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Distribution and Frequency Of Occurrence Of Bacteria And Fungi Isolates In Garden Street Dumpsite in Calabar Municipality, Cross River State, Nigeria.

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Abstract: The study was aimed at investigating the distribution and frequency of occurrence of bacteria and fungi isolates in garden street dumpsite. Municipal waste, soil and air samples within the dumpsite were randomly sampled (during wet and dry season) within Calabar metropolis. The study was undertaken within a period of six months. Standard microbiological methods were used to isolates, characterize and identify both the bacteria and fungi isolate from the collected samples. The result showed that 16 bacterial species were isolated in the wet season, while 8 species were isolated in the dry season, with the most prevalent in the wet season been *Bacillus spp* with a frequency occurrence of 37.22%, compared to other of its bacterial counterpart, *Micrococcu*s (22.18%) *Klebsiella* (12.50%), *Nocardia* (10.89%), *Staphylococcus spp* (8.66%), *Actinomycete*s (7.89%), *Proteus* (6.77%) and *Enterococcus* (4.89%). The most encountered organisms in the dry season were members of the family enterobacteriaceae, *Escherichia coli* (16.6%), *Enterobacter spp* (14.17%), *Klebsiella spp* (8.33% occurrence), while other bacterial isolates were *Pseudomonas* (18.33%) and *Micrococcus spp* (16.67% occurrence). *Aspergillus spp* and *Mucor spp* were the fungi species isolated in the wet season. *Aspergillusspp* was the most prevalent (60.6% occurrence) compared to its counterpart *Mucor spp* (39.4% occurrence). However, the same trend was observed in the dry season, with *Aspergillusspp* also showing a higher frequency occurrence (51.28%) compared to *Mucor spp* which had a lesser frequency occurrence (48.72%). Despite the positive impacts of dumped municipal wastes on microbial distribution and frequency occurrence in the waste, soil and air samples analyzed, disposal of municipal wastes in open dump sites is an archaic, unsustainable option in the management of municipal waste and a threat to both environmental and public health, as it serves as a breeding ground for potential microbial pathogens.

INTRODUCTION

The disposal of domestic, commercial and industrial waste in the world is a problem that continues to grow with human civilization and no method so far is completely safe, as experience has shown that all forms of waste disposal have negative consequences on the environment, public health and local economies (Abdulsalam, 2009). Solid wastes are generated from various human activities such as domestic, hospital, industrial and agricultural activities (UNEP, 2007) and may be categorized according to its origin (domestic, industrial, commercial, construction or institutional), according to its contents (organic material, glass, metal, plastic paper etc), or according to hazard potential (toxic, non-toxic, flammable, radioactive, infectious, etc) (Udiba *et al.*, 2015). Municipal solid wastes are sources of environmental population through introduction of chemical substances above their threshold limit into the environment (Obasi *et al*., 2012). Dumpsite is an old traditional method of waste disposal similar to landfill method of waste management. Dumpsites are often established in

discussed quarries, mining or excavated pits away from residential area (Abdulsalam, 2009). Poor management of dumpsites could create a number of adverse environmental impacts including wind-blow litter, attraction of mice, breeding sites of pathogenic microorganisms and accumulation of pollutants such as toxic heavy metals and leachate which can pollute underground soil bed/aquifer (Ademoroti, 2006). When waste is dumped on land, soil microorganisms including fungi and bacteria, readily colonize the waste carrying out the degradation and transformation of degradable organic materials in the waste (Mirh *et al.*, 2006). Microorganisms in waste dump use the waste constituents as nutrients as their digestive processes break down complex organic molecules into simpler less toxic molecules (Abdulsalam, 2009). However, Municipal solid waste dumpsites are known to contain large amount of persistent organic pollutants and serve as breeding sites for pathogenic microorganisms. Therefore this research was designed to investigate the distribution and frequency occurrence of bacteria and fungi isolates in garden street dumpsite.

MATERIALS AND METHODS

The study area

The study was carried out in Calabar municipality (fig. 1) located between latitude $4^0$13' and $5^0$15' and longitudes $8^0$15' and $8^0$25' in Nigeria. The area is characterized wet and dry seasons with high annual rainfall within the range of 350-400mm (CRBDA, 1982).

Material used

The materials used for this study were, petri-dishes, test tubes, conical flasks, pipettes, slide, cover slips, fitter paper, masking tape, aluminum foil, polyethylene bags and McCartney bottles.

