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Microbial Spectrum on Public Toilet Seats

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ABSTRACT

Public toilet facilities are integrated into the public health departments of Government Ministry. They are major sources of microbial transmission and a hidden source of infection when not cleaned routinely. This study was done to determine the microbial profile on public toilet seats in Calabar metropolis. Samples were obtained from beer parlor, hotels, communal compounds, schools, hostels, offices, hospitals and eateries in Calabar. The toilet seats were swabbed with sterile swab sticks moistened with normal saline. The samples were obtained immediately after washing and inoculated on appropriate media which were incubated at 37°C aerobically for 24 – 48 hours. Isolates were identified by macroscopy, microscopy, biochemical and physiological tests. Out of the 151 samples examined, Escherichia coli 70(46.4%) was the most prevalent isolate followed by Salmonella species 45(29.8%) while Staphylococcus aureus 15(9.9%) was the least encountered isolate. Most of the samples and isolates were from hostels 41(44.0%). The susceptibility profile of the isolates to commonly used antibiotics ranged between 60.0% to 100%. Salmonella species were not susceptible to Fortum but most susceptible to gentamicin (100%). This study demonstrates that public toilet seats that have been washed still harbour high number of bacterial organisms and may serve as a potential source of infections.

Keywords: *Public toilet seats, bacterial profile, contamination*.

BACKGROUND OF STUDY

A toilet is a receptacle into which a person may urinate or defecate, usually consisting of a detachable, hinged seat, lid and a device for flushing with water. Public toilet is a facility where people meet their sanitary needs. They may be located in the markets, and transport centers, schools, eateries, hostels, offices, factories, schools, hospitals, factories, cinemas, bars, museums, restaurants, places of entertainment, railway stations, filling stations, etc [1]. A room or small building containing one or more toilets could be used as public toilets [2]. Portable toilets are also provided at large outdoor events and are separated into male, female and unisex sections [2].

A toilet consists of the seat with a lid which covers the toilet when not in use, to prevent small items from falling in, or to reduce the spread of germs and odour when water splashes from the toilet on flushing. In some public restrooms, the lid is absent or frequently left open [3].Compared to other indoor environments, Public restrooms are settings with microbial diversity because of the high rate of activities by individuals with different hygienic practice [4].

Fankem *et al* [5] in Arizona, United States of America, reported high contaminated rates on public toilets seats in bus terminals, universities and airports with 21.0% coliform colonization rate.

Public toilet facilities are integrated in the public health Departments of the general population. Public toilets are supposed to be kept clean for the comfort of users but they are major sources of microbial transmission and diseases when not cleaned routinely [6]. The ability to transmit bacteria is relatively related to the structure of the toilet, transmission is higher in toilets which are more difficult to clean [7]. Studies by Bashir *et al* [8] revealed that in Jigawa, not only are the number of available public toilets far below adequate, considering the teeming population of residents in the state, most toilet seats, were found filthy.

There are about 761 million public toilet users globally. It is a viable option to avoid open defecation. In rural areas, families keep the cost down by using toilets between more than one household and family unit [9-10]. According to Burton [11] the state of school toilets is a matter of concern both in the UK and internationally,

especially the impact on the health and well-being of children and young people.

Public toilets are said to be one of the essential facilities in cosmopolitan cities. In Ghana, studies have shown that 44.6% of poor households use public toilets [12]. Lack of public toilets or unimproved public toilet facilities is not uncommon. Most public toilets are observed with defecated materials, offensive odour from urination especially in market places, motor-parks, etc. [1]. In the UK, Greed[2] reported that lack of maintenance and cleaning of public toilets resulted in proliferation of toilet-related diseases which was under reported by the media and government.

Studies by Bashir et al[8] revealed that in Jigawa, not only are the number of available public toilets far below adequate, considering the teeming population of residents in the state. Most toilets facilities especially the toilet seats, were found filthy with faeces, urine, dirty water and used bits of toilet paper. Thirty five per cent of people in Calabar have access to modern sanitary facilities. However most house owners (Landlords) resort to constructing one or few toilets for many tenants to share [13].

Health Hazards Associated with Public Toilet Usage

Hazards associated with public toilet usage include; bacterial, fungal and viral infections. Due to the large number of users, if hygiene as well as sanitary practices is not put in place, the users are prone to picking up one of these pathogens, especially the immunocompromised persons [14]. Some common sources of toilet seat contamination includes: the skin, faecal matter and urine.

Hazards associated with toilet seats and other fomites have been established but less attention is given to toilet seats as inanimate objects which could harbor and transmit infectious agents [15]. Fankem *et al* [5] reported that microorganisms may contaminate surfaces due to aerosols generated during flushing, and poor sanitary habits by toilet users resulting in enteric diseases. Some of the public toilets used in Calabar Metropolis are not routinely cleaned and may serve as a source of disease transmission. This study was done to determine the microbial profile on public toilet seats after they have been washed.

