



## Bacterial contaminants of office door handles in Benue state university Makurdi

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### ABSTRACT

Public offices usually have large traffic of users who throng in with their own microbial flora and other organisms they have picked elsewhere and deposit them on door handles/knobs while going into and on their way out. Various bacteria have been isolated from public surfaces there by providing information on the relative hygiene of commonly encountered public surface, identifying the environments with contaminants and risk of exposures. The aim of this paper therefore is to identify the bacterial contaminants of office door handles in Benue State University Makurdi. Results from the research show an overall bacterial contamination rate of 82.5% (189/240). The highest occurrence of bacteria in this research was *Staphylococcus aureus* (40.90%), while the least was *Salmonella* species (6.06%). Other bacterial species isolated in this research included *Escherichia coli*, *Klebsiella* species and *Salmonella* species. Bacterial contamination varies across locations with faculty of sciences having the highest occurrence of bacteria species (47.97%) while the faculty of environmental sciences had the least occurrence (22.22%). The rate of bacterial contamination of the handles is high considering the harm these bacteria cause to the human species. It is therefore recommended that hand washing facilities be installed and used to mitigate the effects of these organisms on humans. Also, door handles be wiped consistently with disinfectants to reduce risk of contamination by bacteria.

**Keywords:** Bacteria, Contamination, Isolates, Knobs, Species, Offices

### INTRODUCTION

Microorganisms are found everywhere and constitute a major part of every ecosystem. In these environments, they live either freely, as parasites or in some cases as transient contaminants in fomites or hands where they constitute a major health hazards as sources of community and hospital-acquired infections [1]. The

increasing incidence of epidemic outbreaks of certain diseases and its rate of spread from one community to the other has become a major public health concern. Although it is accepted that the infection risk in general community is less than that associated with patients in hospitals, the yearly increases in food poisoning cases in which household outbreaks are a major factor, requires

an assessment of the probable causes and sources and faucets, sinks, lockers, chairs, and tables, especially those found in public offices like that of Benue State University, Makurdi [2].

Studies have shown that surfaces can easily be contaminated with bacteria which can be transferred to hands and other parts of the body. The risk of spreading of bacterial infection to other family members *via* the environment, including contaminated hands and surfaces such as office door handles had been highlighted. As people come in contact with surfaces as desks, keyboards and office furniture and lock handles, there is possibility of picking up microbes deposited on them. The offices lock handles are in contact more frequently with their users and visitors, especially public offices. The hazards associated with office furniture and other formites had been established but less attention had been directed to office door handles as inanimate objects which could harbour and transmit infectious agents [3].

Public offices usually have large traffic of users who throng in with their own microbial flora and other organisms they have picked elsewhere and deposit them on door handles/knobs while going into and on their way out. Various bacteria have been isolated from public surfaces there by providing information on the relative hygiene of commonly encountered public surface, identifying the environments with contaminants and risk of exposures. The United State (US) Centre for Disease Control and prevention (CDC) indicates that contaminated public surfaces are perhaps the widest spread problems in contemporary world and is responsible for about one third of death world-wide through infections, with adverse effects which can reduce economic productivity [4].

## MATERIALS AND METHODS

### Study area

This study was carried out at Benue State University. The University is situated in Makurdi, the capital of Benue state, Nigeria. The city is located in central Nigeria along the Benue river, on latitude 07043'N and Longitude 08035'E and holds the base for the Nigerian air force. Makurdi lies on the south bank of the Benue River. Founded about 1927 when the railroad from Porthar court was extended to Jos and Kaduna, Makurdi has rapidly developed into a transportation and market center. As of 2007, Makurdi had an estimated population of 500,797 [5].

The climatic condition in Makurdi is influenced by two air masses: The warm, moist South-Westerly air mass, and the warm, dry North-Easterly air mass. The mean annual rainfall in Makurdi is about 1,290 mm. The temperature in Makurdi is, however, generally high throughout the year, with February and March as the hottest months. The

temperature in Makurdi varies from a daily of 40°C and a maximum of 22.5°C [6].

Makurdi and its environs are built on "Makurdi sandstone" The sandstone is also overlain by shale units in some places especially the low-lying areas of Wadata. The soil here ranges from fine sand on the riverside to silt sand and even clay in some parts of the town. Thus, in the rainy season, a slight rain only can render the untarred streets muddy [7].

Benue State University is one of the first state universities in North central Nigeria and the only state-owned University in Benue State. It is located along Gboko-Makurdi road and is close to the famous tactical headquarters of the Nigerian air force base in Makurdi. The University offers a host of courses and awards degrees ranging from diploma to Doctor of Philosophy Degrees (Ph.D.). Millions of unemployed Americans could be in for a tax shock by next year [8].

### Sampling

The sample size used for the study was determined using the formula below as stated.

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where;

n=Sample size

z=Statistic for a level of confidence, in this case the level of confidence was 95% (1.96)

p=Expected prevalence which in this case was 20% (0.20) and

d=Precision at 5% (0.05)

Thus,

$$n = \frac{1.96^2 \times 0.11(1 - 0.20)}{0.05^2}$$

$$n = \frac{3.84 \times 0.20(1 - 0.20)}{0.05^2}$$

$$n = 245 \text{ approximately}$$

The Standard Operating Procedure (SOP) for the collection of samples was to obtain door swabs from faculties of science, social science, and environmental science. The samples collected were promptly transported to the Benue state university biology laboratory for further analysis [9].