Culture media

The following culture media were used for this study; Nutrients agar (NA), MacConkey agar (MCA), Sabouraud Dextrose Agar (SDA), Triple Sugar Iron (TSI) agar and Citrate agar. All the media were products of diagnostic laboratory, USA and they were all prepared in accordance to the manufacturer's instruction.

Chemicals and reagents

Chemicals and reagents used were; crystal violet, 95% ethanol, lugol's iodine, safranin, lactophenol in cotton blue, kovac's reagent, hydrogen peroxide (H_2O_2), methyl red, vogues proskauer reagents, d-Napthnol solution, potassium hydroxide (KOH) and methylated spirit.

Sample collection

A garden rake was used to remove waste at the dumpsite, so as to expose the soil under it. Soil samples were then collected with hand trowel into aluminum foil and labeled. The decomposing

waste from the dumpsite was aseptically collected into sterile disposable petri-dishes, sealed with masking tape and properly labeled. All of the collected samples were stored in the refrigerator before use isolation of bacteria and fungi isolates.

Soil at dumpsite (Sd)

Serial dilutions using 1.0g of soil samples were aseptically carried out in sterile distilled water, using a 10-fold serial dilutions. 0.1ml dilutions of 10^{-3}, 10^{-6} and 10^{-9} were plated in triplicate on Nutrient agar, MacConkey agar and Sabouraud dextrose agar by spread plate technique. The Nutrient agar and MacConkey agar plates were incubated at 37^0C for 18-24 hours, while the Sabouraud dextrose agar plates were incubated at 35^0C for 48 hours.

Waste at dumpsite (Wd)

Mixed decomposing wastes were aseptically collected. 10g of the waste was soaked in100ml sterile distilled water in a conical flask and well shaken to dislodge microorganisms. Using a 10^- fold serial dilution, 0.1ml of dilutions 10^{-3}, 10^{-6} and 10^{-9} were each plated on nutrient agar, MacConkey agar and Sabouraud dextrose agar using spread plate technique. Nutrient agar and MacConkey agar plates were then incubated at 37^0C for 18-24 hours, while the Sabouraud dextrose agar plate was incurbated at 35^0C for 48 hours.

Air at dumpsite

Plates of Nutrient agar, MacConkey agar and Sabouraud dextrose agar were exposed in triplicates at the dumpsite during the busy hours of the day. The plates were then covered and incubated at 37^0C for 24 hours (Nutrient and MacConkey agar plates) and 35^0C for 48-72 hours (Saburaud dextrose gar plates).

Purification and maintenance of culture

Purification of culture was by streak plate technique. Pure cultures of isolates were maintained on Nutrient agar slants (for bacteria) and Sabouraud agar slants (for fungi) and stored in the refrigerator.

Identification of isolates

Bergey's manual of determinative bacteriology (Holt *et al.*, 1994, Cheesbrough, 2000) was used in the identification of the isolates, and standard tests as specified in microbiological techniques of Steane (1999) and Kaiser (1998) were carried out.

RESULTS

Table 1 presents the result of the distribution and frequency of occurrence of bacterial isolates from garden street dumpsite in the month of December 2015. It showed that *E. coli* occurred

in soil and waste samples with 15.22% frequency of occurrence. *Klebsiella spp* occurred in the soil and air samples with a total frequency occurrence of 6.52% while *Enterobacter spp* occurred in all the three samples with a total frequency occurrence of 17.39%. *Shigella spp* and *Salmonella spp* were isolated only in the waste sample and they had a frequency occurrence of 6.52% each while *Micrococcus spp* and *Pseudomonas spp* occurred in all three samples and they both had a total frequency occurrence of 19.5% each.

Table 2 presents the result of the fungi isolates and frequency occurrence in the garden street dumpsite samples in the month of December 2015. It showed that both *Aspergillus spp* and *Mucor spp* occurred in all the samples with a total frequency occurrence of 52.94% and 47.06% respectively.

Table 3 presents the result of the distribution and frequency of occurrence of bacterial isolates in the garden street dumpsite during the month of January, 2016. It showed that *Escherichia coli* and *Enterobacter spp* were isolated in the soil and waste samples and they both hand a total frequency occurrence of 15.38% and 12. 82% respectively. *Klebsiella spp* was isolated in the soil and waste, sample and had a frequency occurrence of 10.26%, *Shigella spp*, and *Salmonella spp* were isolated in the waste sample and both had frequency occurrence of 5.13% and 7.69% respectively, *Bacillus spp* was isolated from both the waste and air samples and had a frequency occurrence of 20.51% while *Micrococcus spp* and *Pseudomonas spp* were both isolated from the soil and air samples and they showed a percentage occurrence of 12.82% and 15.38% respectively.

