total of 72 percent, which represent a clear majority, are either poor or extremely poor .

The economic status of the people in the study area has been fund to have contributed in no small measure to the prevent level of excreta and waste water management in Ilorin and its attendant negative effects on public health. In a situation where an average of fifteen percent of the people can be said to be above average, nothing encouraging could be expected According to my investigation, the cost of constructing the most simple toilet (127 latrine) is about fifteen thousand Naira while the average monthly income of about sixty percent of the people in the study area is about three thousand Naira. If this is considered against the background of other competing demands like accommodation, feeding, clothing etc, the issue of provision

of toilets and good drainage may not be a priority. This is the reason why the proper management of excreta and wastewater have not been achieved. Most of the people interviewed would have love to have toilets in their residential building at least if not for anything else, for the comfort such facilities usually provide for their users but openly confess that it is fastly becoming a luxury as a result of the present economic arrangement and condition in this country an economic state that has succeeded in creating more poor people.

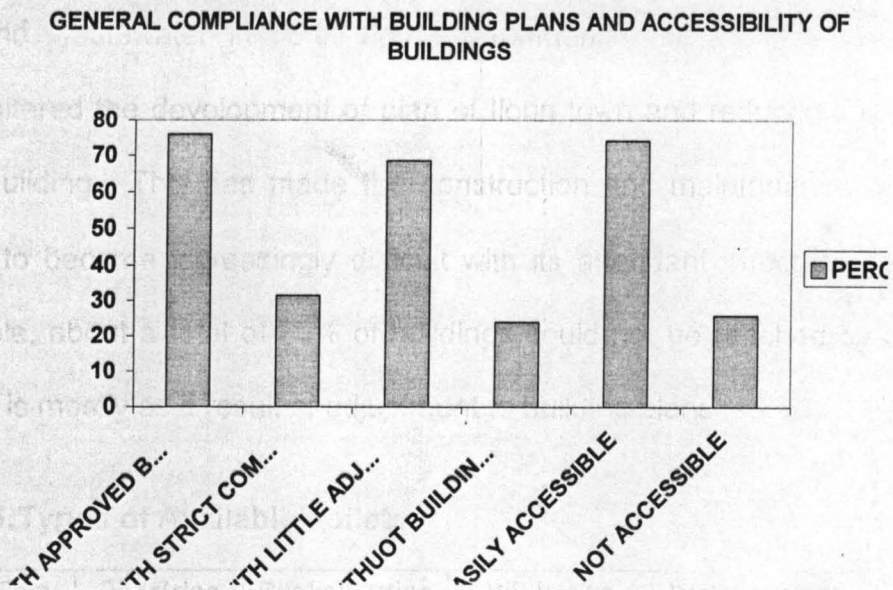
Furthermore, the present economic problem of the government does not help matters. The present ugly situation could have been improved by the construction of public drains in Ilorin. However, this has not been so because of the present learn purse of the government and the preference for the provision of other facilities that will fetch the government cheap popularity.

TABLE 2.5: General Compliance With Building Plans and Accessibility of Building

Building	Number	Percentage
Number with approved building plan	38	76
Number with strict compliance	12	31.5
Number with little adjustments	26	68.5
Number without building plan	12	24

Easily accessible	37	74
Not accessible	13	26

SOURCE: Meteorological Department, Airport, Ilorin



This table which shows the number of buildings with approved buildings plan, the compliance leave with buildings plan as the accessibility of building is very important to this study. Out of the total number of buildings randomly inspected, 38 or 76 percent has approved building plans while only 12 or about 32 percent strictly comply with the approved building plans. A total of 26 buildings, which represent about 69 percent, a clear majority, are with various degree of adjustment to the original building plans. 12 buildings or 25 percent are without approved building plans. 37 buildings are easily accessible. This represent about 74 percent of the building inspected while only 13 or 26 percent are not accessible. (2.5 next sheet).

