

SOME BACTERIAL ISOLATES OF SOLID WASTE IN KANO METROPOLIS: IMPLICATIONS FOR MANAGEMENT

Aliyu Baba Nabegu

Department of Geography, Kano University of Science and Technology, Wudil
Email: marpelione@hotmail.co

ABSTRACT

This study assesses the prevalence of some bacterial isolates in municipal solid waste dump sites in Kano metropolis. Samples of solid waste from dumps located within three different residential zones of Kano metropolis were collected and bacterial flora in the dumps was determined using standard laboratory techniques. Results indicated presence of significant amount of bacterial isolate and a wide variation in the amount between the three residential zones. Bacterial isolates from the dumps with their respective percentage prevalence were E. coli (88.90%), Staphylococcus aureus (80.60%), Salmonella (39.10%), Klebsiella sp (41.60%), Shigella sp (45.2%) and Proteus sp (31.80%) in the city, in the suburban area it is (86.70%), (76.7%), (46.7%), (41.1%), (43.3%) and (33.3%) while in the GRA it is (56.40%), (43.8%), (16.1%), (22.3%), (27.60%) and (11.7%) respectively. Presence and variation of the bacterial isolate in the metropolis has implication for the frequency of collection, storage, transport, disposal, choice and suitability of equipments and health in the city. Understanding the implications and adapting them to the solid waste management system is critical to the success of the endeavor in view of the fact that waste dump in Kano metropolis provides an avenue for scavengers to make a living through collection of recyclables; provides a playing ground for children and livestock to feed - all thoroughfares for diseases transmission to the residents it is recommended among other measures to have much more frequent in the city and sub urban areas than in the GRA.

KEYWORDS: Land use, Waste characteristics, urbanization, Municipal solid waste, Environment

INTRODUCTION

The management of domestic waste is one of the challenges facing urban areas in developing nations. The problem is compounded as they continue to urbanize rapidly with 30-50% of populations in many developing countries living in urban areas (Thomas-Hope, 1998) and in many African countries the growth rate of urban areas exceeds 4% (Senkoro 2003).

In Nigeria's urban centers such as Kano metropolis, management of solid wastes is an issue that has now taken a prime place in public domain with enormous interest mainly due to the increasing attention from bilateral and multilateral development agencies as a result of the mounting urgency of public health, and other urban environmental problems identified in Agenda 21 Chapters 7 and 21 (UN-HABITAT 2006).

Kano metropolis is the largest urban concentration in the sudan region of Nigeria. The population from the 2006 Nigeria's national census for Kano metropolis is 2,828,861. According to figures by (UNDP, 2006), migration into Kano is very rapid at about 10% per annum. Also based on the report of Nigerian population commission, (N.P.C., 2006), natural population growth is also very rapid at about 3%. The burgeoning population fuelled by immigration and natural growth has resulted in waste generation that has continued to defy the best effort of the government. Kano is located between latitude 12° 25 to 12° 40 N and longitude 8° 35 to 8° 45E and thus the climate of the area is the savanna type Aw by Koppens classification. Temperatures are high throughout

the year which makes bacterial decay very rapid at the dump site. During the rainy season, the moisture, coupled with high temperatures results in leaching of the decomposed waste.

Waste management in Kano metropolis is the responsibility of a state agency - the Refuse Management and Sanitation Board (REMASAB). The current system of waste management is very rudimentary, grossly inefficient and ineffective. The equipment used range from bare hand to shovel, various models of trucks, load loaders, compactor trucks, lidded and un-lidded collection boxes. Uncontrolled landfill is the main disposal method. There is dearth of capacity and knowledge by staff involved who work with no protective cover. The service covers no more than 20% of the city and less than 50% of the waste generated is actually collected (Nabegu, 2008). Domestic waste in Kano metropolis is not segregated and comes from several sources the most notable of which are, household, commercial, market, health care and industrial (Nabegu 2009).

The availability and quality of data for the waste sector in Kano metropolis as indeed in most other Nigerian urban centers is poor. Solid waste data are lacking and where available, data quality is variable; city variability is often not quantified. Even where such exist, the information available for use by agencies is generally limited and not systematically recorded and this has hindered the establishment of city and national policies for the improvement of the management of solid waste as well as preparation of guidelines for local and national operation.

One further issue on the state of existing knowledge in waste management in Kano metropolis is that no serious work has been done on the presence of faecal matter and associated bacteria. This study attempts to provide such information by assessing the prevalence of some bacterial isolates from municipal waste dump sites in Kano metropolis and its implication to all the stages of waste management with a view to proffering solution.