Table 4 presents the result of the distribution of fungi isolates and their frequency of occurrence in the garden street dumpsite during the month of January 2016. It showed that *Aspergillus spp* and *Mucor spp* were isolated from the soil, waste and air samples, and both had a frequency occurrence of 51. 22 and 48.78% respectively.

Table 5 present the result of the distribution and frequency occurrence of bacteria isolates in the garden street dumpsite during the month of February, 2016. It showed that *Escherichia coli*, *Klebsiella spp*, and *Enterobacter spp* were isolated from the soil and waste samples and had frequency occurrence of 20% each, while *Micrococcus spp* were isolated from soil and air samples with a percentage frequency of 17.14% and *Salmonella spp* was absent from all the samples collected. Table 6 present the result of distribution and frequency occurrence of fungi isolates from garden street dumpsites during the month of February, 2016. It showed that *Aspergillus* and *Mucor spp* were isolated from all the samples collected, and they both had 50% frequency occurrence each.

Table 7 present the results of the distribution and frequency occurrence of bacteria isolates in the garden street dumpsite during the month of April, 2016. It showed that *Bacillus spp*, *Micrococcus spp* and *Staphylococcus spp* were isolated from air, soil and waste samples and they had 45.21%, and 12.33% respectively, *Proteus spp*, and *Nocardia spp* were isolated from the soil samples and had percentage occurrence of 4.11% and 1.40% respectively while *Klebsiella spp* and *Actinomyces spp*

were isolated from the soil and waste samples and had percentage occurrence of 2.74% and 12.33% respectively.

Table 8 present the result of the distribution and percentage occurrence of fungi isolates in garden street dumpsites during the month of April, 2016. It showed that *Aspergillus spp* and*Mucor spp* were isolated from the soil, waste and air samples and had frequency occurrence of 63.4% and 36.59% respectively.

Table 9 percent the result of the distribution and percentage occurrence of bacteria isolates in garden street dumpsite during the month of May 2016. It showed that *Bacillus spp, Micrococcus spp, Nocardia spp* and *Actinomyces spp* were isolated from air, soil, and waste samples, they had 27.94%, 16.18%, 8.82% and 13.23% respectively. *Enterococcusspp* was isolated from the waste sample and had a frequency occurrence of 7.35%, *Staphylococcus spp*, was isolated from the soil sample and had a frequency occurrence of 7.3%, while *Proteus spp* and *Klebsiella spp* were isolated from the soil and waste samples and had frequency occurrence of 13.23% and 5.88% receptively.

Table 10 present the result of the distribution and frequency occurrence of fungi isolates in garden street dumpsite *Aspergillus spp* and *Mucor spp* were isolated from the soil, waste and air samples and had frequency occurrence of 59.52% and 40.48% respectively.

Table 11 present the distribution and frequency occurrence of bacteria isolates in garden street dumpsites during the month of June, 2016. It showed that *Bacillus spp, Micrococcus spp, Nocardia spp* and *Actinomyces spp* were isolated from the air, soil and waste samples and had frequency occurrence of 32.10%, 24.69%, 13.58% and 3.70% respectively. *Enterococcus spp, Proteus spp* and *Klebsiella spp* were isolated from the soil and waste samples and had frequency occurrence of 8.64%, 7.41% and 3.70% respectively, while *Staphylococcus spp* was isolated from air and soil sample and had frequency occurrence.

Table 12 present the result of the distribution and percentage occurrence of fungi isolates in garden street dumpsite during the month of June, 2016. It showed that *Aspergillus spp* and *Mucor spp* were isolated from the soil, waste and air samples and had frequency occurrence of 59.70% and 40.30% respectively.

Table 13 present the result of frequency occurrence of bacteria isolates in the garden street dumpsite from December 2015 to February 2016. It showed that *Pseudomonas* had the highest frequency occurrence (18.18%) compared to other bacterial counterparts, *Escherichia coli* (16.5%), *Micrococcus spp* (16.53%), *Bacillus spp* (15.70%), *Enterobacter spp* (14.05%), *Klebsiella spp*(9.09%), *Shigella spp* (4.96%), and *Salmonella spp* (4.96%) (fig 2).

