PRESIDENT'S COMMENTS

Jerry Chaka

Two Board of Directors' meetings have been held since the beginning of this year. The first was held in Dublin, Ireland in January and the second meeting was held at Chadwick Court, London, in June.

The Dublin meeting afforded members of the Board of Directors an opportunity to conduct an inspection in loco of the Trinity College, venue for the 9th IFEH World Congress. The meeting also enabled EHOA colleagues to brief the Board about progress made thus far regarding preparations for the World Congress. Preparations are advancing well and the venue is conducive for the hosting of the World Congress. Member organizations are requested to market this World Congress in their respective countries to ensure its success. Bids will be invited during the Vancouver Council meeting for the 2012 World Congress, which will be considered in June 2006 during the Dublin Council meeting. Member organizations that intend to host the 2012 Congress are urged to prepare their bids in line with IFEH policy.

A project is underway to reconstruct our website to be more user friendly and to be on par with other well developed websites. The Danish Association, FMK , have signed an agreement with a consultant, on behalf of IFEH, to assist us in the reconstruction . The work of the consultant will be supervised by the Webmaster. It is my belief that all member organizations should make inputs regarding the reconstruction, so that IFEH has a product that will be suit its needs. We will ensure that we have a system in place that will allow all to input in the process. Ray Ellard will co-ordinate this work on behalf of the Board.

The German Association of Food Control Officers, BVLK, continue to represent us in the Codex Alimentarius Commission. The Hon. Secretary sent a note to all full member organizations and associate member organizations to identify individuals who could assist us in terms of contributing to the Commission work. The view is that the contributions will be made electronically and that no expenses be paid to the volunteers. It is critical for us to contribute, in the interest of global health. All member organizations are urged to participate. More IFEH participation will enhance our influence on the work of the Commission

I had the opportunity of attending the 15th Biennial Conference of the Association of Public Health Officers of Kenya held on 17-20 August 2005 at Mombasa, Kenya. The Conference was the largest gathering of environmental health professionals I have ever attended, slightly over a thousand delegates. The conference was also attended by the Zambian Association , ZIEH , the Tanzanian Association, CHAMATA, the African American Association of Environmental Health and the Northern Center of CIEH, represented by Les Milne. The Africa Group managed to have their meeting during the conference. The conference, with the theme 'Enhancing a healthy environment' addressed a number of topical issues pertinent to environmental health services delivery , namely health law enforcement in substance abuse, radioactivity, contamination of food, food handlers transmittable diseases, Malaria situation in Kenya, sanitation and waste, emerging and re-emerging diseases, etc. A representative of the Deputy President of Kenya opened the conference and the closing address was given by the Assistant Minister of Health. The conference was a resounding success and it was worth attending. My gratitude goes to the leadership of the Association of Public Health Officers (Kenya) and the conference organizing committee for the well organized conference.

The Africa Group resolved to hold an all Africa conference on environmental Health in Nairobi, Kenya, in 2007. The aim is to attract as many African countries as possible to this conference through the African Union Health desk and the Afro WHO office, to share African problems related to environmental health and to develop a common way of resolving these problems It is hoped that many African countries will be recruited to join IFEH at this meeting.

Let us all make the growth of IFEH our concern. Cavett Roberts wrote 'True success is a journey, not a destination'. We all have to take this journey to achieve a successful well represented IFEH.

INDUSTRIAL SOLID AND LIQUID WASTE POLLUTION IN THE LIMBE RIVER, MALAWI.

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ABSTRACT
Waste from commercial centres and industry in Blantyre, often lands in the Limbe River in Malawi. During a three-month period, on five separate occasions, five industries and three commercial centre clusters had water samples (n = 330) collected from solid and liquid waste polluted sites along the Limbe river in Blantyre. Analyses were conducted for phosphates, nitrates, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total coliform count and total dissolved solids (TDS). In general, sample results showed no statistical significant difference between mean influent and effluent phosphate and nitrate concentrations. High BOD's were recorded in industrial waste polluted samples, and total coliform concentrations did differ significantly between influent and effluent in different areas, (with commercial centre clusters showing relatively higher mean total coliform concentration in all clusters). Highly significant statistical differences ($p < 0,05$) between mean influent and effluent COD concentrations were also demonstrated for 80% of the industries.

With regard to TDS concentrations which were obtained from commercial water sampling points, results from 7% (n=2) of the industries involved illustrated values higher than the established WHO and Malawi water quality guidelines of 500 mg/l. Therefore, although nitrate and phosphate pollution does not seem to pose a serious problem, the pollution of the water of the Limbe river as a result of poor waste management at industries and commercial sites along the river, is clearly demonstrated by research findings.

Based on these findings an integrated waste management system is therefore recommended for the City Council of Blantyre in order to reduce further waste pollution of the Limbe river.

INTRODUCTION

In Malawi's urban centres, as a result of industrial growth and street vending, there is an increase in waste production. Such waste eventually finds its way into urban water bodies-leading to pollution thereof. The literature provides that in Malawi waste management which encompasses waste generation, storage, collection, transportation, treatment and disposal is far behind as compared to the cities of the neighbouring countries of Zimbabwe and Zambia (Yap, 1999. Matope, 1999., Chinyama & Madhlopa, 1999).

The latest data on amount on waste generation for the city of Blantyre indicate that 0.37 kg of waste is generated per person per day (Blantyre City Council, 1995). Considering the population of Blantyre which is at 640,000 (National Statistical Office, 2000), it means that over 237 tonnes of waste is being generated everyday, out of which 12% is said to be dumped into the city's rivers. Waste collection in both industrial and commercial centres is less than 11% of the total amount of waste generated. There was a drop of 89% in waste collection vehicles provided by the Blantyre City Assembly between 1994 and 1999 whereas vehicle breakdown was estimated to be 50% per week (Blantyre City Council, 1995, Matope, 1999).

Concentrations of inorganic nutrients (phosphate and nitrate), Biological Oxygen Demand (BOD), microorganisms, Chemical Oxygen Demand (COD) and Total Dissolved Solids (TDS) in the rivers of Blantyre city prevail in mild and serious forms (Matope, 1999). Phosphate and nitrate concentrations of 2.20 mg/l and 4.2 mg/l respectively (phosphate greater than the established WHO and Malawi water quality guidelines) have been reported on the Limbe river while BOD and microbiological concentrations have been attributed to both waste and sewage discharges. In the case of COD and TDS, values of more than 250 mg/l and 500 mg/l respectively (recommended WHO and Malawi values), have

also been documented (Mvuma, 1994).
This study was conducted to determine the level of pollution of the Limbe river due to commercial and industrial waste and further recommend the development of an integrated waste management system for the city of Blantyre so that further pollution of the river could be averted.

MATERIALS AND METHODS

The study was done on the Limbe River in Blantyre City, Malawi, a country in the southern hemisphere. The river runs along the industrial and commercial centres of the Limbe Township.

Water samples (n = 330) were obtained from the river at: three commercial centre clusters within the vending community and five industrial sites along the Limbe river. In the case of the commercial centre, three clusters were identified based on the location of the solid waste holding point and liquid waste discharge points close to the river and believed to be polluting the river water. The clusters were subsequently named as: City Assembly Waste Holding Cluster (C1), Vendors' Cluster (C2) comprising second-hand clothes, groceries and hardware vending activities and Restaurant Cluster (C3). With regard to industries, five industries i.e. Royale Chemicals (RC), Grain and Milling (G&M), Lever Brothers (LB), Kadewere Garage (KG) and Motor Care Garage (MCG) were randomly selected from a population of 12 industries. From each industry, a site was identified where solid or liquid waste was being discharged either directly or indirectly into the river.

At each commercial centre cluster and industrial site, two water-sampling points were identified. Water samples were then collected upstream and downstream, i.e. before and after waste discharges into the river and they were respectively named as influent and effluent water samples. The samples were collected, transported and analysed using the standard methods for phosphate (Ammonium Molybdate spectrometer), nitrate (Sulfosalicylic acid), BOD (Electrochemical Probe), COD (British International standard 6068), total coliform (Detection and enumeration of coliform organisms: thermotolerant and presumptive) and TDS 2540c (APHA, 1995., Argent et al, 1991. BSI, 1988., Lewis, 1987).