MATERIALS AND METHODS

The data for this study was generated through the collection of waste sample from dump sites located in three different residential zones of Kano metropolis. The study was undertaken between February to April 2007. To determine sample collection dumps, a basic knowledge of the urban area of Kano was helpful guided by the assertion of (Gordon 1983) that an urban area is usually defined to comprise of three levels within which data could be collected: - the city proper (in this study the old walled city); Metropolitan transition area (in this study the G.R.A.) and Urban agglomeration (in this study suburban area). Identified residential zones were subdivided into equal grids using Kano metropolis as base map. Table of Random Numbers was used to choose sample dump areas as follows: -

i - Old Walled City - Yan Awaki Quarters waste dump

Old city where settlements are more than 1000 years old predates urban planning as we know it today. It is essentially a very high density area characterised by inaccessibility especially to vehicular movement. Residents are mixed consisting of middleclass, high income business people and low income earners who are the majority.

ii - G.R.A. - Sokoto Road waste dump

Settlement in this area started with the coming of the colonial administration. It is a very low density area with well laid out plans and accessible to vehicular and other means. The residents are mostly middle class, senior civil servants, high income business men and foreigners.

iii - Suburban - Kwana Hudu Area waste dump

This area is akin to what Gaffney, (1964) described as high density areas of sub standard housing and services springing upon empty land near other established settlement. The area has poor vehicular accessibility and no adequate provision for the collection of domestic waste. Residents are mostly low income immigrants in to the city.

Sample collection and Analysis

Five hundred (500) grams of wastes were collected from each sampling point into a sterile can. Wastes were weighed using the Tip-loading balance. Waste samples were collected once a week for three months making a total of twenty four samples from all the dump sites. After collection, the wastes were taken to the laboratory. Bacteriological examinations of the wastes were carried out. Blood agar and MacConkey agar were used as culture media. They were prepared as described by Corry *et al.*, (1982). From each dump 1 gm of pulverized waste was put into a sterile MacConkey bottle with 9mls of peptone water. The MacConkey bottle with its contents was vigorously shaken to produce a suspension of bacteria, contained in the waste. Serial single fold dilutions of the suspension to 10⁻³ were made and 1ml of each diluents was then flooded on a Blood agar plate and another 1ml on a MacConkey agar plate. Duplicates of each plate were made which were then incubated at 37°C for 48 hours. This procedure was repeated three times for each dump sample. Bacterial colonies noted on the different media sub cultured several times until pure cultures were obtained. Morphological and Biochemical tests to identify the bacterial isolates were carried out in accordance with methods described by Corry *et al.*, (1982).

RESULTS AND DISCUSSION

Table 1 shows the cumulative percentage occurrence of the bacterial flora isolated from samples of wastes collected as stated earlier. Of the six bacterial isolates recovered three were coliform bacterial (*E. coli*, *Klebsiella* sp and *Shigella* sp. *E. Coli*). Percentage occurrence of *Shigella* sp, and *Klebsiella* sp did not differ significantly ($p < 0.05$). *Shigella* sp and *Proteus* sp had the same percentage occurrence. Presence of coliforms such as *E.coli*, *Klebsiella* sp clearly indicates that the waste in the zones, especially the city and suburban areas is contaminated with faecal matter.

All the bacterial isolates recovered from the waste samples in the three zones have been directly implicated in food borne infections such as typhoid, diarrhea and gastroenteritis. These diseases occur sparingly in all the zones.

However, the data indicates variation within the three zones of the city observed. From the data, the city and sub-urban areas have the highest occurrence of the bacteria, compared with the G.R.A. The reason for the variation could be due to among others the fact that the G.R.A in Kano metropolis is predominantly inhabited by high income earners mainly as civil servant/technocrats, business men and expatriates. The GRA has over 90% of its houses subjected to plan approvals compared to the city 28% and the suburban area 18% (Nabegu, 2006).

Table 1: Percentage frequency occurrence of bacterial Isolate from waste dump sites in the three residential zones of Kano metropolis.

Bacteria isolate	% Occurrence of bacterial isolate		
	G.R.A	City	Suburban
Samonella sp	16.10	39.40	46.70
<i>Klebsiella</i> sp	22.30	41.60	43.30
<i>Proteus</i> sp	11.70	31.80	33.30
<i>Escherichia coli</i>	56.40	88.90	86.70
<i>Staphylococcus aureus</i>	43.80	80.60	76.70
<i>Shigella</i> sp	27.60	45.20	43.30

Source: Laboratory Analysis 2007

A major feature with waste collection scheme of REMASAB is that the residents generally collect and transport the waste over a relatively short distance up to the transfer point from where the waste should be collected immediately by REMASAB. However collection is never immediate in Kano and this creates not only unhygienic dump but resistance from residents close to the collection points thereby disrupting the whole operation. Nabegu (2008) found that 70% of the residents do not have an authorized dumping site for their waste. This confirms a nationwide survey by the Federal office of statistics (FOS, 1978), which found that 52% of urban households in Nigeria do not have access to an authorized dumping ground and Karshi (1981) also concluded that the single most critical problem confronting waste management in Jos metropolitan area is not equipment or manpower but indiscriminate dumping of wastes by the road side, gutters and other unauthorized dumping grounds by residents of the city.

The lack of speedy collection of waste mixed with faecael matter provides a favorable habitat for spread of diseases since, due to the lack of efficient storage, waste is dumped in empty lots and in local bodies of water, where it constitutes a health risk and a contamination source for surface water and underground water due to the infiltration of leachates into the subsoil which is significant risk considering the fact Adnan (2010), estimates that 80% of the population in Kano metropolis use underground water as the primary source of water supply.