Table 14 present the result of frequency occurrence of fungi isolates in the garden street dumpsite from December 2015 to February 2016. It showed that *Aspergillus* had a highest frequency occurrence (51.28%) compared to *Mucor spp* (48.72%) (fig. 3).

Table 15 present the result of frequency occurrence of bacteria isolates in the garden street dumpsite from Apirl to June, 2016. It showed that *Bacillus spp* had the highest frequency occurrence (34.98%) compared to other bacteria counterparts; *Micrococcus spp* (20.63%), *Actinomyces spp* (9.42%), *Staphylococcus spp* (8.97%), *Proteus spp* (8.07%), *Nocardia spp* (8.07%), *Enterococcus spp* (5.83%) and *Klebsiella spp* (4.04%) (fig 4).

Table 1

The distribution of bacterial isolate in Garden street dumpsites and their frequency of occurrence during the month of December 2016

Bacterial isolate	**S_d**	**(F)**	**W_d**	**(F)**	**A_d**	**(F)**	**F-Total**	**F%**
Escherichia coli	+	(3)	+	(4)	-		7	15.22
Klebsiella spp	+	(2)	-		+	(2)	4	6.52
Enterobactersp	+	(4)	+	(2)	+	(2)	8	17.39
Shigella spp	-		+	(3)	-		3	6.52
Salmonella spp	-		+	(3)	-		3	6.52
Bacillus spp	-		-		+	(4)	4	8.70
Micrococcus spp	+	(4)	+	(1)	+	(4)	9	19.57
Pseudomoans spp	+	(4)	+	(3)	+	(2)	9	19.57
Total		**17**		**16**		**14**	**47**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite
F - Frequency of occurrence

Table 2

The distribution of fungal isolates in garden street dumpsites and their frequency of occurrence during the month of December 2015

Bacterial isolate	**S_d**	**(F)**	**W_d**	**(F)**	**A_d**	**(F)**	**F-Total**	**F%**
Aspergillus spp	+	(6)	+	(5)	-	(7)	18	52.94
Mucor spp	+	(3)	-	(6)	+	(7)	16	47.06
Total		**9**		**11**		**14**	**34**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite

Table 3

The distribution of bacterial isolates in garden street dumpsites and their frequency of occurrence during the month of January

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Escherichia coli	+	(3)	+	(2)	+		1	15.38
Klebsiella spp	+	(3)	-	(1)			4	10.26
Enterobacter spp	+	(2)	+	(2)	+	(1)	5	12.82
Shigella spp	-		+	(2)	-		2	5.13
Salmonella spp	-		+	(3)	-		3	7.69
Bacillus spp	-				-		8	20.51
Micrococcus spp	+	(1)			+	(4)	5	12.82
Pseudomoans spp	+	(3)			+	(3)	6	15.38
Total		**12**		**15**		**12**	**39**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite
F - Frequency of occurrence

Table 4

The distribution of fungal isolates in Garden street dumpsites and their frequency of occurrence during the month of January 2016

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Aspergillus spp	+	(7)	+	(6)	-	(8)	21	51.22
Mucor spp	+	(7)	-	(5)	+	(8)	20	48.78
Total		**14**		**11**		**18**	**41**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite

Table 5

The distribution of bacterial isolates in garden street dumpsites and their frequency of occurrence during the month of February, 2016

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Escherichia coli	+	(3)	+	(4)	+		7	20
Klebsiella spp	+	(2)	+	(1)			3	8.57
Enterobacter spp	+	(1)	+	(3)			4	11.43
Shigella spp	-		-		+	(1)	1	2.86
Salmonella spp	-		-	-	-		0	0

Bacillus spp	+	(2)	+	+	(3)		5	20
Micrococcus spp	+	(3)	-		+	(3)	6	17.14
Pseudomonas spp	+	(2)	+	(1)	+	(4)	7	20
Total		**13**		**9**	**3**	**8**	**33**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite
F - Frequency of occurrence
\+ - Present (growth)
\- - Absent (No growth)

Table 6

The distribution of fungal isolates in garden street dumpsites and their frequency of occurrence during the month of February, 2016

Bacterial isolate	**S_d**	**(F)**	**W_d**	**(F)**	**A_d**	**(F)**	**F-Total**	**F%**
Aspergillus spp	+	(7)	+	(6)	-	(8)	21	50.0
Mucor spp	+	(7)	-	(6)	+	(8)	21	50
Total		**14**		**12**		**16**	**42**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite

Table 7

The distribution of bacterial isolates in garden street dumpsites and their frequency of occurrence during the month of April 2016

Bacterial isolate	**Ad**	**(F)**	**S_d**	**(F)**	**W_d**	**(F)**	**F-Total**	**F%**
Bacillus spp	+	(6)	+	(10)	+	(17)	33	45.21
Micrococcus spp	+	(3)	+	(8)	-	(4)	15	20.55
Enterococcus spp	-		-		+	(1)	1	1.37
Staphylococcus sp	-		+	(3)	+	(5)	8	12.33
Klebsiella spp	-		+	(1)	+	(1)	2	2.74
Nocardia spp	-		+	(1)	-		1	1.40
Actinomyces spp	-		+	(4)	+	(5)	9	12.33
Total		**9**		**27**		**33**	**69**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
F - Frequency of occurrence

+ - Present (growth)

- - Absent (No growth)

Table 8

The distribution of fungi isolates in garden street dumpsites and their frequency of occurrence during the month of April 2016

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Aspergillus spp	+	(7)	+	(11)	-	(8)	26	63.41
Mucor spp	+	(4)	-	(4)	+	(7)	15	36.59
Total		**11**		**15**		**15**	**41**	**100**

KEY: S_d - Soil at dumpsite

w_d - Waste at dumpsite

A_d - Air at dumpsite

+ - Present (growth)

- - Absent (No growth)

Table 9

The distribution of bacterial isolates in garden street dumpsite and their frequency of occurrence during the month of May, 2016

Bacterial isolate	Ad	(F)	S_d	(F)	W_d	(F)	F-Total	F%
Bacillus spp	+	(1)	+	(11)	+	(7)	19	27.94
Micrococcus spp	+	(3)	+	(4)	+	(4)	11	16.16
Enterococcus spp	-		-		+	(5)	5	7.35
Staphylococcus spp	-		-		+	(5)	5	7.35
Klebsiella spp	-		+	(2)	+	(2)	4	5.88
Nocardia spp	+	(1)	+	(1)	+	(4)	6	8.82
Actinomyces spp	+	(4)	+	(4)	+	(4)	12	13.23
Total		**9**		**22**		**31**	**62**	**100**

KEY: S_d - Soil at dumpsite

w_d - Waste at dumpsite

F - Frequency of occurrence

+ - Present (growth)

- - Absent (No growth)

Table 10

The distribution of fungal isolates in garden street dumpsite and their frequency of occurrence during the month of May 2016

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Aspergillus spp	+	(8)	+	(9)	-	(8)	25	59.52
Mucor spp	+	(6)	-	(6)	+	(5)	17	40.48
Total		**14**		**15**		**13**	**42**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite
\+ - Present (growth)
\- - Absent (No growth)

Table 11

The distribution of bacterial isolates in garden street dumpsite and their frequency of occurrence during the month of June 2016

Bacterial isolate	Ad	(F)	S_d	(F)	W_d	(F)	F-Total	F%
Bacillus spp	+	(6)	+	(6)	+	(14)	26	32.10
Micrococcus spp	+	(6)	+	(4)	+	(10)	20	24.69
Enterococcus spp	-		+	(1)	+	(6)	7	8.64
Staphylococcus spp	+	(3)	+	(2)			5	6.17
Klebsiella spp	-		+	(1)	+	(2)	3	3.70
Nocardia spp	+	(1)	+	(5)	+	(5)	11	13.58
Actinomyces spp	+	(1)	+	(1)	+	(1)	3	3.70
Total		**17**		**20**		**38**	**75**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
F - Frequency of occurrence
\+ - Present (growth)
\- - Absent (No growth)

Table 12

The distribution of fungal isolates in garden street dumpsite and their frequency of occurrence during the month of June 2016

Bacterial isolate	S_d	(F)	W_d	(F)	A_d	(F)	F-Total	F%
Aspergillus spp	+	(12)	+	(18)	-	(10)	40	59.70
Mucor spp	+	(8)	-	(10)	+	(9)	27	40.30

Total	**20**	**28**	**19**	**67**	**100**

KEY: S_d - Soil at dumpsite
w_d - Waste at dumpsite
A_d - Air at dumpsite
\+ - Present (growth)
\- - Absent (No growth)

Table 13

The frequency of occurrence of the bacterial isolates in the garden street dumpsite from December 2015 to 2016