Material and Methods

The study ran for five months, from June to October, 2017 in Calabar metropolis. It was a cross sectional prospective study. The city of Calabar is bounded to the east by Cameroun, bounded to the north by Odukpani and to the south and west by the Cross River. She has an area of 406 square kilometers and a population of 371,022 [16]

This research was carried out in some selected public toilets in Calabar Metropolis. One hundred and fifty one toilets were selected for the study in various sites including: beer parlors, hostels, offices, eateries, churches, hospitals, communal compounds, schools and hotels.

Ethical Issues and Informed Consent

Since the study did not involve the use of human subjects, ethical clearance was not obtained.

Sample Collection

A total of 151 samples were collected from different toilets within Calabar Municipality and Calabar South Local Government Area after they have been washed by the cleaners. Samples were collected using a sterile swab sticks moistened in normal saline. The toilet seats were swabbed immediately after they have been washed by the facility cleaners. The samples were analyzed in the Department of Microbiology, University of Calabar Teaching Hospital, Calabar.

Culture

The samples were inoculated on Chocolate agar, Deoxycholate citrate agar (DCA) and cysteine lactose electrolyte-deficient (CLED) agar at 37°C for 24 – 48 hours aerobically. The swabs were also placed in 5ml of sterile Selenite F broth and incubated for 30 minutes at 37°C before re-inoculating on DCA agar.

Identification of isolates

The identification of isolates was based on microscopic examination and biochemical tests. Coagulase test, Urease test, Kligler iron agar (KIA), string test and motility tests were performed on isolates where necessary.

Data Analysis

Data obtained in this research was analyzed using Epi-Info statistical software, 2012. Descriptive statistics were carried out. Frequencies (prevalence, etc.) were calculated for categorical variables.

RESULTS

Table 1 shows the distribution of bacterial isolates on the toilet seats sampled. Out of the 151 samples examined, *Escherichia coli* 70(46.4%) was the most prevalent isolate followed by *Salmonella* species 45(29.8) while *Staphylococcus aureus* 15(9.9%) was the least encountered isolate.

Table 2 shows the distribution of bacterial isolates on toilet seats in Calabar South LGA. Most of the isolates 18(31.6%) were from Communal compound toilet seats followed by Hotel toilet seats 14(24.5%). The least encountered isolates were from Beer parlor toilets. Out of the 18(31.6%) isolates from communal compounds, *Escherichia coli* 10(83.3%) was the most encountered isolates while *S, aureus* was the least encountered 1(8.3%).

Table 3 shows the distribution of bacterial isolates by sample sites in Calabar Municipality. Out of the 93 bacterial isolates from toilet seats in Calabar Municipality, 41(44.0%) were from Hostels while 19(20.4%) Schools. Eateries and Hospitals had the least number of isolates 4(4.3%) each. *Escherichia coli* 38(40.4%) were the most encountered bacteria; followed by *Salmonella* species 31(33.0%) while *Staphylococcus aureus* 10(10.6%) was the least encountered isolate in Calabar Municipality.

Because of financial constraints, only 20 isolates were subjected to antibiotic susceptibility testing. These comprised 5 of each bacterial species. Figure 1 shows the susceptibility rates of bacterial isolates to antibiotics tested. The susceptibility profile of the isolates to commonly used antibiotics ranged between 60.0% to 100%. S*almonella* species susceptibility ranged between 0.0% to 100% with the highest susceptibility to gentamicin (100%) and no susceptibility to Fortum (0.0%). *Escherichia coli* susceptibility ranged between 60.0% to 80% with the highest susceptibility to Augmentin 80% and Fortum 80.0%. *Proteus* species susceptibility ranged between 60.0% to 80% with the highest susceptibility to Gentamicin. *Staphylococcus aureus* susceptibility ranged between 60.0% to 100% with the highest susceptibility to ceftriaxone 100% and the lowest to gentamicin 60.0% and Fortum 60.0%. Erythromycin was not tested on the gram negative isolates because it is not indicated.

Table1. *Distribution of bacterial isolates on toilet seats*

Types of isolates	No(%) of isolates
Salmonella species	45 (29.8)
Escherichia coli	70 (46.4)
Proteus species	21 (13.9)
Staphylococcus aureus	15 (9.9)
Total	151

Table2. *Distribution of bacterial isolates on toilet seats in Calabar South LGA*

Collection Sites	No of Samples examined	No (%) of isolates				
		***Salmonella* Species**	***Esherichia coli***	***Proteus* spp**	***Staphylococcus aureus***	**Total**
Beer parlour	14	1(7.1)	5(35.7)	0(0.0)	1(7.1)	7(12.2)
Hotels	12	4(33.3)	7(58.3)	2(16.7)	1(8.3)	14(24.5)
Communal compounds	12	5(41.6)	10(83.3)	2(16.7)	1(8.3)	18(31.6)
Churches	10	2(20.0)	5(50.0)	3(30.0)	1(10.0)	11(19.2)
Schools	9	2(22.2)	5(55.5)	0(0.0)	1(11.1)	8(14.0)
Total	57	14(24.5)	32(56.1)	7(12.2)	5(8.5)	58