This table has shown that generally, people do not comply with buildings rules and regulation. Even where they get approved plans probably as a result of the town planning Authority who might prevent them from the construction if they do otherwise, they still deviate from the plan. Development of slums as a result of non compliance with building laws and regulations does not have way for the proper management of excreta and wastewater in Ilorin and environments. The present situation has seriously altered the development of plan of Ilorin town and reduced the accessibility of many building. This has made the construction and maintenance of toilets and drainages to become increasingly difficult with its attendant effect on public health. For example, about a total of 25% of buildings could not be reached by a motorable road. This is mostly as a result of adjustment to building plans.

TABLE 2.6:Types of Available Toilets

Types of toilets	Pit latrine	Bucket latrine	VIP latrine	Water system	No toilet
Percentage	35	1	9	24	31

SOURCE: ~~Meteorological Department, Airport, Ilorin~~
QUESTIONNAIRE

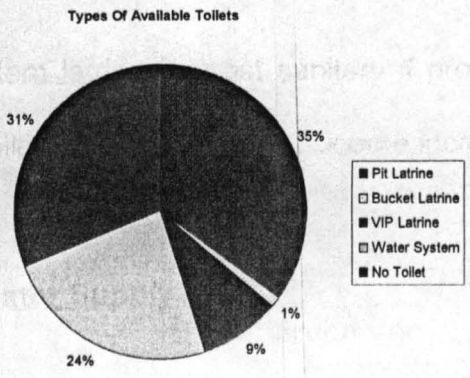


Table 2.6 which shows the type of available toilets was randomly collated during the physical inspection of some buildings. 35 percent of the houses were provided with pit latrine while only 1 percent is having bucket latrine. 9 percent of the houses have ventilated improved pit latrine (vlp latrine), 24 percent with water - system and 31 percent of the houses without any means of excreta disposal. (2.6 next sheet).

About three types of toilets used to be very common in Ilorin and environs. This ranges from pit latrine, which has been adjudged to be most common and economical to VIP latrine (ventilated improved pit latrine) and water system. The factors that determine the type of toilet to be used by each household includes economic, socio cultural and technical factors. The most important factor however is the economic factor. As a result of its lower cost, pit latrine is very popular among the average people. The difference between pit latrine and VIP latrine is the vent ripe. This is a ripe that is connected to the pit and provided with trap meant for the destruction of flies. This is what actually makes VIP latrine to be more sanitary when compared with pit latrine.

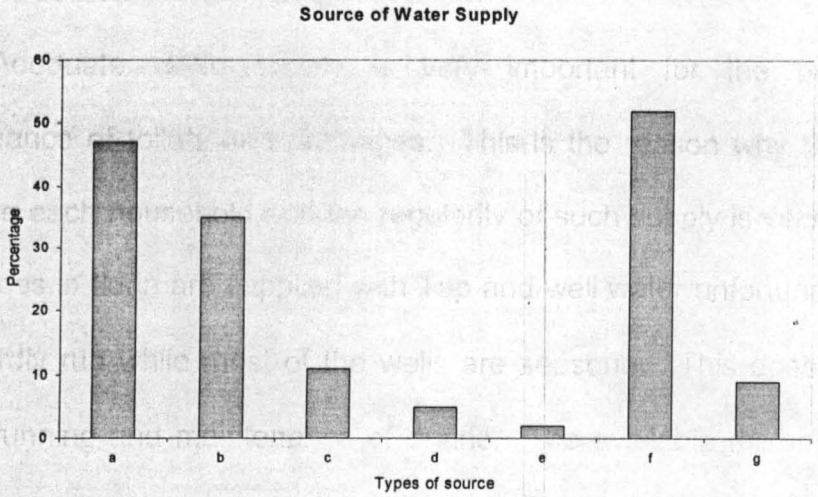
However, water system latrine is most sanitary if properly maintained but not economical as pit latrine while bucket latrine has become increasingly unpopular.