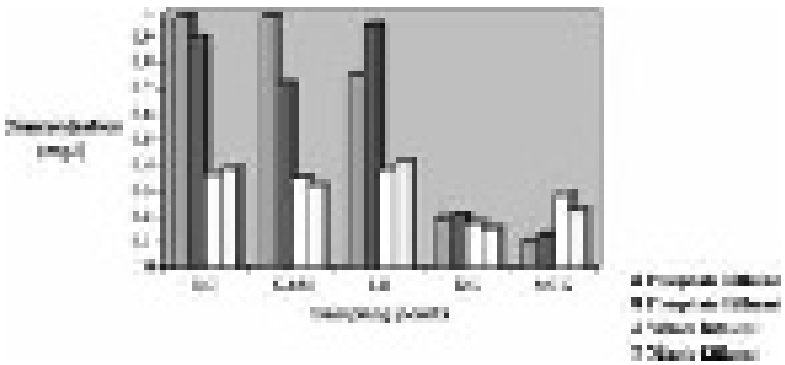
Samples for phosphate and nitrate analysis were collected from industrial waste polluted sites while TDS analysis was done on commercial waste polluted samples. In the case of total coliform count, only ten samples were collected from the industries.

Data for the analysis of the differences between the mean influent and effluent concentrations at each sampling point were obtained by a parametric paired t-test using the SAS program. Levels of $p > 0.05$ were taken to be non-significant. In the case where the t value was negative, it was concluded that the mean influent concentration was greater than the mean effluent concentration. As for the calculation of phosphate and nitrate concentrations, regression equations were developed using both SAS and Epi-Info programs (CDC, 1994). Concentrations were used to evaluate the level of pollution for all the parameters measured. Comparisons were made between influent and effluent concentrations at each sampling point. A higher effluent concentration meant that waste pollution had occurred at that particular sampling point.

RESULTS

The presence of phosphate and nitrate influent and effluent concentrations from the industrial sites are shown in figure1. Mean influent phosphate concentrations (n = 25) ranged from 0.11 mg/l to 0.98 mg/l while mean effluent phosphate concentrations (n=25) ranged from 0.13 mg/l to 0.95 mg/l. In the case of nitrate, mean influent concentrations ranged from 0.17 mg/l to 0.38 mg/l. No statistical significant difference was found between mean influent and effluent concentrations for both phosphate and nitrate. However, 60% and 40 % of the industries depicted higher effluent phosphate and nitrate concentrations respectively.

Figure 1



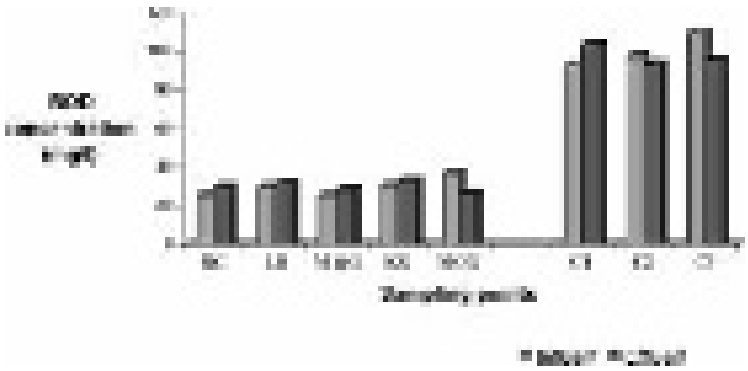
Influent and effluent water samples (n = 80) from both commercial centre clusters and industrial sites were collected and processed for BOD concentrations. Of the commercial clusters, 33% reported high effluent BOD concentrations while 80% of the industrial sites showed high effluent BOD values (Figure 2). The Blantyre City Waste holding Cluster showed a high statistical significant difference between its mean influent and effluent concentrations (p=0.0320: df = 4). As summarised in Table 1, a high statistical significant difference between mean influent and effluent concentrations in the industrial samples was observed at Lever Brothers (p = 0.0349: df= 4).

Table 1: Statistical summaries of mean influent and effluent BOD concentrations from both commercial and industrial waste polluted sites

Sampling point	df	Mean influent (mg/1)	Mean effluent (mg/1)	t	p-value
Royale Chemicals	4	26	30	1.38842	0.2373
Grain & Milling	4	26	29	1.094887	0.3351
Lever Brothers	4	30	32	3.137858	0.0349*
Kadewere Garage	4	31	33	0.740233	0.5003
Motor Care Garage	4	37	27	-4.70415	0.0093
Waste Holding Point	4	93	104	3.229711	0.0320*
Vendors Cluster	4	98	99	0.374701	0.7269
Restaurant Cluster	4	110	96	-3.23748	0.0317

** High statistical significance*

Figure 2



The mean effluent COD concentrations in most samples were high, with 67 % (2 of 3) of the commercial centre clusters and 100% of the industries having high effluent concentrations. The highest concentrations were observed in industries whose waste was discharged into the river directly. A high statistical significant difference between mean influent and effluent COD concentration was shown in 60% of the industries whilst commercial waste sampling points showed a high statistical significant difference (df = 4; p = 0.0094) between mean influent and effluent concentrations at only one cluster. (Table 2).

Table 2: Statistical summaries of mean influent and effluent COD concentrations from both commercial and industrial waste polluted sites.

Sampling point	df	Mean influent (mg/1)	Mean effluent (mg/1)	t	p-value
Royale chemicals	4	179	182	0.329513	0.7583
Grain & Milling	4	179	203	3.91625	0.0173*
Lever Brothers	4	194	223	4.71624	0.0092*
Kadewere Garage	4	207	228	4.41276	0.0116*
Motor Care Garage	4	232	246	2.155132	0.0974
Waste holding point	4	251	264	1.4498067	0.2085
Vendors cluster					
Restaurant cluster	4	251	268	4.688423	0.0094*
	4	285	280	-0.24766	0.8166

* High statistical significant difference

Total coliform concentrations in the samples were consistently high in all cases (Table 3) However, the concentrations from the industrial waste polluted sampling points were lower than those of commercial waste polluted samples with a mean maximum of 23 x 10^5cfu/10ml. The situation regarding samples from commercial sampling points however, was different. An extreme value of 101 x 10^5 cfu / 10ml (exceeding the WHO and Malawi drinking water quality guidelines of 0 cfu /10ml and 5 cfu /10ml respectively) was recorded at Restaurant cluster.

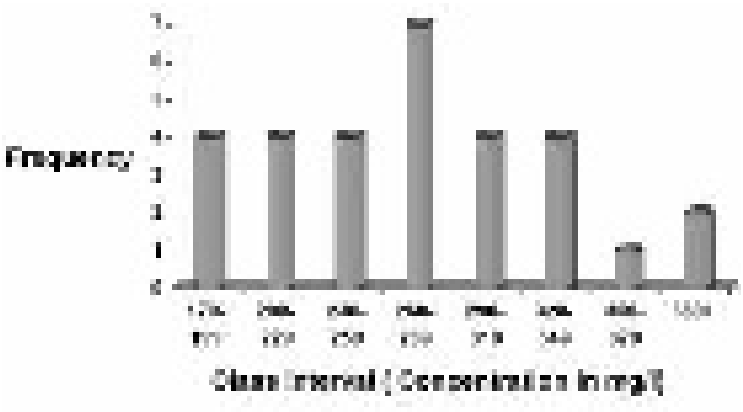
Table 3: Statistical summaries of mean total coliform concentrations from both industrial and commercial waste polluted sites.

Site	Sample Size (n)	Range (cfu/10ml)	Variance	S.D	Mean (Cfu/10ml)
Industrial In	5	(7; 20)x105	448x105	669328.02	18x105
Industrial Ef	5	(5; 23)x105	565x105	7516664.82	18x105
BTCity Ass In	5	(20; 37)x105	737x105	8564487.04	27x105
BTCity Ass Ef	5	(18; 42)x105	76x105	871779.79	32x105
Vendors Cluster In	5	(21; 44)x105	1.012x105	1005982.11	33x105
Vendors Cluster Ef	5	(26; 50)x105	1.287x105	1134460.22	35x105
Restaurant Cluster In	5	(18; 94)x105	1.4622x105	3823872.28	50x105
Restaurant Cluster Ef	5	(20; 101)x105	9.573x105	3094026.50	50x105

In = Influent
Ef = Effluent
BTCity Ass = Blantyre City Assembly waste holding point

Results with regard to TDS concentrations were only obtained from commercial water sampling points. The mean concentrations ranged between 179mg/l and 662 mg/l. Only two samples showed COD values which were higher than the established WHO and Malawi drinking water quality guidelines of 500mg/l (APHA, 1995.,Mvuma, 1994), the highest having been recorded at Vendors cluster, specifically the Day 4 sample. Day 4 and 5 samples provided expected results, i.e. effluent concentrations being higher than influent concentrations (Figure 3).

