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Full Length Research Article

ANALYSIS OF SOME BACTERIAL LOAD ON WASTE SCAVENGERS IN SELECTED LOCATIONS WITHIN JERE LOCAL GOVERNMENT AREA OF BORNO STATE, NIGERIA

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ABSTRACT
Throughout cities of Africa, Asia and Latin America, varying number of poor individuals survive by scavenging materials from the waste stream. These people recover the materials to sell for reuse or recycling as well as diverse items for their own consumption. This work was aimed to determine the presence of bacterial load on waste scavengers from four dumpsites in Jere Local Government Area of Borno State. A total 20 samples (10 each) from waste scavengers were collected from two (2) different dumpsites and transported to the Microbiology Laboratory. Nine different types of bacteria were isolated and identified from the study sites. *Staphylococcus. aureus*, *Escherichia. coli*, *Klebsiella* sp*, Salmonella* sp, *Shigella, Enterobacter* sp*, Proteus* sp*,* and *Staphylococcus epidermidis* and other species of *Staphylococcus* were isolated. The Mean Bacterial Load on Waste Scavengers at Selected Dumpsites was $2.659x10^{10}$ CFU/mL and $2.228x10^{10}$ CFU/mL. for Kwanar Mutuwa Dumpsite and State Low-cost Dumpsite respectively. The highest number of bacterial colony per plate (300) was found in Kwanar Mutuwa Dumpsite as compared with the lowest colony per plate (40) from State Low-cost Dumpsite. Other bacteria species isolated from samples *Staphylococcus aureus*, *Salmonella sp* and *Shigella* sp*, Staphylococcus epidermidis, and Klebsiella* sp. This study has determined the presence of bacteria on waste scavengers and as such recommended that hygienic measure should be strictly observed by waste scavengers after retiring from their work before interacting with the members of the community. Provision of protective clothing, face masks and hand gloves while handling waste should be encouraged by waste managers and ensure they use the materials effectively.

Keywords: Bacterial, Load, Waste, Scavengers, Jere LGA, Borno State.

INTRODUCTION

Throughout the cities of Africa, Asia and Latin America, varying number of poor individuals survive by scavenging materials from the waste stream. These people recover the materials to sell for reuse or recycling as well as diverse items for their own consumption. They are generally known as 'waste scavengers' or rag pickers and the activities they undertake is referred to as scavenging **(**Medina, 1997). Waste scavengers are not refuse workers, and they are not concerned with waste management, but rather they enter into trade for economic reasons, and their relationship with waste is as a resource, they only collect those materials for which there is market value. They provide primary service of collecting materials in response to cost and market needs (Ahmed and Ali, 2004).

Solid waste management systems are often run inefficiently and operate to low standards. They can be unreliable, provide inadequate coverage and may conflict with other urban services. Developing countries often collect only between 50% and 80% of waste generated, with open dumping as the only disposal method available (Medina and Dows, 2000). The Millennium Development Goals (MDGs) focus development efforts on poverty reduction, and again it would seem counter-intuitive to try to move forward by removing the means of livelihood from a major section of the urban poor , this is an adaptive response to scarcity by disadvantaged populations (UN, 2005). In cities with a formal, municipal waste collection and disposal system, at least four main categories of informal waste recycling can be identified, depending on where and how material recovery takes place, these recovery procedure can either be by the followings: itinerant waste buyers, street waste picking and Municipal waste collection crew (Li, 2002; Bernache, 2003). The role of informal sector recycling in waste management in developing countries was documented by David *et al*. (2006).

MATERIALS AND METHODS

Study Area

The study was conducted in Jere Local Government area of Borno State, Nigeria. Jere is located in the transitional desert zone and it lies within latitudes 11º41' and 12º05'N and longitudes 13º50' and 12º20'E (Tijani *et al*., 2010). It is about 270 km north of Maiduguri the Borno State capital. It is the second largest most populous metropolitan in Borno State, estimated to be 209,107 with an annual growth rate of 3.16% since 2006 census, as one of the largest in the sub-region. This rapid population growth has also lead to increase in solid waste generation in the capital city of Borno state. Two (2) dumpsites in the study community were selected out of the list of dumpsites presented and their specific locations were determined with Global Positioning System (GPS) respectively. The names of four dumpsites were;

i. Kwanar Mutuwa Dumpsite (KMDS):
ii. State Low coast Dumpsite (SLDS),

These dumpsites were selected taking into account the diversity of the dumpsite and number of years the practice of scavenging has been ongoing, a minimum of ten years for each site, and the estimated population of those that were involved directly or indirectly.
(Figure 1).

