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Research Article

Bacteria Loads, Types and Antibiogram of Isolates from Hand Rails in Faculty of Life Science Building, Ambrose Alli University, Ekpoma, Nigeria

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Abstract

Inanimate objects (fomites) have for decades been shown to play a role in the transmission of human pathogens either directly, or by surface-to-mouth contact, or indirectly, sometimes through contamination of fingers and subsequent hand-to-mouth contact. This study aimed to isolate and identify bacterial contamination on the rails of the stair case in Faculty of Life Sciences, Ambrose Alli University, Ekpoma. Following standard microbiological procedures and analysis, it was shown that the frequency of bacteria isolates from rails of the stair case samples were *Staphylococcus aereus* 12(30%), *Escherichia coli* 3(23.25%), *Staphylococcus epidermidis* 3(23.25%) and *Proteus* spp 2(12%). From the result obtained it shows that *Staphylococcus aereus* 4(30%), have the highest percentage of occurrence in the samples while the least occurrence was *Proteus* spp 6(12%). This study has revealed the presence of *Staphylococcus aereus*, *Escherichia coli*, *Staphylococcus epidermidis* and *Proteus* spp and it was shown that ground floor had the highest number of bacterial load. From the antibiogram profile of this study, it was shown that augmentin and gentamycin were the most effective antibiotics to treat infections caused by these organisms because none of the isolates were resistant to these antibiotics. The presence of these potential pathogenic organisms in this study poses a health risk to students and staff using the stair case rails in the faculty of life sciences, Ambrose Alli University, Ekpoma, Edo State, hence, there is great need for proper hygiene practices like frequently washing of hands, use of hand sanitizers and cleaning staircase handrails with ethanol.

Keywords: *E. coli*; *Helicobacter pylori*; *Staphylococcus aureus*

Introduction

Inanimate objects (fomites) have for decades been shown to play a role in the transmission of human pathogens either directly, or by surface-to-mouth contact, or indirectly, sometimes through contamination of fingers and subsequent hand-to-mouth contact [11]. Some other routes of transmission include the eyes, nose, and cut or abraded skin. Being a part of the society, many common spaces are shared with other people and this makes it possible to

spread diverse microorganisms that can lead to infections. Public areas such as restaurants, public transportation systems, parks, schools, daycare centers, health care facilities and other community areas can bring a large number of people together and facilitate the transmission of microbes [17].

Many environmental materials could serve as a mode of spread of pathogens in the population in many ways. Hence, environmental factors could play an important role in the transmission of microbial agents to humans [9]. The most common media of microbial transmission are water, soil, air and certain objects such as door handles, mobile phones, staircase hand rails, office desk, among others. People may also serve as medium of transmission through physical contact with each other or indirect contact with contaminated surfaces [7]. In addition, some enteric and respiratory pathogens are capable of surviving for several hours to months on fomites depending on their number, type and the environmental factors [12]. The level of contamination of different objects by potential pathogenic microorganisms is of public health importance, as such, contaminated materials can be a possible sources of transmission of such pathogens. This is likely due to the fact that, communicable diseases may be spread through contact with these contaminated fomites [1].

Gastrointestinal infections can occur by direct hand to mouth transfer of infectious agents that are transmitted via hands or environmental surfaces. Infectious agents that could be spread through these routes include bacterial strains such as *Salmonella*, *Shigella, Campylobacter*, *E. coli* (including *E. coli* O157 and *E. coli* O104), *Helicobacter pylori* and *Staphylococcus aureus* [14]. Studies according to [8] showed that *Staphylococcus aureus* bacteria is also the most common cause of skin and soft tissue infections, which are mostly self-limiting, but a little percentage of these cases, lead to severe invasive bacteremia or pneumonia. Micro-organism live as transient contaminants in fomites or hands where they constitute a major health hazards, Bacteria and Fungi are always present in our body, houses, workplaces and whole environment. Fortunately among many billions of Bacteria, only 1,500 can be dangerous for health, causing ranges of disease including; Pneumonia or skin infection [3].