Figure 3



DISCUSSION

In Malawi, as in most developed countries urban river pollution is positively associated with waste discharges. The present study, however, suggests that the degree of pollution differs according to the type and composition of the waste. Industrial waste has been found to significantly increase the level of BOD, phosphate and COD pollution. On the other hand commercial waste has been attributed to high BOD, TDS and total coliform concentrations (Chinyama & Madhlopa, 1999).

The mean effluent phosphate concentrations for the industries included in the study period were higher than the mean influent phosphate concentrations, results that are similar to those conducted by other researchers (Harding, 1992, Koning & Roos, 1998). One of the samples collected after a heavy downpour depicted an extremely high phosphate concentration (1.28 mg/l). In addition to industrial waste discharges, other sources like fertiliser washed from nearby maize fields and human waste could have contributed to this high phosphate level. However, this maximum phosphate concentration was lower than that detected by Mvuma (1994) on the same river. The high values detected by Mvuma could have been due to discharges of phosphate from rainfall runoff since some of his samples were collected during the rainy season. This, together with the fact that effluent phosphate concentrations exceeding the acceptable standard set by WHO of 0.1mg/l were detected leads to the conclusion that phosphate pollution does occur in the Limbe river.

In regard to nitrate, most of the effluents depicted low values. Only Lever Brother's effluent samples were shown to be higher than the influent samples. It was observed that the liquid waste from this industry was rich in foam, and this was attributed to detergents. Soap, oils and households chemicals are some of the products that are manufactured at this industry. These, therefore, could have contributed to the high nitrate concentrations. The non- significant difference between all the mean influent and effluent samples and the low concentrations which were less than the established WHO and Malawi drinking water quality guidelines of 10 mg/l, lead to a conclusion that nitrate pollution is not a serious problem in the Limbe river.

There appeared to be a little difference between the mean influent and effluent BOD concentrations for commercial waste polluted water samples. Only Blantyre City waste holding cluster might have contributed to waste pollution as evidenced from its high effluent concentrations. At this cluster, there were over -filled refuse skips whose wastes were being blown into the river. Sewage from a broken sewer-line was also observed to be spilling into the river. The above sources therefore, could have contributed to the high effluent BOD concentration. In the case of Restaurant cluster, lower effluent concentrations were demonstrated, contrary to the expectations. At both sites illegal toilets and broken sewer lines were observed near the influent sampling point and these could have contributed to the high influent values. It was therefore, difficult to attribute the pollution from direct commercial vending activities. Surprisingly, most of the industrial effluents (80%) had higher values than the influent. One would expect fewer BOD's in industrial waste as compared to commercial waste polluted water samples. BOD is often associated with organic waste and therefore, it could be said that the industrial wastes were rich in organic waste.

In contrast to the BOD, COD concentrations recorded for the Limbe river during the study period showed a marked increase for both industrial and commercial sites with most of the industrial sites (60%) depicting a statistically significant difference between influent and effluent concentrations. The study results are also in agreement with those of Mvuma (1994). Although most of the results in this study indicated COD levels of <250 mg/l, the WHO recommended drinking water quality guidelines, it can be concluded that industrial wastes are polluting the Limbe river. Most industrial activities generate more inorganic wastes like oils, acids and grease and these could be attributed to

the high COD results. In the case of the commercial site, the high COD results at the Vendors cluster could be from hardware vendors who are very much involved in selling second-hand car spare parts which contain oils, acids and grease.

Total coliform results were consistently high in all cases. However, the concentrations from the industrial waste polluted sampling points were lower than those of commercial waste polluted samples with a mean maximum of 23 x 10^5 cfu/10ml. All the effluent samples were extremely high (above the recommended WHO and Malawi values of 0 FC/ 100ml and 50FC/100ml for drinking water) especially at Restaurant cluster where a mean maximum concentration of 101 x 10^5 cfu/10ml was recorded on Day 4 sample. Previous researchers on the same rivers and in other countries reported results which are similar to the current studies (Wyer *et al*, 1998., Mvuma, 1994). The presence of total coliform and E. coli which are not generally harmful themselves indicate that other harmful bacteria could be present in waste polluted river waters. The high values depicted in this study, therefore, lead to a conclusion that the water in the Limbe River is heavily contaminated with harmful micro-organisms. No wonder that during the rainy season, some of the communities, which heavily depend on its water, are infected by cholera.

Total dissolved solids are primarily cations of magnesium, sodium, potassium, phosphate and nitrates and anions of bicarbonate, carbonates, sulphate and chloride being present in surface waters (United States. Geological Survey, 1990). These concentrations in surface water would mostly be due to human activities such as cultivated fields which can increase levels of potassium in surface water as a result of runoff containing ions from fertilisers as well as water from industrial and public wastewater treatment facilities. In general, the results fell within the same range as those reported on the same river from June to August 1993-1994 by Mvuma (1994). In studies conducted on surface waters of the Kansas, West Fork Big Blue, Black Vermilion and Delaware rivers in the United States, by United States. Geological Survey (1990), TDS concentrations of 340, 120, 150, 200 and 270 mg/l were respectively reported and the results correspond with the findings of the present study. However, in the study carried out in twenty streams in Predmont in United States (United States. Geological Survey, 1990), Total Dissolved Solids (TDS) concentrations ranged between 15 and 61 mg/l and these results were lower than those reported for the present study. High values in the current study could be attributed to the already mentioned human wastes. In developed countries urban sanitation is highly advanced as opposed to urban developing countries like Malawi.

The higher TDS reported for Day 4 and 5 commercial waste polluted samples could be due to a heavy storm runoff that washed away pollutants from the commercial area and discharged them into the river. Phosphate and potassium from fertiliser washed from the maize fields established along the riverbanks could further have contributed to the high levels of TDS. This scenario is supported by the fact that samples from the Vendors cluster showed the highest TDS concentrations and grocery vendors from this cluster were found selling pre-packed fertiliser sachets. The incineration of solid waste produces ash, which if it is released into water bodies, can increase the total dissolved solids (United States. Geological Survey, 1990). Some of the waste discharges produced by the vendors were being treated by incineration and eventually disposed of near the river.

It should be noted that this was an academic study that was faced with a lot of limitations. In some circumstances sample collections like phosphate and TDS were limited to one source because of financial problems. Samples were also collected during summer (within a short period) when most of the wastes, which could increase pollutants in the samples, were not yet washed into the river by rainfall runoff. Therefore, the results of this study are not exhaustive.

The study has demonstrated that there is massive generation of waste from both commercial and industrial areas, which is poorly managed. As a result, such waste finds its way into water bodies through direct and indirect discharge. The composition thereof is varied and therefore, the degree of pollution of the water of the Limbe river also varies. Inorganic pollution and BOD have been shown to be severe in industrial waste polluted sites. The waste released by vending activities is highly organic in nature and is therefore contributing to high microbiological contamination. The continued discharges of sewage are aggravating the pollution of the river. It is recommended that an integrated waste

management system should be implemented in both industrial and commercial centres. This will include firstly, waste minimisation where industries must control the raw materials, intermediate products, final products and associated waste streams within their premises. They should only purchase materials that will be needed at a specific time. Excessive materials must be disposed of to avoid such materials from becoming expired and eventually becoming unwanted and expensive waste. Stocking of unwanted materials by vendors should also be discouraged. Secondly, city authorities need to encourage the kerbside waste collection system in both industrial and commercial areas. The sorted waste that is recyclable should be placed in a container for easy collection. Introduction of measures that can reduce waste generation can help to make recycling effective. In the long run secondary materials (recyclable) will compete more fairly with original raw materials.

In addition to the above, pollution prevention through rehabilitation of the sewer network which is close to the river, establishment of effluent discharge permits, protection of river catchment and onsite treatment of wastewater should be compulsory for new industries and the level of major toxic substances should be pre-determined.

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REFERENCES

American Public Health Association, (1995). *Standard methods for examination of water and wastewater,* 19th ed. Washington DC: American Public Health Association.

Argent, V.A., Booth, N.E., Flyn, T., Jones, C.E., Kent, J., Man, B.N& Reed, R.H. (1991). A pilot U.K evaluation of a rapid defined substrate method for enumeration of total coliform and Escherichia coli in water. *Journ. Inst. of Water and Environmental Management*. 5, 413-418.

Blantyre City Council [BCC]. (1995). *Sanitation master plan for city of Blantyre*. [S.I, S.n].

British International Standards 6068. (1988). *Water quality - physical and biochemical methods*. 19th edn. London: British International Standards.

Centre for Disease Control [CDC]. (1994). *Epi - Info 6 version 6.02*. Geneva: World Health Organisation.

Chinyama, M & Madhlopa, A. (1999). *An assessment of municipal solid waste management in the city of Blantyre*. Edited by. N. Yap. Harare: Weaver Press.