Sample Collection

Ethical clearance was obtained from the Ministry of Health and

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Environment in order to conduct the research work. A total of 20 swab samples (10 each) were obtained from waste scavengers in the two dumpsites using purposive sampling technique. Waste scavengers were first contacted using the snow ball approach method, which is a non-probability sampling method that is picking up more snows along the way to have a larger ball (Portney and Watkins, 2007). Surface swabs of hands, feet and skin of the waste scavengers who spend not less than 5 h a day at the dumpsites were collected. The swab samples properly labeled, placed in ice packs in a cooler and then transported to the Laboratory for processing.

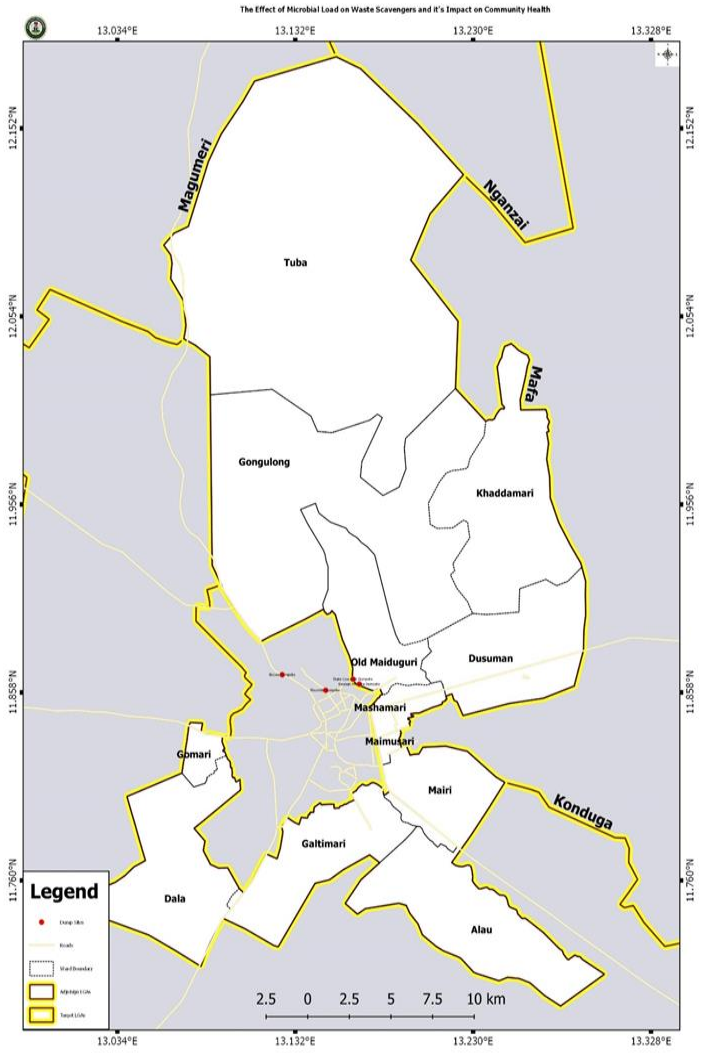

Figure. 1: Map of Borno State showing Jere LGA,
Source: (Google Map. Com)

Isolation and Characterization of Bacteria in Samples
The isolation and identification of bacteria from dumpsites was performed according to the method described by Chessbrough (2002).