TABLE 2.7 Sources of Water Supply

Types of source	Percentage
Tap water	47
Well water	35

SOURCE: QUESTIONNAIRE

Bore hole	11
River	5
Spring	2
Combination of more than one source	52
No source of water supply	9



SOURCE: Questionnaire

NB

S: Sources of water supply

A: Tap water

B: Well water

C: Borehole

D: River

E: spring

F: Combination of more than one source

G: No sources of water supply

Table 2.7 shows the various sources of water supply that is available to each building. This was derived from the response of the people to the questionnaire. 47 percent of the respondents confirmed that they have access to tap water while 35 percent have wells. Borehole accounts for 11 percent while rivers and springs accounts for 5 and 2 percent respectively. A number of 52 percent of the buildings have provision for more than one source of water supply while 9 percent does not have any source of water. (2.7 next sheet)

Adequate water supply is very important for the proper running and maintenance of toilets and drainages. This is the reason why the sources of water supply to each household and the regularity of such supply is very important. Most of the houses in Ilorin are supplied with Tap and well water unfortunately, majority of the taps hardly run while most of the wells are seasonal. This does not encourage the proper running and maintenance of drains. The available major rivers i.e River Asa and Aluko also becomes dry especially during the dry season. Moreover, these rivers are being polluted as a result of man's activities. All these have actually reduced the quality and quantity of water available for the management of excreta and wastewater.

TABLE 2.8 Factors that discourage provision of toilets and drainage facilities.

Factors	Economic	Socio-cultural	Educational/ Ignorance
Percentage	65	21	14

SOURCE: Questionnaire

Table 2.8 shows some of the factors that discourage the provision and use of toilet and drainage facilities of all; economic factor which accounts for 65 percent is

mostly responsible while socio-cultural factors and educational factors accounts for 21 and 14 percent respectively. (2.8 next sheet)

As earlier slated in this chapter, economic factor has being a major contribut0or to the deportable condition of excreta and wastewater management. Many people knows the Importance of providing sanitary facilities but they cannot just afford them. This is as a result of their low income and declining purchasing power. On the other hand, there are some socio – cultural beliefs that doesn't encourage the provision and use of toilets and drainage facilities.

There are still some people who are not adequately educated about the provision and use of toilets and drainage facilities. They are ignorance of the fact that they may contact excremental diseases if their excreta is not properly disposed.

TABLE 2.9:Types of Available Drainage Facilities

Types	Open	Closed	Soakaway pit	No drainage
Percentage	52	15	25	8

SOURCE: Questionnaire.

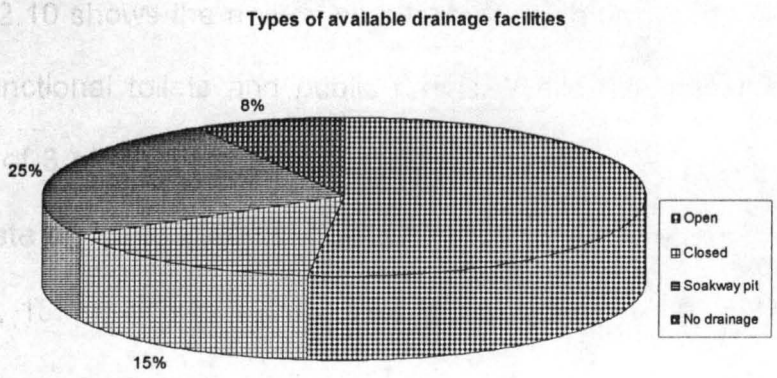


Table 2.9 shows the various types of available drainage facilities open drains account for about 52 percent while soakaway pits and closed drainage represents 25 percent and 50 percent respectively. An average of about 8 percent of buildings doesn't have provision for drainage system. (2.9 **next** sheet)

Different types of drainage facilities are available in Ilorin and environs. Open drains which account for fifty-two percent is most common. Economic factor also play a significant role here. Because of its lower cost, many houses are provided with open drain, which usually leads to accommodation of wastewater and breeding

TABLE 2.10:Estimated Population Growth, Number of Functional Toilets and Public Drains

Year	Estimated Population	Number of functional toilets	Number of public drains
1997	688286	4441	628
1998	708934	4487	637
1999	730202	4550	649
2000	752108	4614	660

SOURCE: Kwara State Environmental Protection Agency

Table 2.10 shows the annual population growth between 1997 and 2000, the number of functional toilets and public drains. While the population growth at an average rate of 3 percent per annum, number of toilets and public drains grows at an average rate of 1.5 to 2 percent per annum. There are about 155 people to one toilet in 1997, 158 to one in 1998, 160.5 to one 1999 and 163 to one in the year 2000.