Harding, W.R. (1992). Water quality and phytoplankton. *Journ. Water South Africa*. 18, 237 - 245.

Koning, N & Roos, J.C. (1998). The continued influence of organic pollution on the river water on the turbid Moddler river. *Journ. Water South Africa*. 25, 321 - 325.

Martin, J & Guymer, I. (1999). Predicting dissolved oxygen variations downstream from intermittent discharge. *Journ. Chartered. Inst. Water and Environmental Management*. 13, 301-307.

Matope, J.J. (1999). *Blantyre city environmental profile (draft)*. [S.I, S.n].

Mvuma, G.G. (1994). *The assessment of environmental impact of industrial (trade) and domestic waste effluent on Mudi and Limbe streams in Blantyre, Malawi*. Zomba: University Research Committee.

National Statistical Office [NSO]. (2000). 1998 *Malawi population census*. Zomba: National Statistical Office.

United States Geological Survey. (1990). *Effects of agricultural land_management practices on water quality in Northeastern Guilford County. North Carolina*. Washington D.C: United States Printing Office.

Wyer, M.D., Kay, D., Crowther, J., Whittle, J., Spence, R., Huen, V., Wilson, C., Carbo, P & Newsome, J., (1998). Faecal - indicator budget for recreational coastal waters: a catchment approach. *Journ. Chartered Inst. of Water and Environmental Management*. 12, 414 - 424.

Yap. N. T. (1999). *Cleaner production and consumption: challenges and opportunities*. Harare: Weaver Press.

ENVIRONMENTAL HEALTH CONDITIONS IN LESOTHO PRISONS: THE CASE OF MASERU DISTRICT

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ABSTRACT

The study was carried out in Maseru District. It was aimed at exploring and describing the environmental health conditions of the prisons in the District. The Central, Female and the Juvenile Prisons were conveniently selected since they are the only prisons in the District. The data were collected using an observation checklist and an interview schedule. Inmates and staff were randomly selected from the stations for interviews. The observations were centred on five areas- dormitories, ablution, toilets, kitchen and dining as well as the surroundings. These were assessed on the basis of cleanliness, number of inmates in cell, the size of the cell, the fitness of the physical structures and state of repair of fittings. The adequacy of both lighting and ventilation as well as the presence of pests was also investigated. The study revealed that, the conditions in the prisons were unsatisfactory more especially at the Central and Juvenile Prisons. However, the conditions at the Female Prison were relatively satisfactory.

INTRODUCTION

Prisons contribute tremendously to the safety and prosperity of society by taking custody of those who contravene the law. While in prison appropriate reformatory measures are put on such outlaws. Even if such persons will have committed crimes, for which punitive measures have to be taken, the physical environment and their general well-being while in prison are very important to their overall health.

The primary health care (PHC) concept, which has been adopted by many developing countries advocates for health promotion for all citizens in their countries. Despite the nature and severity of their offences, prisoners remain citizens and their health and environment matter also.

Prisons serve a variety of objectives to different societies. While some are more correctional in their overall philosophy, others are punitive inclined. Levy (1997) documented that incarcerating people means that their personal freedoms are denied - “loss of choice over sanitation, diet, recreation, cellmate to name a few.” As crime rates continue to escalate, the capacities of most prisons are limited. The Asian Crime Prevention Forum (1996) observed that there seemed to be a problem of prison overcrowding in many countries today. As a result, there is also a gross inadequacy of essential facilities such as sanitation, water for bathing and washing, medical and recreational facilities. Such a state of affairs was found by Squires (1996) to be a major cause of morbidity and mortality among the prison population.

One of the major tasks of prisons is the rehabilitation of inmates. This led to a change in philosophy from one of punitive to correctional. Through rehabilitation and reformation, prisons seek to rectify the behaviour that led to imprisonment. In order to realize this goal, prison authorities must ensure that the environment is conducive for living in and for health promotion. Haghud, et al.(1996) argued that one’s place of residence and the environmental conditions in that place are important in determining one’s health.

Environmental health is only one aspect of the integrated health care delivery programme and a component of PHC. The World Health Organization defines it as “the control of all those factors in mans physical environment which exercise or may exercise a deleterious effect on his physical development, health or survival.” It is concerned with the detection and control of environmental hazards that affect human health (Basset 1997). It includes among other things: the management of waste, food, sanitation, housing, epidemiological control, occupational health and safety, water quality monitoring and control as well as educational activities. Ehlers and Steel (1950) noted that houses or buildings that have dampness, poor ventilation and overcrowding contribute a great deal to the spread of diseases. These are just some of the problems that can be encountered in a place with poor environmental health conditions.

Pineo, et al. (1981) cited that the unsafe environment is the single greatest barrier to a productive and healthy population. So it is

important for everyone who is involved in penal work to think critically about the environment and health conditions in general, to which offenders entrusted in his/her care are subjected.

The researchers observed among other things that, the number of inmates in prisons in Lesotho is increasing, particularly in the Maseru central prison. This is an indication that in the long run, carrying capacities of the prisons will be exceeded and as a result there will be overcrowding. Through observation and complaints received from inmates, the researchers also gathered that some prisons are infested with rodents, cockroaches and lice. These pests are known for their notorious effects on human health. According to the Mississippi State Health Department (1998), they may bite or sting, contaminate and even transmit infectious diseases. One of the most observable of all things in most prisons in the country is ageing buildings. Some of these buildings were built during the colonial era and may not meet the health standards as required by rule ten of the United Nations (UN) standard minimum rules for the treatment of offenders. This being the case the researchers can hypothetically say that the environmental health conditions in Lesotho prisons are not satisfactory.

The researchers realised that no study has ever been carried out on health related issues in any of the prisons in Lesotho. The researchers also noted that there were reports on prevalent communicable diseases endemic to some prisons in the country. Some of these diseases were tuberculosis, chicken pox, sexually transmitted diseases, as well as diarrhoea especially in summer seasons.

As environmental health professionals, the researchers felt it as an obligation to carry out a study that explored the environmental health conditions inmates are subjected to in the prisons within the Kingdom of Lesotho.

The broad objective of this study was to explore and describe the living conditions prisoners are subjected to in the prisons of Lesotho. The specific objectives were:

- To determine the prisoner population with regard to available space in the cells
- To determine the adequacy and fitness of existing structures for human habitation.
- To assess the hygiene status of yards and surroundings.
- To determine the level of awareness, attitudes and practices of both inmates and staff towards health issues.
- To elicit suggestions on how best the environmental conditions of prisons in Lesotho could be improved.

It was envisaged that the study would benefit the Department of Prisons and the country as a whole, as it would reveal all the existing environmental health conditions in prisons and the problems faced by people living or working therein. Thus the state of affairs is known by the relevant authorities and proper action taken where necessary towards improvement.

It was expected that the findings of this study would be very useful in the prevention of disease in prisons and in preventing prisons from becoming reservoirs of infections which may not only be deleterious to inmates' health but also to that of the entire prison community, families of inmates and the general public.

It was also thought that, the study would provide a good basis for informed decision- making, as it was to provide factual data based on empirical evidence. One of the objectives of the Department of prisons is to make prisons well-ordered communities with no danger to life or health; this study therefore, was envisaged to be a useful tool in the endeavour to achieve this goal.

LITERATURE REVIEW

Deplorable environmental conditions in prisons have been reported in many countries around the world. As observed by Human Rights Watch (2002) in almost all countries all over the world, prison populations are continuing to rise every day. This rise in number of prisons has resulted in overcrowding in prisons and detention facilities. The report further went on to reveal that inadequate sanitation, lack of medical care and decaying physical infrastructure are some of the major problems existing in prisons.

These harsh prison conditions have been observed in Bolivia (Bureau of Democracy, Human Rights and Labour, 2004). Dissel (1994) revealed that in South Africa up to about 50 inmates were held in dormitories designed for 29 prisoners. She observed that this resulted in the shortage of cell furniture forcing other inmates to sleep on floor mats. Alon (2001) revealed that these deplorable

sanitary conditions were also present in Hasharon detention centre in Israel. He wrote that there were no closets, no ventilation and there was poor lighting. Detainees, he continued, slept on wet mattresses on the floor due to leaking water pipes. In Haiti the conditions were described as "dreadful" (National Coalition for Haitian Rights, 2003). The coalition indicated that in many detention centres of Haiti the cells are lacking in size and light, and that there was not enough water for bathing.

According to Human Rights Watch (2002), the spread of communicable diseases in numerous prison systems was the predictable result of overcrowding, malnutrition, poor ventilation, lack of potable water, inadequate sanitation and lack of medical care. The report also shows that in most prisons including the developed countries health care and medical services were poor to non-existent.