Table3. *Distribution of Bacterial isolates on toilet seats in Calabar Municipality*

Collection Sites	No of samples examined	No (%) of isolates				
		***Salmonella* species**	***Escherichia coli***	***Proteus* species**	***Staphylococcus aureus***	**Total**
Beer parlour	7	2(28.6)	4(57.1)	3(42.8)	1(50.0)	10(10.7)
Hotels	12	5(41.7)	2(16.7)	1(8.3)	1(8.3)	9(9.6)
Eateries	5	1(20.0)	3(60.0)	0(0.0)	0(0.0)	4(4.3)
Hostels	47	13(27.7)	15(31.9)	9(19.1)	4(8.5)	41(44.0)
Hospitals	4	2(50.0)	2(50.0)	0(0.0)	0(0.0)	4(4.3)
Offices	5	2(40.0)	3(60.0)	0(0.0)	1(20.0)	6(6.4)
Schools	14	6(42.8)	9(64.2)	1(7.1)	3(21.4)	19(20.4)
Total	94	31(33.3)	38(40.9)	14(15.0)	10(10.7)	93

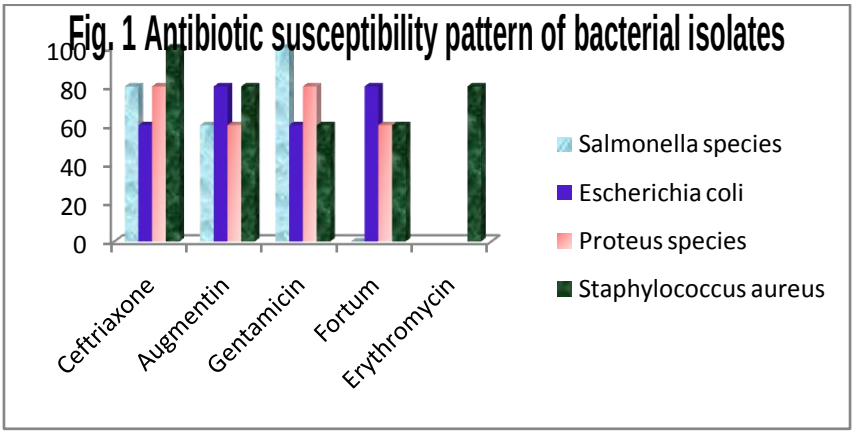

Fig1. *Antibiotic susceptibility pattern of bacterial isolates*

DISCUSSION

The result showed that most of the isolates were from hostels 41(44.0%). This may be due to the number of hostel samples examined, compared to the number of samples from other sites. Also the high number of users and lack of proper sanitary measures may have resulted in the high number of isolates encountered in the hostels. Amala and Ade[15] reported on shortage of cleaners in University hostels. In this study the number of cleaners in the University of Calabar hostels was inadequate compared to other sample sites. This may have resulted in the high contamination of the toilet seats with bacteria from the Gastro intestinal tract.

Although the number of students per toilet in the hostel was not investigated, the student population and traffic in the hostel toilets was also very high which could have resulted in high bacterial contamination of the seats. The Millennium Development Goal (MDG) targets for sanitation was to reduce by halve the problems by 2015. The country could not meet the MDG's target up till 2016 because most people still lacked access to good water supply which is complimentary to good toilet sanitation in several parts of the country[17-18]. In Calabar South LGA, communal compounds showed high toilet seat contamination 31.6% even after washing. This may be due to the low standard of living in that part of the city. The common practice there is that many tenants are made to share one toilet alongside poor or lack of cleaning routines. This is in agreement with the work of Alepu *et al* [17] who reported that institutional sanitation rates are very poor in Nigeria.

Salmonella species 40.0% and *Escherichia coli* 33.0% were the most encountered isolates. This may be as a result of faecal contamination of the toilet seats or lack of proper cleaning routine or long survival time on toilet seats. Chen *et al* [19] reported the presence of gut bacteria on toilet seats and attributed it to the long survival time of those isolates on the seats, in this study we did not investigate the survival time of the isolates on the seats. Staphylococcus aureus were also encountered in the study. This may be due to the shedding of the skin flora of users on the toilet seats.

To prevent these infections toilet seats should be cleaned properly with the proper disinfectant especially hostel toilets. Cleaners of public toilets should be adequately trained on the proper methods of cleaning toilet seats. University authorities and Landlords should provide more toilet facilities for students and their tenants.

The susceptibility rates of the isolates to most of the antibiotics used was high with *Salmonella* species having the highest susceptibility while *Staphylococcus aureus* was most susceptible to ceftriaxone.

CONCLUSION

The study has shown that public toilet seats in Calabar Metropolis after being washed still harbour considerable number of bacterial organisms which are potential pathogens. The insinuation that gonorrhea which is caused by *Neisseria gonorrhoeae* may not be transmitted through dirty toilets as insinuated by some people.

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CONFLICTS OF INTEREST

None

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