RESULTS
The number of bacterial load per plate indicated that KMDS had the highest number of bacterial load per plate when compared to the lowest bacterial load per plate for SLDS. On the overall, all the ten samples of KMDS, and SLDS, gave certain bacterial load per plate known as colony forming unit per milliliter CFU/ml (Table 1).
Nine bacteria were isolated from soil of banana waste dump site. They include: *Corynebacterium* sp., *Streptomyces* sp., *Micrococcus leutus*, *Pseudomonas aeruginosa, Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus cereus, Lactobacillus bulgaricus* and *Klebsiella pneumoniae*. The cultural, morphological and biochemical characteristics of the isolates are presented in Table 1. Plate 1 shows clearance zone (hydrolysis) of selected bacterial isolate on pectinase screening agar.
Table 2 presents the zone of hydrolysis of the different isolates while, Table 3 presents the fermentation pattern for pectinase production for all bacterial isolates with agitation. The molecular characterization of selected bacteria isolates is presented in Table 4. The proximate composition of substrate used and enzyme activity of pectinase by selected isolates from glucose graph is presented in Tables 5 and 6 respectively.

Table 1: The Mean Bacterial Load on Waste Scavengers at Selected Dumpsites in Jere Local Government Area, Borno State in CFU/g

S/No. of Plates	KMDS	SLDS
	Bacterial loadCFU/g	Bacterial loadCFU/g
1.	$2.89X10^{10}$	$1.05X10^{10}$
2.	$2.99X10^{10}$	$2.06X10^{10}$
3.	$2.16X10^{10}$	$2.78X10^{10}$
4.	$2.97X10^{10}$	$2.38X10^{10}$
5.	$2.30X10^{10}$	$2.30X10^{10}$
6.	$2.95X10^{10}$	$2.95X10^{10}$
7.	$2.58X10^{10}$	$2.58X10^{10}$
8.	$3.00X10^{10}$	$1.53X10^{10}$
9.	$1.77X10^{10}$	$1.77X10^{10}$
10.	$2.98X10^{10}$	$2.88X10^{10}$

Key:
KMDS= Kwanan Mutuwa Dump Site, SLCDS= State Low-cost Dumpsite

Nine types of bacteria were isolated from samples collected at the study sites Staphy*lococcus aureus* had the highest fraction (100%, followed by *E. coli* and *Enterobacter* species (40%) respectively, while *Salmonella* species and *Shigella* species had (10%) each. Additionally, other Staphylococci spp were equally isolated and had a fraction of 20%. (Table 2 & 3).

Table 2: Diversity of Bacteria Isolated from Scavengers within Kwanan Mutuwa Dumpsite in Jere Local Government Area, Borno State.

S/No.	Sample Identity	Eosin methylene blue agar (EMB)				Salmonella shigella agar (SSA)		Mannitol salt agar (MSA)		
		E. coli	*Klebsiella* sp	*Enterobacter* sp	*Proteus sp*	*Salmonella* sp	*Shigella* sp	*Staph. epidermidis*	*Staph. aureus*	Other *Staph.* species
1	KMDS 1	-	-	+	-	-	-	-	+	-
2	KMDS 2	-	-	+	-	-	-	-	+	-
3	KMDS 3	-	-	+	-	+	-	-	+	-
4	KMDS 4	+	-	+	+	-	-	+	+	-
5	KMDS 5	-	-	-	-	-	-	-	+	-
6	KMDS 6	+	-	-	-	-	-	+	+	+
7	KMDS 7	-	-	-	-	-	-	-	+	-
8	KMDS 8	+	+	-	-	-	-	-	+	+
9	KMDS 9	-	+	-	+	-	-	-	+	-
10	KMDS 10	-	-	-	+	-	+	+	+	-
Fraction		4/10	2/10	4/10	3/10	1/10	1/10	3/10	10/10	2/10

Staph.: *Staphylococcus*, *E. coli* = *Escherichia coli*, KMDS: Kwanan Mutuwa Dumpsite

Dominance Order: *Staph. aureus* >*E. coli* and *Enterobacter* >*Proteus* and *Staph. epidermidis* >*Klebsiella* and Other *Staph.* Species >*Salmonella* and *Shigella*

Table 3: Diversity of Bacteria Isolated from Scavengers within State Low Coast Dumpsite in Jere Local Government Area, Borno State