Effects of Poor Sanitation

Mason (2002) observed that about 40% of the world's population is affected by poor sanitation. He argues that 80% of diseases occurring in most developing countries are due to a synergistic effect of poor hygiene, contaminated water and poor sanitation. Diseases such as dysentery, cholera, typhoid and typhus fever are some of the diseases he said occur as a result of poor sanitation. Poor sanitation has been noticed in prisons (correctional institutions) in some parts of Eastern Europe and was implicated as one of the contributing factors to the occurrence of diseases (Partridge, 1998).

Blackett (1997) observed that sanitation plays a major role in the contamination of food grown in contaminated soil. She argues that although a sustainable water source does reduce the transmission of diseases, the major transmission routes such as via soil and flies cannot be broken down unless faeces are removed from the environment. She further added that adequate sanitation can protect surface and groundwater supplies.

Although the provision of safe water has greatly reduced the incidence of communicable disease, diseases associated with contaminated water still pose a major health risk to most of the world's population (Warner, 1997). He observed that diseases causing agent can be ingested with drinking water and contaminated food. The ingestion of these faecal pathogens, he claims, can cause diarrhoeal diseases, cholera, intestinal worm infection and typhoid fever. World Health Organization (1996) supported this and further went on to show that more than 5 million lives are lost every year as a result of illnesses related to unsafe drinking water and poor sanitation. According to Tumwine, et al. (2002) diarrhoea is the main culprit. About four billion cases of diarrhoea occur each year with 2.2 million deaths. Perez and Reddaway (1997) also added that diarrhoeal diseases are the major cause of death in children and warned that adults are also at risk.

Several interventions have been cited by different authors. The promotion of personal and domestic hygiene according to WHO (2002) can greatly reduce the effects of poor sanitation on human health. Other measures cited include washing of hands after defecation and before eating. Carr and Straus (2002) mentioned the importance of personal and domestic hygiene. Awareness creation which involves sanitation education in schools and in adult literacy programmes have been suggested (Shenkut, 1998).

Pests and their Health Effects

The presence of pests in the house has been closely linked with the transmission of pathogens that cause illness in humans. Boulder County Environmental Health Division (2002) noted that rodent fleas play a significant role in the transmission of bubonic plague. Flies, cockroaches, lice, and mites have been implicated in the transmission of diseases. Rosendaal ((1997) observed that mites cause scabies. He continued to say that cockroaches play a significant role as mechanical carriers of intestinal diseases. Diarrhoea, typhoid fever, and cholera are some of the diseases he listed. Cockroaches may also play a role in passing on worms and pathogens of poliomyelitis, hepatitis A and leprosy. Other pests such as bedbugs and head lice, he said, are of lesser importance in the transmission of diseases. However, Rosendaal (1997) indicated that their biting can be a serious nuisance. North Carolina University (2003) added that stinging often affects the comfort and health of people. Bedbugs are also known for their characteristic and unpleasant smell (WHO and UNEP, 1991). The adult when disturbed, the organizations revealed, emits a very bad odour from its stink gland. This unpleasant odour together with the smell of their excreta in damp conditions can lead to discomfort of people in the house.

Rosendaal (1997) observed that allergic reactions and weariness have been reported as a result of toxic saliva that lice inject into human skin. He continued to say that the body louse has a close link with the transmission of trench fever and typhus fever. This was also supported by WHO and UNEP (1991) who reported that infection of louse borne typhus occurs by exposure of wounds or the conjunctiva and mucous membranes to the faeces of body lice. The report also indicated that lice often infect people living in crowded conditions. They said that body lice infestation is usually the result of poor personal hygiene. Other persons in regular close contact with infested persons may also be infested, the report continued.

According to Rosendaal (1997) and WHO and UNEP (1991) flies, because of their high preference for decaying organic material, also pose a major threat to human health. They feed freely on human food and filthy matter and can easily transmit germs carried on their feet to food (Rosendaal). Flies may also cause infection as they also favour moist skin surfaces such as the mouth, sores and wounds (WHO and UNEP, 1991). Enteric infections such as cholera and typhoid fever as well as eye infection like trachoma have been attributed to flies (Rosendaal, 1997 and WHO & UNEP, 1991).
Rats and mice are also among pests of public concern. They have been described by many as reservoirs of infection and also associated with the spread of plague, murine typhus and leptospirosis (WHO & UNEP, 1991). They contend that fleas transmit pathogens from infected rats to people through bites. They also noted that salmonellosis can be transmitted through food contaminated with faeces or urine from infected rats. Illinois Department of Public Health observed that house mice transmit salmonellosis by contaminating food-preparation surfaces with faeces that contain the bacteria. The department also recognized that damage to property and structures can result from their constant gnawing. Fire accidents can also occur as a result of exposed electric wires. Rodents eat away the insulating material of such wires (Timm, 2004). Washington State University (2002) pointed out that rats and mice have a tendency to infest crowded, unsanitary areas and old buildings, and cited poorly managed waste as the attraction.

Effects of Poor Housing
Several health effects associated with poor housing have been observed by many researchers. According to Evans and Bennett (1998) there is a direct link between poor housing and illnesses such as respiratory and infectious diseases, psychological problems and accidents. They also point out that poor general health as well as mortality may also result from poor housing. Wilkinson (1999) mentions that home accidents are a leading cause of death and injury especially to young children and the elderly. This has been supported by Brandon (2002) who argues that the inadequate shelter does not only put the quality of life at stake but life itself. He also revealed that one of the major environmental health problems associated with housing is lead poisoning. He said that high levels of lead content in blood were attributable to older housing painted with lead based paints. On the Move Limited (2000) claims that living in damp and cold houses greatly affects people's health. In addition to illnesses cited by Evans and Bennett (1998), On the Move Limited (2000) also mentions other ailments such as heart disease and stroke as well as depression. United Nations (2002) was also in support of the claims made by other authors who linked poor living conditions with poorer health status and increased mortality. Bryant (2004) recognized that shelter is a pre-requisite to health. He pointed out that inadequate housing leads to stress which also affects physical health. Other problems associated with poor housing included dampness in the form of rising or penetrating dampness which can also result from plumbing defects and long-term condensation (Energy Saving Trust, 2004). The Trust continued to show that dampness has a direct link with mould effects. Dust Mites are also known to thrive well in damp and poorly ventilated dwellings. Their faecal pellets, according to the Trust, can lead to and exacerbate respiratory problems. Evans and Bennett (1998) added that dampness also leads to an increased level of fungal spores in the house.

Indoor Air Quality
According to Boston University (Undated) the quality of air we breathe at home and at work has gone largely unnoticed. The University says that people suffer from illnesses and discomfort which are caused or aggravated by poor indoor air quality. The University further states that we breathe in Oxygen and replace it with Carbon Dioxide. This can make occupiers drowsy in poorly ventilated and overcrowded rooms which lack enough fresh air supply to keep the Carbon Dioxide concentration levels low. The University mentions that some materials used in buildings

may contain 'volatile' chemicals that may cause problems such as allergic reactions e.g. Formaldehyde. It also highlighted that excess moisture causes moulds which may cause adverse reactions ranging from eye and sinus irritation to even more pronounced allergic reactions. According to US Environmental Protection Agency, Montana State University and US Agriculture Department (1999) other factors that affect health include temperature, relative humidity, noise, ventilation and lighting, second-hand smoke, radon, mites, mould spores and volatile organic compounds (VOCs). They recommend that humidity should be between 35 and 50%.

Effects of poor indoor air quality were mentioned by EPA et al (1999) and Vesilind (1997), and include irritant or allergic conjunctivitis, dryness and irritation of the throat, rhinitis, chronic sinusitis, rash, asthma, hypersensitivity pneumonitis, headaches, fatigue and poor concentration. They mention that mites may cause allergic rhinitis and asthma while second-hand smoke may lead to increased risk of cancer and other lung infections. Carbon monoxide is said to cause brain damage and heart problems by binding to haemoglobin and thus reducing oxygen that reaches tissues and organs (Vesilind 1997). According to EPA et al humidity as well may lead to growth of moulds and bacteria which can cause diseases. It is mentioned by the Boston University that if indoor temperatures are above comfort zones occupants may feel uncomfortable. This is true even for winter temperatures which are said to dehydrate the skin and mucous membranes causing painful throats and sinuses. The University mentions that other factors that can contribute to poor indoor air quality include improper workplace design and poor or inadequate lighting.