Isolate	December	January	February	Total	% total
Escherichia coli	7	6	7	20	16.53
Klebsiella spp	4	4	3	11	9.09
Enterobacter spp	8	5	4	17	14.05
Shigella spp	3	2	1	6	4.96
Salmonella spp	3	3	0	6	4.96
Bacillus spp	4	8	7	19	15.70
Micrococcus spp	9	5	6	20	16.53
Pseudomonas spp	9	6	7	22	18.18
Total	**47**	**39**	**35**	**121**	**100**

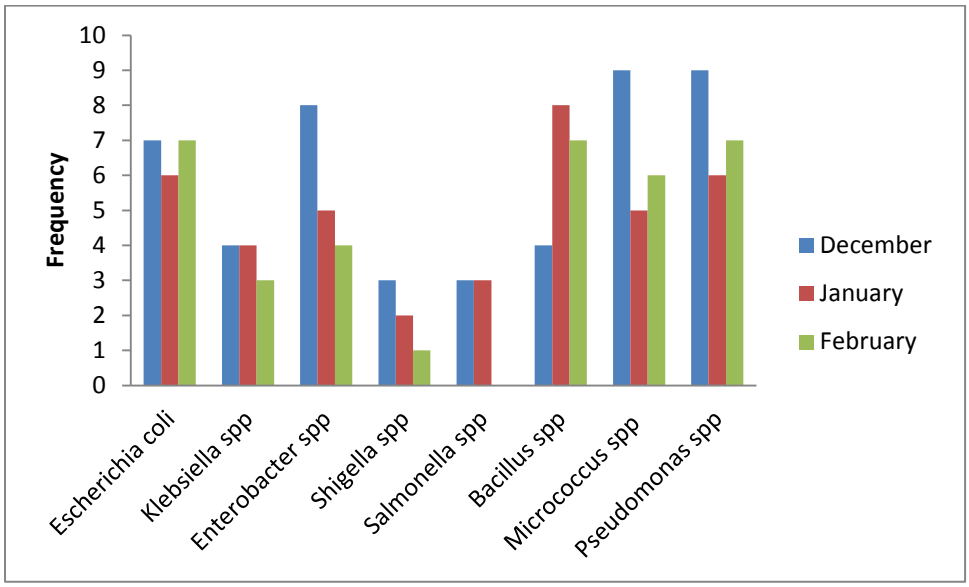

Fig 1: The frequency of occurrence of the bacterial isolates in the garden street dumpsite from December 2015 to February 2016

Table 14

The frequency of occurrence of the fungal isolates in the garden street dumpsite from December 2015-2016

Isolate	December	January	February	Total	% total
Aspergillussp	18	21	21	60	51.28
Mucorsp	16	20	21	57	48.72
Total	**34**	**41**	**42**	**117**	**100**

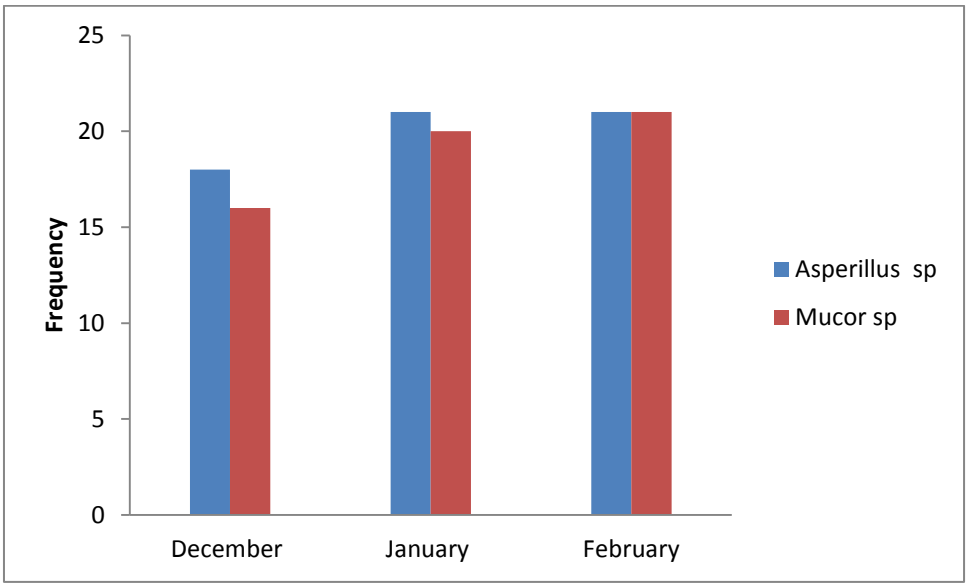

Fig 2: The frequency of occurrence of the fungal isolates in the garden street dumpsite from December 2015 to February 2016