S/No.	Sample No.	Eosin methylene blue agar (EMB)				Salmonella shigella agar (SSA)		Mannitol salt agar (MSA)		
		E. coli	*Klebsiella*s p	*Enterobacter* sp	*Proteus* sp	*Salmonella* sp	*Shigella* sp	*Staph. epidermidis*	*Staph. aureus*	Other *Staph.* species
11	SLDS `1	-	-	+	-	-	-	+	+	+
12	SLDS 2	+	-	+	-	-	-	+	+	-
13	SLDS 3	+	-	+	-	+	+	+	+	-
14	SLDS 4	+	-	-	+	-	-	+	+	+
15	SLDS 5	+	-	+	-	-	-	+	+	-
16	SLDS 6	-	-	+	-	-	-	+	+	+
17	SLDS 7	-	-	+	-	-	+	-	-	+
18	SLDS 8	-	-	-	+	-	-	-	-	-
19	SLDS 9	+	-	-	-	+	-	+	+	+
20	SLDS 10	+	-	+	-	+	-	+	+	-
Fraction		6/10	0/10	7/10	2/10	3/10	2/10	8/10	8/10	5/10

Key:
SLDS1 - SLDS 10, Sample Codes

DISCUSSION

The diversity of bacterial types from the four dumpsites sampled were nine. These were morphologically and biochemically characterized and their CFU/mL determined. These bacteria include *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* sp, *Salmonella* sp, *Shigella* sp, *Enterobacter* sp, *Proteus* sp, *Staphylococcus epidermidis* and other undermined *Staphylococcus species*. The prevalence in replicates was found to be 100% for Staphylococcus *aureus*, while the lowest was 0% for *Klebsiella* species and *Enterobacter* species at different dumpsites. This finding is in consonance with the work of Omusi *et al*. (2017) who reported that bacterial such as *S. aureus*, *E. coli*, *Enterobacter* sp, *Salmonella* sp, *Shigella* sp, *Proteus* sp, other *Staphylococcus* species and *Staphylococcus epidermidis* were also isolated from various dumpsites. The bacterial load from surface swabs on waste scavengers indicated that bacterial load per plate ranges from 1.00 x 10^{10} to 5.20 x 10^{10} CFU/mL. On the overall, the total bacterial load for ten samples per site in Kwanar mutuwa and State low cost were 26.59 x 10^{10} and (22.28 x 10^{10} CFU/mL respectively. The findings of this research has shown that bacterial load per samples collected from waste scavengers at different dumpsites, gave the impression that waste scavengers convey heavy loads of microorganisms on them during their visit to dumpsites. The identification of the effect of bacterial load on waste scavengers and its impacts on health was determined by O'Brien, *et al.* (2009). These people recover the materials to sell for reuse or recycling as well as diverse items for their own consumption. This study confirms that there was an association between the two communities; Kwanar mutuwa, State low cost dumpsites and the scavengers, as revealed by the

number of different bacterial counts. The isolation of *Staphylococcus aureus*, *Klebsiella* sp, *Pseudomonas* sp, *Proteus* sp and *Streptococcus* species from the dump sites is an indication that microbes are not only ubiquitous in nature but are widely distributed in the soil, thereby raising the nutritional value of the soil. Additionally, these microbes do produce enzymes like DNase, hyaluronidase, staphylokinase, staphylolysin, streptokinase among others, which assist in degrading waste materials at dumpsites as opined by Williams and Hakam (2016). The findings of this study has shown that the scavengers are at risk of been infected by microbes, particularly the bacteria (*Staphylococcus aureus*), which was most predominantly isolates from four different dumpsites. Rockson *et al*. (2013) stressed the challenges faced by waste scavengers due to exposure to pathogenic bacteria and other microbes like fungi and viruses; representing major threat to human health and wellbeing of members of the communities. Many of these microbes are dangerous for very frail elderly.

Conclusion

The bacterial load on waste scavengers at dumpsites indicated that Kwanan Mutuwa Dumpsite recorded *Staphylococcus aureus* with the highest fraction (100%), while those with least fraction of isolation (10%) were *Salmonella* species and *Shigella* species.

The State Low coast Dumpsite revealed that *Staphylococcus aureus* and *Staphylococcus epidermidis* both had the high fraction of 80% each and 0% for *Klebsiella* species *respectively*.

In conclusion this study has determined the presence of bacterial on waste scavengers who scavenge at dumpsites. It is therefore needful that the waste scavengers require careful handling before been permitted to interact with the members of the community.

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