TABLE 2.11:Excremental Diseases and Mortality Rate

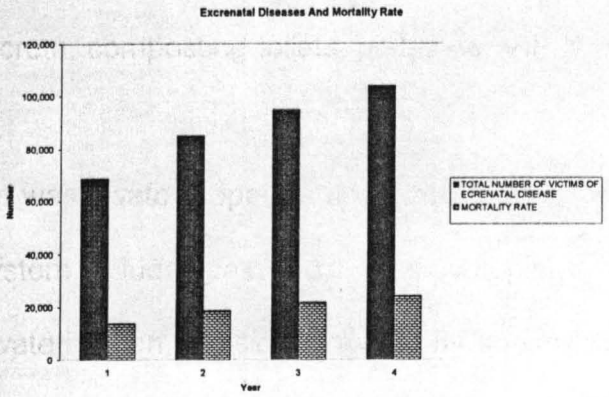
Year	Total number of victims of excremental disease	Mortality rate
1997	68,828	13766
1998	85,072	18716
1999	94,926	21832
2000	103,791	24391

SOURCE: Data Bank Kwara State Ministry of Health

Table 2.11 shows the number of victims that suffered from excrenatal diseases and the mortality rate between 1997 and year 2000. Excrenatal diseases in this case includes diarrhea, bacillary dysentery, worm infection, typhoid fever, malaria fever and food poisoning.

A total of 10 percent of the population suffered from various diseases 1997 while about 12, 13 and 13.8 percent suffered from excrenatal diseases in1998, 1999 and year 2000 respectively.

Furthermore 20 percent mortality rate was recorded in 1997, while about 22, 23 and 23.6 percent mortality rate was recorded in 1998, 1999 and year 2000 respectively.



CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMARY: FINDING

Faeces, wastewater management and public health has being a topical environmental issue that has generated a lot of interest among environmental experts inn developing countries of the world.

This study has examined the climatic condition of Ilorin and environs. the average temperature, relative humidity, number of rainy days and volume of such rain, the relief, land use and population. The population has been growing at a very rapid rate with average growth of three percent per annum. This is seen to have put undue pressure on the existing sanitary and thereby contributing to the present deplorable condition of excreta and wastewater management.

Different types of pathogens could be found in the excreta. This includes Adenovirous poliovirus, Hepatitis A virus e.t.c. These viruses cause numerous diseases like poliomyelitis hepatitis e.t.c. Bacteria like campylobacter fetus ssp Jejuni which causes diarrhoea, salmoneller typhi which causes Typhoid fever and S.Paratyphi which causes paratyphoid fever could be found in the excreta. Hookworm, Roundworm, whipworm are some of the worms that could be found in the excreta. For proper disposal of excreta, composting toilets, pit latrine, VIP latrine and water system toilet are suitable.

The quantity of wastewater depends upon domestic water use. Different types of sullage disposal system includes casual disposal by tipping wastewater receptacles in the yard, garden watering; on the side disposal by soakaways; drainages into an open drains; and drainage into covered drains or sewers.

There many laws, regulations and standard governing the management of faeces and wastewater in the country. This ranges from the Northern Nigeria Public health law of 1963 to Guidelines and standards for Environmental pollution control in Nigeria (FEPA 1991) and Kwara State Environmental Protection Edict of 1984.

CONCLUSION:

This study has actually helped in arriving at some logical conclusion. The relationship between faeces and wastewater management and the health of the people is no more in doubt. However, economic factor is one of the reasons why we now experience the present deplorable state of faeces and wastewater management in Ilorin metropolis. Other factors include social - cultural and educational/ignorance

In order to reduce the high mobility and mortality rate in Ilorin metropolis, the issue of faeces and wastewater management should be taken seriously. It is not mere management but proper management.

RECOMMENDATION:

In order to improve the present low level of excreta and wastewater management, and elevate the public health status of our people in the Ilorin and environs, the following recommendation will be expedient.

The government should improve the economic status of the people. Effort should be made by the various tiers of government to alleviate if not eradicate poverty among the people. The present arrangement that does not encourage equitable distribution of resources should be avoided.