Table 13

The frequency of occurrence of bacterial isolates in the garden street dumpsite from April to June, 2016

Isolate	April	May	June	Total	% total
Bacillus spp	33	19	26	78	34.98
Micrococcus spp	15	11	20	46	20.63
Enterococcus spp	1	5	7	13	5.83
Staphylococcus spp	10	5	5	20	8.97
Proteus spp	3	9	6	18	8.07
Klebsiella spp	2	4	3	9	4.04
Nocardia spp	1	6	11	18	8.07
Actinomyces	9	9	3	21	9.42

Total	**74**	**68**	**81**	**223**	**100**

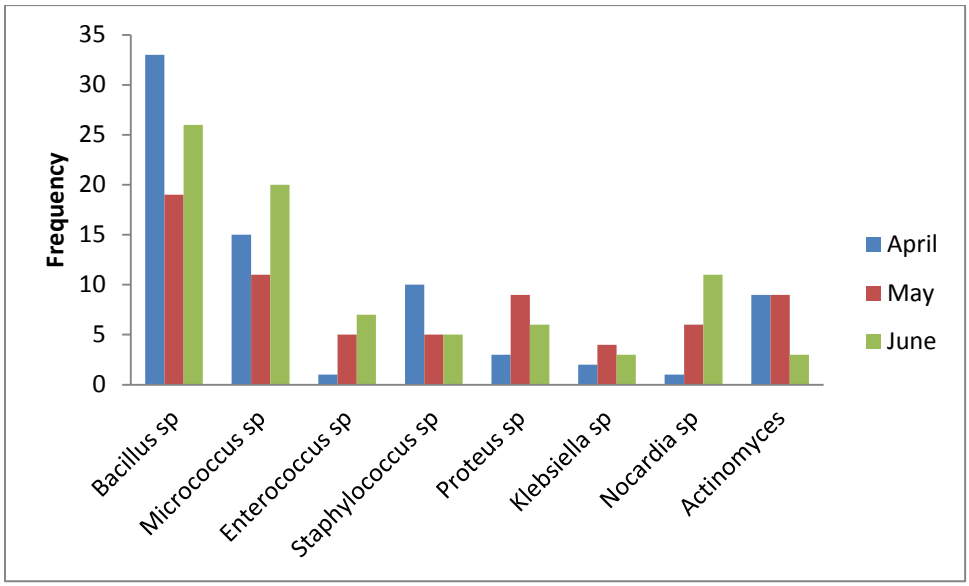

Fig 3: The frequency of occurrence of bacterial isolates in the garden street dumpsite from April to June 2016

Table 15

The frequency of occurrence of the fungal isolates in the garden street dumpsite from April to June 2016

Isolate	April	May	June	Total	% total
Aspergillus spp	26	25	40	91	60.67
Mucor spp	15	17	27	59	39.33
Total	**41**	**42**	**67**	**150**	**100**