Problems Associated with Overcrowding

Many authors have highlighted a number of problems brought about by overcrowding in dwellings. (WHO, 1993) revealed that overcrowding increases the risk of infections and respiratory diseases. Bandon (2002) observed that overcrowding increases and also exacerbates most respiratory infections. Overcrowding also has been linked with mental health problems (Marshy, 2003). According to The John Howard Society of Alberta (1996) overcrowding has been closely linked with stress in inmates. The society contends that withdrawal, aggression or depression may be the result of trying to deal with stress. The report also showed that overcrowding resulted in illness complaints and high blood pressure. Higher rates of suicide and other forms of violent deaths have been found in overcrowded prisons. It continued to say that overcrowding creates competition for limited resources and increased recidivism. Overcrowding is thought to increase vulnerability to airborne infections (Brandon, 2002). He also showed that enteric diseases occur very frequently in overcrowded houses. Health problems such as malaria, tuberculosis and others mentioned earlier were observed in many houses in Dar Es Salaam (Lugalla, 2000). Lugalla claimed that there is a close link between overcrowding and the above-mentioned health problems. He continued to indicate that respiratory problems have been associated in many studies, with overcrowding and inadequate ventilation. He contended that overcrowding is a health hazard as it assists the easy transmission of communicable diseases.

Marshy (1999) observed quite a number of problems associated with overcrowding. He indicated that overcrowding puts a burden on toilets and kitchens and causes rapid deterioration of such facilities thus increasing health risks. He said the increased risk is mainly due to unhygienic conditions resulting from being overcrowded. Psychological effects are also very much noticeable in overcrowded places, he concluded.

METHODOLOGY

The study was carried out in the Maseru district at Central prison, Female prison and Juvenile Training Centre (JTC). Maseru, besides being one of the ten districts is also the capital city of Lesotho. This study adopted an exploratory and descriptive quantitative approach in which the researchers merely explored and described the environment within which prisoners in Lesotho live. According to Burns and Grove (1997) quantitative research is a formal, objective, systematic process in which data are used to obtain information. This type of study is conducted to describe and examine relationships, and determine causality among variables

Mouton (1996) wrote that an exploratory study is that which seeks to establish a new explanation about a given situation or phenomenon. He further added that "it is a study that breaks new ground." It is applicable in this study since prisons in Lesotho have hitherto enjoyed very limited attention in so far as research is concerned.

Moreover no such study has ever been carried out in the country, and to the researchers' knowledge no such study was done in any of the neighbouring countries.

Descriptive studies according to Selltiz et al. (1976) and Burns and Grove (2001) present accurately a portrayal of characteristics of a particular situation. Burns and Grove also added that this type of a study generates new knowledge about topics with limited or no research having been conducted before. Because there is very little known about environmental health conditions in prisons the researchers saw fit to use a descriptive approach in conducting this study since they want to generate new information and describe the existing conditions.

As observed by Okolo (1990) and Brownlee et al. (1984) there are two basic sampling methods: Probability sampling method and non probability sampling method. In probability sampling, the chances that an element in a target population will be selected are known. As a result, the sample is representative of the population. It includes simple random sampling, systematic sampling, stratified random sampling and cluster or area random sampling (Oyster, 1987). Conversely, in non-random sampling the chances that an element in a target population will be selected are unknown. Therefore the sample is not representative of the population. It includes among others accident or convenience sampling, network or snowball sampling, purposive or judgement sampling as well as mixed sampling design.
The juvenile training centre, female prison and central prison were conveniently chosen for the mere fact that they were the only prisons in Maseru. One hundred and one inmates were randomly selected at central prison, ten from Juvenile training centre and six from female prison. Eleven staff members were selected from central prison, three from juvenile training centre and four from female prison.

The researchers together with four assistants administered the collection tool. Each station was given at most two days of data collection. The first day was for interviews and the second one for an inspection tour. The data was collected using two interview schedules, one for inmates and the other for staff members, and an observation checklist. The data collected from central prisons was marked by the letter C, that from Juvenile training centre was marked JTC, female prison marked F.

The identity of all respondents was concealed. Care was taken to ensure that after the interview even the researchers' were unable to match notes taken during the interview with the interviewees. The collection tool was pre-tested in the Sidwashini correctional institution in Swaziland with the aim of determining its validity and reliability. The data were analysed using SPSS computer programme.

RESULTS, DISCUSSION AND INTERPRETATION

Inmates' responses.

All the respondents (100%) reached at central prison were males. The same applies to Juvenile Training Centre. The results agree with the expected outcome as both of them are male institutions. A similar situation was noticed at female prison where all respondents were females as expected.

Figure 1

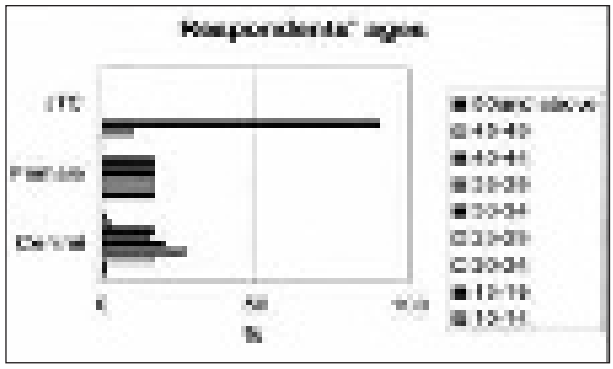
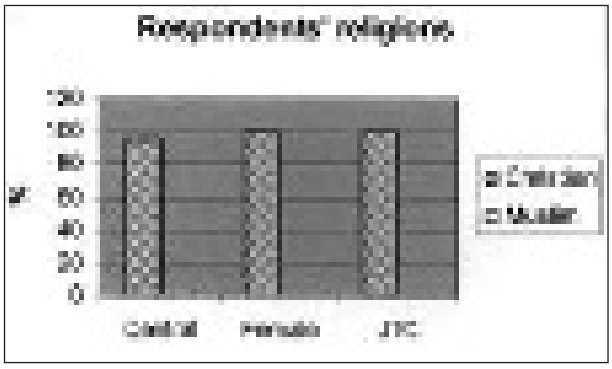


Fig 4.1.1 indicates that the majority of the respondents at central prison (26.7%) were in the age group 25– 29. It also shows that 19.8% of the total respondents were around the age of 30-34, 14.9% were around 35 - 39, 2% 45 – 49. Age groups 50 -54 and 15 – 19 constituted only 1% each to the total. Only 1% was in the age group 10 – 14. Practically no one below the age of 18 is supposed to be detained at central prison as he is considered a Juvenile. It is likely that the person will be abused physically and even sexually by older inmates. It would be proper to ensure that such an individual is transferred to Juvenile Training Centre. It can be observed again that respondents at JTC were aged between 10 and 19 years. 90% of them were in the age group 15 – 19 and the other 10% were between 10 and 14 years. At female prison the respondents were evenly

distributed among the age groups 15 – 19, 20 – 24, 25 – 29, 30 - 34, 35 – 39 and 40 – 44. Each age group constituted 16.7% of the total respondents. One may have some questions about 15 – 19 age group. It is highly possible to have inmates in that age group or even below the lower limit of that age group since female prison has a young offenders section.

Figure 2



The graph indicates that the majority of respondents were Christians (96%), 3% were Muslims and 1% did not respond to the question. 100% of all respondents at both Juvenile Training Centre and female prison were Christians. Religious beliefs and cultural norms may influence certain behaviours and practices which may have deleterious effect on an individual's health.

Figure 3

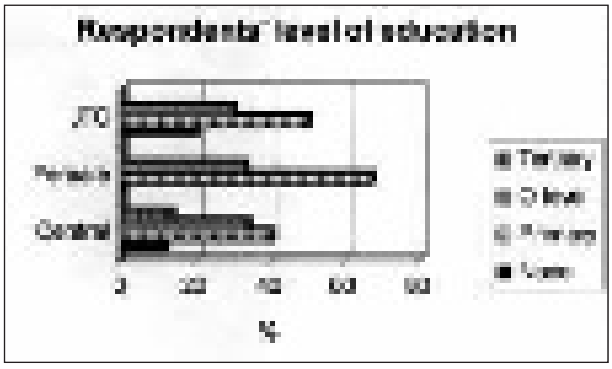
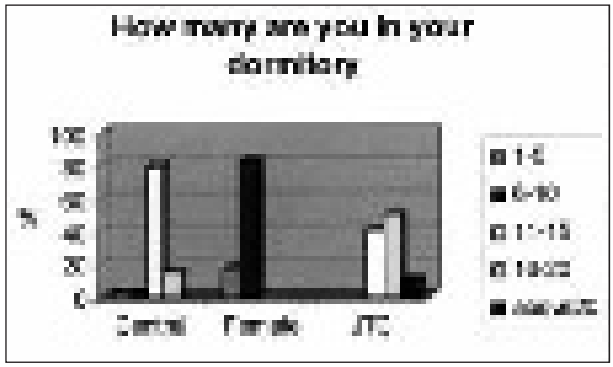


Figure 4.1.3shows that 40% of the respondents only went as far as primary school, 33% had high school education and 13% went beyond O level. The graph also shows that 12% never attended school at all. It also shows that 50% of the respondents at JTC went as far as/ or were still in primary school. 30% of them reached high school or went through O level. The remaining 20% did not receive any formal education whatsoever. It was also learnt that 67% of the respondents at female prison received primary education only while the other 33% reached high school level.