Handrail, also referred to as banister, is the part of staircase that people often hold on to get support while going up and down the stairs. The handrail must provide stability and a continuous guide along the stair [19]. These handrail can be made of a variety of materials [20]. A stair, or a stair step, is one step in a flight of stairs. In buildings, stairs is a term applied to a complete flight of steps between two floors. A stair flight is a run of stairs or steps between landings. A staircase or stairway is one or multiple flights of stairs leading from one floor to the other, and includes landings, newel posts, handrails, balustrades and other parts. A stairwell is a compartment extending vertically through a building in which stairs are placed. A stair hall is the stairs, landings, hallways, or other portions of the public hall through which it is necessary to pass when going from the entrance floor to the other floors of a building. Box stairs are stairs built between walls, usually with no support except the wall strings [2].

Materials and Methods

Study area and study design

This study was carried out in the Faculty of Life Sciences (FLS), Ambrose Alli University, Ekpoma, Nigeria. FLS is comprised of five departments which included Microbiology, Biochemistry, Plant Science and Biotechnology, Zoology and Human Nutrition and Dietics. Ambrose Alli University is a State owned University. This study was designed to investigate the level of bacterial contaminations of the stair case handrails in the Faculty of Life Sciences which is made up of a ground floor, first and second floor. These staircase runs from the ground floor to the second floor.

Materials and instruments used

The materials and equipments used in this study included, incubator, masking tape, hot air oven, light microscope, sterile swab sticks, measuring cylinder, glass pipettes, bunsen burner, conical flasks, nutrient agar, MacConkey agar, blood agar, eosin methylene blue agar, beakers, pasteur pipettes, wire loops, cotton wool, hand gloves, bijou bottles, petri dishes, and others.

Media preparation

All media were prepared according to the manufacturer's specification and sterilized at 121°C for 15mins. The media used included, Nutrient agar, Eosin Methylene Blue agar, MacConkey agar, Blood agar.

Sterilization of materials used

All glass wares were properly washed with detergents, rinsed in distilled water, and sterilized at 100°C in a hot air oven for 1 hour. Wire loops were sterilized by passing them through a Bunsen burner flame until it was red hot before used and media prepared were sterilized by autoclaving at 121°C for 15 minutes.

Sample collection

According to methods adopted by [16], commercially purchased swab sticks (oxoid) were used to swab each rails of the stair case in Faculty of Life Science which comprise of ground floor, first floor and second floor. A total of twenty seven swab samples were collected, nine from each of the floors, and the swab samples were taken by gently rubbing the sterile moistened (to increase the chances of obtaining microbes from the dry steel staircase) swab sticks on the surface of each staircase rails and taken to Microbiology laboratory for analysis.

Isolation and identification bacteria

In this study, the methods by [15] was adopted. Briefly, after the collection of the samples with the swab stick, they were then immersed in peptone water for two hours. Thereafter, from the peptone water culture, 1ml was taken and put inside a test tube of 9ml distilled water, from which serial dilution was done on six test tubes. After serial dilution, 0.5 ml was taken from the fourth test tube and poured on a sterile petri dish onto which molten nutrient agar was added for pour plate method of culturing so as to enumerate the bacterial load. This was then incubated at 37°C for 24 hours. After 24 hours incubation, colonies were counted and recorded. These colonies were then sub cultured onto Blood agar, MacConkey agar and Mannitol Salt agar, and incubated at 37°C for 24 hours. All suspected colonies were Gram stained and subjected to biochemical tests which were carried out to identify the bacterial isolates as described by [4].

Results and Discussion

Results

The bacteria isolated from this study as biochemically characterized were *Staphylococcus aereus*, *Escherichia coli*, *Staphylococcus epidermidis* and *Proteus* spp. It was also shows the bacterial load of the isolates while, Table 3 shows frequency of bacteria isolates from rails of the stair case samples were *Staphylococcus aereus* 12(30%), *Escherichia coli* 9(23.25%), *Staphylococcus epidermidis* 9(23.25%) and *Proteus* spp 6(12%). From the result obtained it shows that *Staphylococcus aereus* 12(30%), have the highest percentage of occurrence in the samples.