As the improvement of the economic status of the people will definitely encourage them to provide necessary sanitary facilities, government should also step up the

construction of public toilets and public while the existing ones should be properly managed. These toilets should be strategically located for the use of members of the public.

People should be encouraged to obtain approved building plan before they embark on the construction of any projects. Adjustment/ alteration to already approved plans should be heavily paralysed while people should be educated on the importance of street compliance with building rules and education.

The government should review the existing laws governing excreta and wastewater management. A situation where some laws especially the 1963 Northern Nigerian Public Health law still prescribe a fine of about 2 pounds for an offence like improper management of excreta and wastewater is a mockery of justice.

Kwara State town planning Authority should be provided with adequate equipment and manpower. This will help intensification of patrol and enforcement of regulation on developers.

The government should embark on the health education of the people on the relationship between excreta and wastewater management with public health. Reliant posters could be produced on this topic and pasted at strategic locations. Workshops and seminars may also be organised in order to sensitise members of the public.

The Kwara State environmental protection Agency should be adequately funded. Necessary equipments should also be provided for the agency. A situation where the agency does not have equipments for the evacuation of septic tanks will not encourage the proper excreta and wastewater management.

Socio-cultural beliefs that do not encourage the provision and use of sanitary facilities should be discouraged. Efforts should be made to identify areas where such beliefs

could be found while appropriate educational machinery should be put in place in such areas in order to nullify such beliefs.

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FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

PGD ENVIRONMENTAL MANAGEMENT

PROJECT TOPIC:- **FAECES, WASTEWATER MANAGEMENT AND PUBLIC HEALTH IN ILORIN METROPOLIS.**

QUESTIONNAIRE

1. Name:.....
2. Sex: Male, Female: .....
3. Educational background: .....
4. Professional: .....
5. Address: .....
6. Marital status: Married/Single: .....
7. Employment: Civil Servant ☐ Business man/ Woman ☐ Artisans ☐ Trader ☐ Others (please Specify) ☐ Unemployed ☐
8. Economic Class: Very Rich Rich Not so Rich ☐ Poor ☐ Extremely Poor ☐
9. Size of family: very large ☐ Large ☐ Medium ☐ Small ☐
10. Which type of building do you own/rent: Bungalow ☐ Three bedroom flat ☐ Four bedroom flat ☐ Duplex ☐ Mansion ☐
11. Are you aware of any relationship between feaces, wastewater management and public health? Yes ☐ No ☐
12. Does your building have an approved building plan? Yes ☐ No ☐
13. Was it built strictly according to the approved building plan? Yes ☐ No ☐
14. Did you erect your building on a well drained land ☐ swampy area ☐ rocky area ☐ sloppy area ☐
15. Is your building provided with all necessary sanitary facilities? Yes ☐ No ☐
16. Type of toilet available: pit latrine ☐ VIP latrine ☐ Bucket latrine ☐ water system latrine ☐
17. How accessible is your building? Easily accessible ☐ Accessible ☐ Not accessible ☐
18. Type of source of water supply available: Tap water ☐ Well water ☐ Borehole ☐ River ☐ Spring ☐

19. How often do you or any member of your family suffer from malaria fever, typhoid, Bacillary dysentery, Worm infection, food poisoning, Others (please specify) very often ☐ Periodically ☐ Rarely ☐ Never ☐

20. Generally, do you have access to toilet facilities? Yes ☐ No ☐

21. How often do you evacuate your toilet? Every Year ☐ Every five years ☐ Whenever it gets filled up ☐

22. Any cultural barrier that inhibits you from using toilet facilities? Yes ☐ No ☐

23. IF yes please specify:

.....

.....

.....

.....

b. What other things that discourage you from providing toilets and drainage facilities

24. Which type of drainage do you use? Open drainage ☐ Close drainage ☐ Soak-away Pit ☐ No drainage ☐

25. The drainage is constructed with: Very Impervious material ☐ Impervious material ☐ Semi Impervious material ☐

26. How often do you clean your drainage? Every day ☐ Every three days ☐ Every Week ☐ rarely ☐

27. How steep is your drainage (Gradient)? Adequate ☐ manageable ☐ Flat ☐

28. Where does your drainage leads to? Soak-away ☐ Other drainage system ☐ Public drains ☐