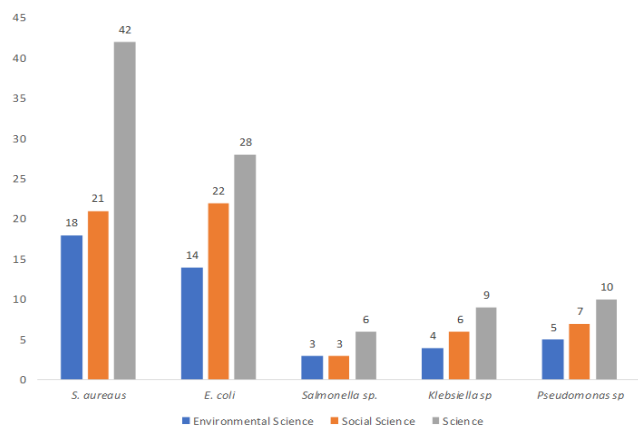
**RESULTS**

Table 1 represents the occurrence frequency of occurrence of the bacteria swabbed from door knobs in the research. It shows the different bacteria as they occur on the door knobs of various faculties. The total viable

count of bacteria isolated across the three locations, while Table 3 depicts the biochemical characteristic of the isolated organisms (Tables 1-3 and Figure 1) [10].

**Table 1:** Occurrence of bacterial isolates from door handles.

Bacteria	Frequency of occurrence	Percentage (%)
<i>Staphylococcus aureus</i>	81	40.9
<i>Escherichia coli</i>	64	32.32
<i>Salmonella sp</i>	12	6.06
<i>Klebsiella sp</i>	19	9.59
<i>Pseudomonas spp</i>	22	11.11
Total	198	100



**Figure 1:** Contamination based on location.

**Table 2:** Total viable count of bacteria isolates across the three locations.

Sample locations	Mean bacterial counts (cfu/ml)
Environmental science	$1.75 \times 10^6$
Social science	$1.28 \times 10^6$
Science	$1.68 \times 10^6$

**Table 3:** Biochemical characteristics of isolated organisms.

Bacteria	Gram Stain	Catalase	Coagulase	Oxidase	Indole	TSI
<i>S. aureus</i>	+	+	+	-	-	-
<i>E. coli</i>	-	-	-	-	+	AA
<i>Pseudomonas sp.</i>	-	+	-	+	-	K/K

<i>Klebsiella sp.</i>	-	+	-	-	-	AA
<i>Salmonella sp.</i>	-	+	-	-	-	K/A+

**Note:** += positive; -=negative;AA= Yellow Slant/Butt with presence of crack or bubbles;K/K=Red slant/butt;K/A = Red slant/yellow but with the presence of crack and black precipitate.

## DISCUSSION

An overall bacterial contamination rate of 82.5% was observed in this study with 189 office door handles harbouring bacteria out of the 240 door samples examined. This level of bacterial contamination of office handles is high considering the harm that occurrence of bacteria species can pose to humans who are constant users of office door handles. This level of high contamination is in agreement with the findings of who reported a high occurrence of bacterial species in door handles in a tertiary institution in Uyo, Akwa-Ibom state. The findings of this study however differs from that of in that a 100% rate of contamination was recorded in their study which is quite higher than the findings of this study [11].

A high contamination rate recorded in this study is also similar to the reports of who reported an overall bacterial contamination of 86.7% in door knobs in Abuja and that of who reported an overall contamination rate of 95% in London. According to, differences in contamination rates across different locations as representative of various studies are as a result of variations in hygiene and sanitary conditions in the environments where the study were carried out. This is in agreement with the findings of this study. A contamination rate of 82.5% is also lower than an 86% contamination rate reported by in a tertiary institution in Umuahia [12].

Highest occurrence of bacteria species in this study was for *Staphylococcus aureus* with (40.90%) while least occurrence of bacteria species was for *Salmonella* species (6.06%). Similar finding has been reported. The high occurrence of *Staphylococcus aureus* on door handles might be as a result of it being a major component of the normal flora of the skin which makes it easy for it to be transferred to door handles. Despite being a major component of the skin, its presence in other locations of the body might be of detrimental effects indicating its pathological nature if adequate preventive measures are not instilled. According to, *Staphylococcus aureus* is the most important potential pathogen that cause boils, abscesses, wound infections, toxic shocks syndromes and pimples in people.

Other bacteria species isolated included *Escherichia coli*, *Klebsiella* species and *Salmonella* species. The occurrence of *Escherichia coli* is a pointer to faecal contamination of door handles which might be as a result of usage of toilet without proper washing of hands or unavailability of hand sanitizers to disinfect pathogens

before using door handles. The occurrence of the bacterial species isolated from this study is in accordance with the findings of who reported similar bacteria.

Bacterial contamination varied across locations with faculty of sciences having the highest occurrence of bacteria species (47.97%) while faculty of environmental sciences had the least occurrence of (22.22%). This high occurrence of bacteria in faculty of sciences could be as a result of the long standing age of the buildings which could result in easy contamination of the structures unlike what is obtainable for faculty of environmental sciences which is still new and have fewer students and staff to use office handles. Social sciences despite having the highest population of students and staffs however had an average occurrence of bacterial contaminants which could be attributed to recent renovations in the university which required transference of the faculty to a new location.

## CONCLUSION

Contamination of office door handles in the Western wing of Benue State University, Makurdi may be a possible route of contraction of infection by Students, Staffs and visitors. The occurrence of bacterial isolates implies that hand hygienic practices of individuals on the Western wing are poor. It points to the need for better practices to be instilled by the management of Benue State University, Makurdi so as to ensure the reduction in bacterial load on door handles and eradicate possible routes of transmission of infections.

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