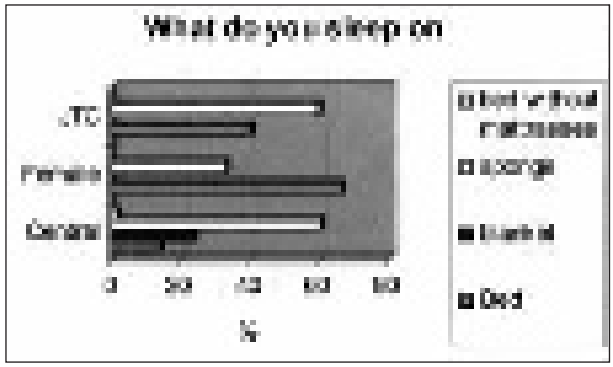
An individual's level of education can have a great influence on the way he views things and on his understanding of health related issues. From the data above one expects the level of understanding of inmates about matters pertaining to health to be high.

Figure 4



The graph shows that 78% of the respondents at central prison indicated that there were between 11-15 inmates in their respective dormitories. 14% showed that there were about 16-20 inmates in their dormitories. Those who said they were between 1 and 5, as well as those who said there were 6-10 each constituted 3% of the total respondents. Only 1% (1) said they were above 20 in their dormitory. At female prison however, 83% of the respondents showed that there were about 6-10 inmates in their dormitories. The remaining 17% indicated that the number of inmates in their dormitories was between 1 and 5. 50% at JTC indicated that they were between 16 and 20 in their dormitories, 40% said 11-15 while the other 10% showed that they were more than 20 in their dormitory

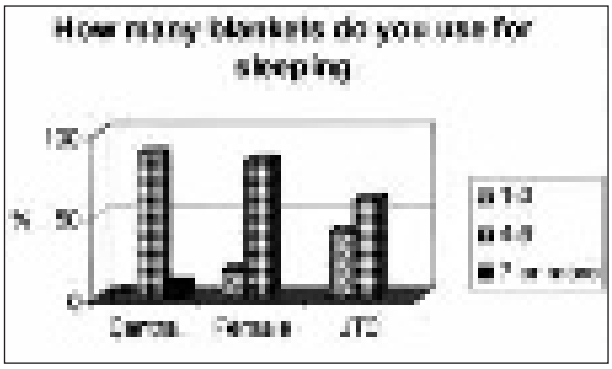
Figure 5



The graph shows that 60% of the respondents at central prison slept on sponges, 24% on blankets, 13% used beds and 2% indicated that they sleep on beds without mattresses. This then implies that quite a number of inmates at central prison were exposed to cold given that temperatures in

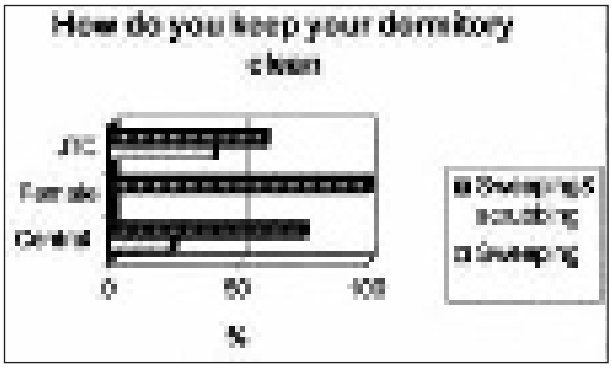
winter can get below freezing point. It also shows that 60% of the respondents slept on sponges and 40% slept on beds. 67% of the respondents at female prison slept on beds while 33% slept on mattresses on the floor

Figure 6



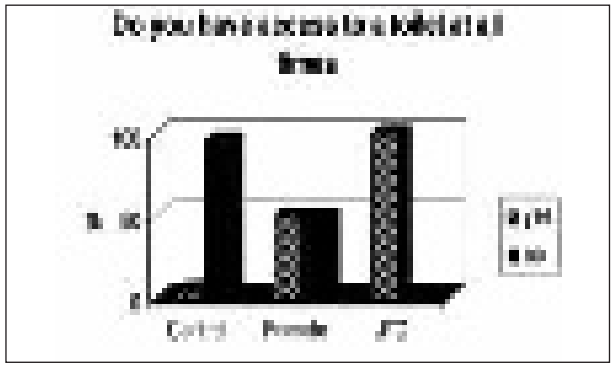
The graph shows that the majority of the respondents (87% central, Female 83%& JTC 60%) used between 4-6 blankets for sleeping. 89% (central) indicated that they use 7 or more blankets where as 4% used between 1 and 3 blankets. At JTC used 1-3 blankets. 17% at female prison used between 1 and 3 blankets for sleeping. These blankets may be enough in summer but may not be adequate in winter when one has to use some for sleeping on. This also might have an influence on the health of inmates if they have to use some of their blankets for sleeping on a concrete slab type of floor especially in cold weathers.

Figure 7



75% of the respondents indicated that they sweep and scrub their cells while 23.8% showed that they keep their dwelling places clean only by sweeping, while 1% other. 45.5% of the respondents also showed that they clean their dormitories on daily basis, 23.8% twice a week, 22.8% other and 7.9% once a week. In this kind of institution one would expect to see some uniformity in the way things are done, and that uniformity can be brought about by proper supervision. 91.1% of the respondents also indicated that they are not provided with cleaning equipment and only 8.9% said yes they are provided with such. Out of the 8.9% of the total respondents, 5% indicated that they receive cleaning equipment only once a month, 2% said fortnightly,1% weekly and another 1% said they receive equipment only once in a long time(after two or even three months). At JTC they kept their dormitories clean by sweeping and scrubbing (i.e. 60%) and 40% said no scrubbing was done. However all respondents agreed that cleaning of dormitories is done daily. 50% said cleaning equipment is provided while the other 50% said no. Those who said yes further went on to show that cleaning equipment was provided weekly (30%) and the other 20% said it was provided monthly. All respondents at Female prison indicated that they keep their dormitories clean by sweeping and scrubbing. This was done on a daily basis. Asked on whether they are provided with cleaning equipment, the respondents indicated that they are issued with cleaning equipment monthly(67%) and 33% said weekly. The information above shows that dormitories in all the three stations were cleaned on a daily basis although some inconsistency was detected in the provision of cleaning equipment.

Figure 8

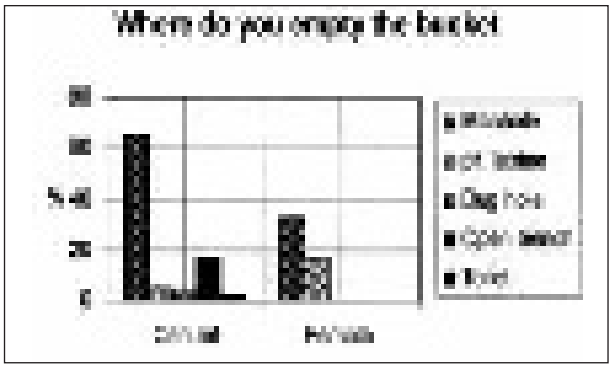


At JTC all respondents had access to a toilet both day and night. 95% at central prison had limited access to a toilet and only 5% said yes they do have access at all times. 73% of those who said no to the above question said such inaccessibility is mainly at night since they do not have toilets in their dormitories, the other 22% said any time when circumstances force them to be indoors, be it at night or during the day. 92% of those who indicated that their access to toilets is limited showed that at such times when they cannot access the toilets they use a bucket. The other 3% indicated that they wait for a chance to avail itself for them to go to toilet.

They further went on to show that the bucket is emptied in the morning (91%) whilst 1% said the bucket is emptied when it is full. It should be noted that the other7.9% did not respond to the question. 50% at the Female prison indicated that their access to toilets was limited to day time, whereas the other 50% agreed to have access at all times. They revealed that they use a bucket during such time and also said they empty those in the morning.

From the information above it is clear then that the inmates still use the bucket system. It can be observed again that they spend all their nights with a bucket full of human excrement which is likely to produce unpleasant odours. This also increases the risk of faecal oral route infections.