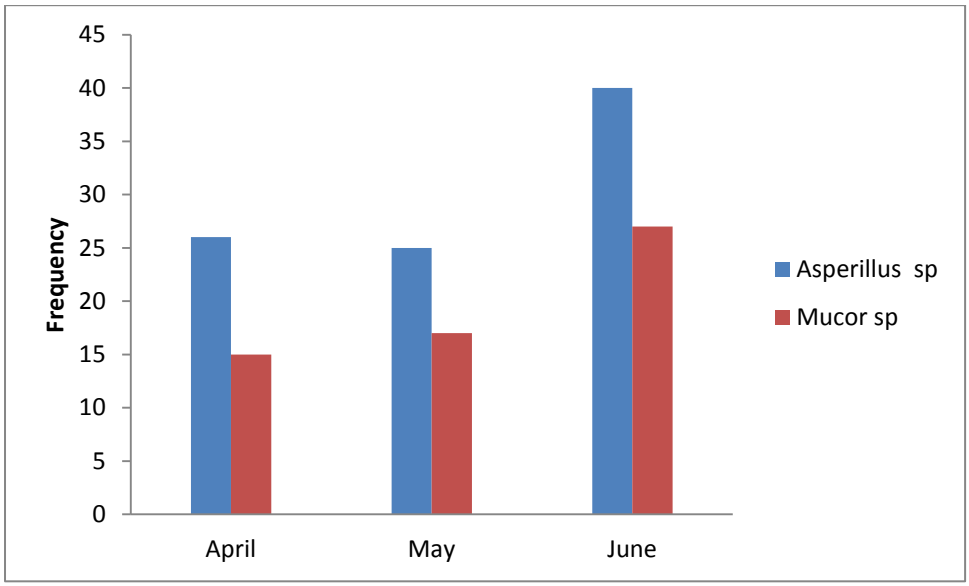

Fig 4: The frequency of occurrence of fungal isolates in the garden street dumpsite from April to June 2016

DISCUSSION

The study to evaluate the distribution and frequency of occurrence of bacteria and fungi isolates in garden street dumpsite in Calabar Municipality was carried out. The presence of pathogenic bacteria such as *Bacillus spp, Proteus spp, Enterococcus spp, Micrococcus spp, Pseudomonas spp, Staphylococcus spp* and Coliforms such as *Klebsiella spp, Escherichia coli, Shigella spp* and *Salmonella spp* in the waste dumpsite as observed in this study was not surprising, as it corroborates with that Igbinosa and Okoh (2009) who reported to have identified the presence of coliforms, faecal coliforms and pathogens such as *Escherichia coli, Pseudomonas spp* and *Salmonella* from samples collected close to sewage sites. Also the observation was in line with that Ogboma *et al.,* (2006) who identified the presence of *Bacillus, Staphyloccocus* and *Klebsiella* from a waste dumpsite located at Eagle Island, River state. The presence of these identified organisms in the study site is a thing of great concern as these bacteria have been associated with a number of public health problems (Obire *et al.,* 2002). *Pseudomonas spp* had the highest frequency of occurrence (18.33%) during the dry season while *Bacillus spp* had the highest frequency of occurrence (34.98%) during the wet season and this was worrisome as researches have shown that certain environmental and commercial species of *Bacillus* can cause food poisoning as well as play a role in food spoilage (Graumann, 2012) and they can produce oval endospores, to which they can reduce themselves and remain in a dominant state for long periods of time (Graumann, 2012). Also *Pseudomonas spp* is increasely recognized as an emerging opportunistic pathogen of clinical relevance causing chronic infections in humans, with one of its most worrying characteristics been its low antibiotic susceptibility (Palleroni, 2010). Proteus are human pathogens and has been shown to occur in manure, soil and polluted water (Palleroni,2010) , they are human pathogens and are capable of causing urinary tract infections and also they serve as secondary inhalers that may cause septic lesson is burnt patients. *Klebsiella* and other species are opportunities pathogens that have been reported to occur in soil, water, vegetables and waste sites, they can cause bactericemia, pneumonia, urinary tract and other human infections, they also frequently cause infections in neonatal, intensive care and immune suppressed patients (Podschun and Ulmann, 1998). *Enterobacter* has been reported to occur in soil, fresh water, sewage plants and vegetables and are associated with urinary tract infections. *E. coli* are capable of producing enterotoxins and other virulence factors including invasive and colonization factors, they can cause diarrheal disease, urinary tract infections and nocosomial infections including septicemia and meningitides (Ishii and Sadowskey, 2008) while *Salmonella* and *Shigella* are human pathogen and are the causative agents of typhoid fever, enteric fevers gastroenteritis, septicemia and dysentery respectively (Obire *et al.,* 2002).

The presence of fungi such as *Aspergillus spp* and *Mucor spp* in the collected waste samples, is of public health importance, as *Aspergillus spp* are important producers of mycotoxins such as aflatoxins, and in human they cause aspergillosis. The spore of *Aspergillus* in the environment have

been reported to cause allergic response and opportunistic infection in immune-compromised persons (Bennet, 2010).

CONCLUSION

The study had revealed that despite the positive impacts of dumped municipal wastes on microbial properties of the analyzed air, soil and waste samples, disposal of municipal wastes in open dumpsites is an archaic, unsustainable option in the management of municipal wastes and a breeding site for pathogenic microorganisms. The onus is therefore on the government and other environmental agencies in particular, to create a well planned and closed dumpsite systems, so as to help reduce or curb further public health risk and environmental hazards that may result from the use of open dumpsites.

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