Further risk to the population could also be as a result of livestock feeding on contaminated wastes. The feeding of animals with solid waste is a practice that is widespread in Kano metropolis in waste disposal sites as well as in storage areas in households, streets, markets and other public sites. Also due to the high cost and dearth of chemical fertilizers in the face of dwindling yield of land, farmers in and around Kano use municipal waste on the land as manure.

Transport of waste from households and other generation sites is a growing problem. Rapid urbanization of Kano metropolis leaves little time for adequate layout and planning especially the sub urban areas at the periphery of existing settlement. The old city predates town planning as we know it today, consequently most of the alleys leading to the city are too narrow to allow

equipments to access the waste. The new areas on the fringes are inhabited mostly by low income immigrants and those who have moved out of the city and are built without planning. According to the association of town planners of Nigeria (ATOPCAN, 2010), in the over 800 urban centres in Nigeria less than 1% have master plan and data pertaining to city planning are insufficient and unreliable is insufficient.

Transport also relies on operational vehicles, and frequent breakdowns coupled with parts shortages can immobilize collection vehicles for extended periods of time. It was observed that 40% percent of trucks available are always out of service at any one time (Nabegu, 2009). Similar situation was reported in Onitsha, eastern Nigeria where, the few available trucks breakdown frequently due to overuse (Agunwamba *et al*, 2003). Thus, less than 20% of the city residents are assured of waste collection service (Nabegu 2008), this confirms earlier observation that less than 60% of municipal waste generated is collected in developing countries (Ogwueleka, 2003).

Due to the variation in the three residential zones of Kano metropolis, it would appear that the city and suburban areas face the greatest risk. However, no studies have been carried out on the epidemiology to measure the inadequate waste management impact on health. Nonetheless, a municipal solid waste that consists of faecael could be contributing to the increase in the incidence of gastrointestinal, respiratory infectious diseases, and skin conditions, as well as the possibility of increasing the risk of cancer, neurotoxic disorders and congenital malformations due to the presence of hazardous waste in garbage.

The presence of human fecal matter in all the solid waste dump sites of the three zones in Kano metropolis presents a potential health problem not only to the general public, but more so to waste workers, scavengers and even children who like to play in or around waste containers. Even though a great number of legal provisions related to workers' health in Nigeria and Kano metropolis - among them the Health and Occupational Safety Law that addresses the obligations that the employers have with regards to the health of their employees, not too much attention is given to the health risks on sanitation workers.

It is observed that in general, there is a lack of compliance with basic occupational health standards, many times due to the lack of training and lack of awareness regarding the hazards involved in this occupation.

CONCLUSION AND RECOMMENDATIONS

The conclusion drawn from this limited study is that the management of municipal solid waste would have to involve detailed study of the constituents of waste as the variation in waste type and composition has effect on human health, environment and all the processes of waste management system from the storage, collection, transport disposal and choice of equipments. Furthermore, the variation in the concentration of bacterial isolate of waste observed within the three different residential zones of Kano metropolis shows that intra city variation in waste characteristics can be significant. Consequently, a careful consideration of all these factors must be the basis of a sound and sustainable waste management programme.

The study also highlights the potential threat to public health due to inadequate management of waste that contains faecal matter which is especially more significant in tropical area such as Kano metropolis due to the fact that biological degradation and growth conditions of pathogen organisms is greater.

A notable risk is with formal and informal workers and scavengers from the solid waste sector who are more exposed to health risks considering that a great portion of the work that they carry out is done manually without any training and without the use of protective equipments or protective cover. Besides the diseases commonly related to the inadequate solid waste management, this population is more exposed to accidents due to cuts

with glass and metals, pricks with hypodermic needles, traffic accidents, falls from collection equipment and accidents at the final disposal sites.

In order to ameliorate the identified problem, there is the need to reassess all legislations regarding waste disposal by household to ensure that faecal is not allowed into the municipal waste. Refuse management must also be decentralized to the local government and community associations so that local knowledge will be used to solve an issue that is essential.

A reasonable schedule of evacuation of one to two weeks must be aimed at to reduce the chances of contamination of the environment and water sources by decomposing waste. There is the urgent need to evaluate the health situation of waste workers and scavengers considering the enormous risks to this segment of the population.

Differences in the volume of bacteria observed in the three residential zones of Kano metropolis has implication for storage and collection such that the city and the suburban zones which generate wastes that are more bacterial isolates should have some form of corrosion-resistant container with lids in order to facilitate safe collection. Lidded containers would also exclude most animal pests, reduce the amount of rainfall soaking into garbage and the leaches getting in to the ground, help to reduce trash blowing about on the street and domestic animal feeding rather than the practice now where the waste are dumped on the ground. Also, due to the bulky nature of the waste in the city as a whole, the use of large 6-7cm³ trucks with mechanical press to compress the waste would be more economical and safe than the current open tipper mode of collection.

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