Figure 9

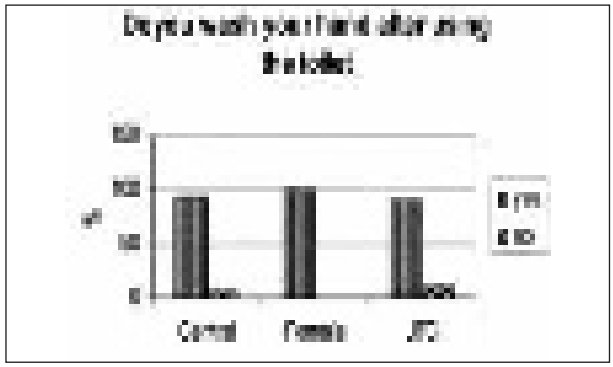


The majority (65% Central & 33% Female) of the respondents indicated that they empty the bucket into a manhole. 17% at Central emptied their buckets in an open trench, 3% said in a dug hole and 5% pit latrine.

Although the majority showed that buckets are emptied into a manhole, a significant number of them showed that some are emptied in an open trench. If this is the case, chances are high that there'll be stagnant water with human waste in such trenches. That will result in breeding sites for flies which may transmit disease causing organisms from the waste to food and maybe drinking water.

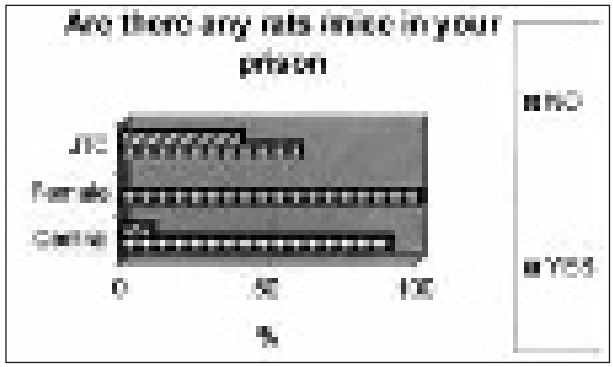
Once there are pools of sewage/ excreta, biodegradation (decomposition) will take place and when it happens some unpleasant odours are produced, thus polluting the air and creating unsightly conditions. The other 17% at female prison said that they empty their buckets into a pit latrine.

Figure 10



The majority of the respondents (94 %Central, 100% Female, 90% JTC) showed that they do wash their hands after using the toilet. Only (6%Central & 10%JTC) did not wash their hand after using the toilet. This could have been because of lack knowledge of the importance of washing hands after defecation or just a negative attitude towards the washing of hands after using the toilet.

Figure 11

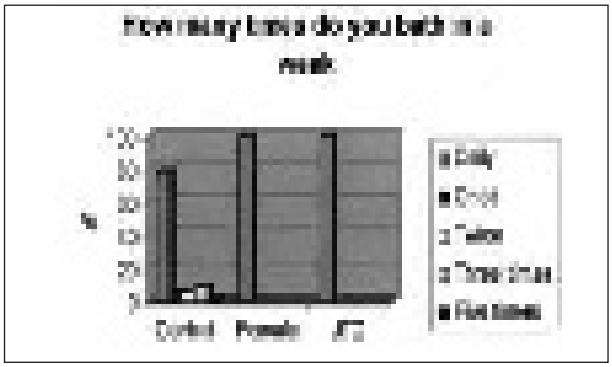


90% Central prison, 100% female prison, and 60% JTC all acknowledged the presence of rats. Others (10% Central, &40% JTC) said there were no rats in the prison. Asked about the presence of cockroaches, 86 % at Central prison, 60% at JTC and 100% at Female prison said that there are cockroaches in their prisons, while others said they have not seen any(14 % Central& 40% JTC). Respondents at both JTC (100%) and Central prison(97%)said there were inmates with body lice in their institutions while the other 3% (Central) and 100% (Female) indicated that there were no such people in their prisons. On bed bugs 65% at central prison said yes and 34% (Central) 100% (JTC & Female) said no.

Although the extent of the infestation can not be quantified, it can be seen from the above statistics that there are infestations of rats, cockroaches and bedbugs at central prison. These pests are known to have an effect on the transmission of some infectious diseases and may be a result of

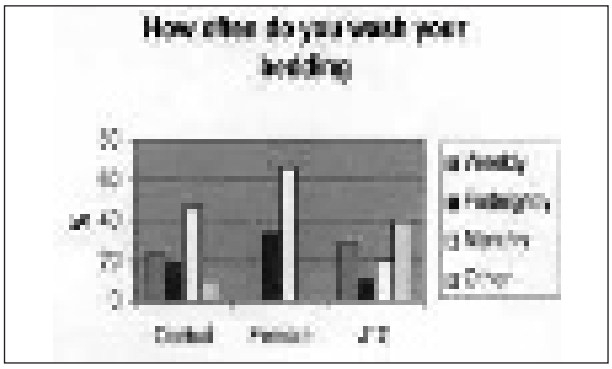
unsanitary conditions. Out of the 65% of those who said there are infestations in the prison at central prison, 31% indicated that they just kill the pests when they see them. 30% indicated that they report such to warders; the other 5% do not bother themselves about such. All the respondents at JTC and Female prison reported the existence of all infestations.

Figure 12



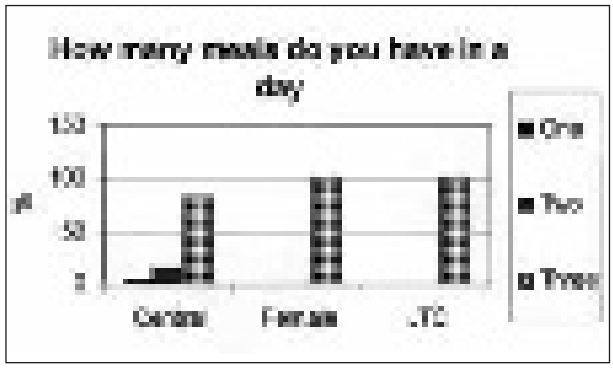
The graph shows that all respondents at Female prison and JTC as well as 78% at Central prison bathed on a daily basis, 10% three times a week, 6% once and another 6% twice a week. Only 1% indicated that they bath five times a week.
When asked about the presence of hot water inmates at both JTC and Female prison revealed that they had no hot water. 63% at central prison showed that hot water is available at all times and the other 37% said it is not always that hot water is available. Looking at the above data one gets the impression that the level of personal hygiene is quite high. The availability of hot water and soap are essential in promoting personal hygiene and discouraging the incidence of some of the water related diseases.

Figure 13



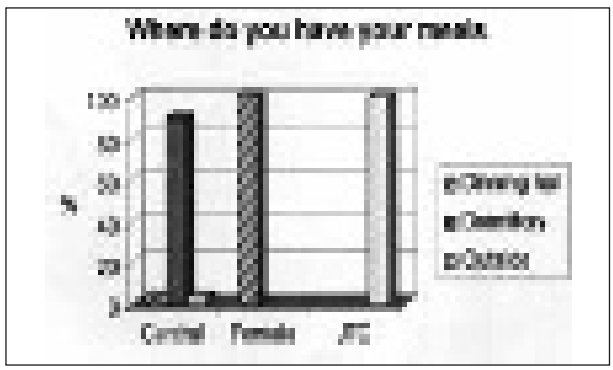
The graph shows that 47%(Central) 20% (JTC) and 67%(Female) washed at least once every month, 25%(Central) 30% (TJC) on a weekly basis,18%(Central),10%(JTC)and 3%(Female) washed after every two weeks and the other 11% said when they deem it necessary to do so. Among the remaining 40% at JTC some said every two months and others said after five months.

Figure 14



On the issue of meals 100% (Female prison & JTC) and 81% at central prison indicated that they have 3 meals every day, 15% said two and those who said they have only one meal constituted 4% of Central prison's total respondents. Asked on who provides the food, All at JTC, 88% at Central and 83% at Female prison indicated that their meals are provided by the prison, 8%(Central) indicated that they get food from both prison and relatives. The other 4% (central) and 17% at Female prison said their meals were provided by relatives.
Food is important and essential for every human being to survive and to keep healthy. It is important therefore to ensure that everyone, free or incarcerated, is provided with clean and healthy food that the body needs for growth, strength and also for protection against diseases. From the above data it can be observed that the department of prisons does provide inmates with food and that there is a privilege given to inmates to also receive food from their relatives.

Figure 15



At least 99% of the respondents at Central prison answered this question. 90% of them showed that they have their meals in their dormitories, 4% said outside, another 4% said dining hall and the other