Cultural Characteristic	Gram reaction	Cat	Coag	Ind	Ur	OX	Citrate	Lactose	Glucose	Organism identified
Golden yellow	+ Cocci	+	+	-	-	-		+	+	*Staphylococcus aereus*
Red colonies	- Rod	+	-	-	+	-	-	+	+	*Staphylococcus epidermidis*
Round pinkish	- Rod	-	-	-	-	-	-	+	+	*Escherichia coli*

Table 1: Cultural, Morphological and Biochemical Characteristics of Bacterial Isolates.

Keys: Cat= Catalase, Coag= Coagulase, Ind= Indole, Ur= Urease, + = Positive, - = Negative, OX= Oxidase.

Sample Number	Mean Total Bacteria Count		
	1st Floor	2nd Floor	3rd Floor
Wing A	7×	4×	2×
	6×	4.5×	4×
	8×	6×	2×
Wing B	7×	6×	3×
	9×	4×	1×
	8×	3×	2.5×
Wing C	4×	2×	2×
	3×	4×	1×
	7×	3×	4×
Total	5.9×	3.6×	2.1×

Table 2: Mean Total Heterotrophic Count of Bacterial Isolates From Each of the Floors in FLS.

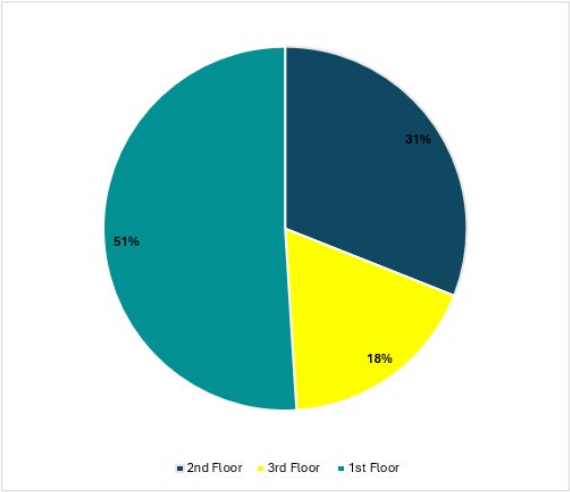

Figure 1: Percentage Distribution of Bacterial Isolates from each Floor.

Isolates	Number of Isolate and Frequency
Staphylococcus aereus	12 (30%)
Escherichia coli	9 (23.25%)
Staphylococcus epidermidis	9 (23.25%)
Proteus spp	6 (12%)
Total	36 (100%)

Table 3: Frequency of Bacteria Isolates from Rails of the Stair Case Samples.

Bacteria isolates	TET	AUG	CPR	OFL	GEN
S. aureus	R	S	R	S	S
E. coli	S	S	S	S	S
Proteus sp	S	S	R	S	S
S epidermidis	S	S	S	S	S

Table 4: Antibiotic Inhibition Spectrum of bacteria isolated from rails.

Key: R = Resistance; S = Sensitive.

Discussion

Rails of the stair case are mostly found in public places and are commonly touched by hands. Hand rails are contaminated with bacteria from human secretions as saliva, urine and skin origin and in turn these hand rails serve as vehicle for cross-infections and recontamination of unwashed hands [13]. Moreover, majority of isolated bacteria in this research work are potentially pathogens and can be transferred from one person to another [6]. This research work shows that the level of contamination of stair case rails of the stair case from the samples collected in Faculty of Life Sciences (FLS).

The incidence of bacterial load, types and antibiogram of bacteria isolated from FLS sraircase rails revealed that the bacterial load from this staircase rails ranged from $1x10^4$ to $9.0x10^4$. The stair case contamination assessed in this study resulted in the isolation of some bacterial isolates which included *Staphylococcus aereus* 12(30%), *Escherichia coli* 9(23.25%), *Staphylococcus epidermidis* 9(23.25%) and *proteus* spp 6(12%). The findings of this research work is in line with that of [5], where he stated that most of the bacteria contaminants of staircase from their study are coliforms.

It was also shown that of the three floors, ground floor staircase rails had the highest number of bacteria 5.9 $x10^4$, followed by first floor which had 3.6 $x10^4$ and finally, 2.1 $x10^4$. This could be attributed to the fact that the ground floor of FLS is majorly accessed by all students and staff of the faculty because most of the lecture rooms and some offices are on this ground floor and the first floor is occupied by some offices and few lecture rooms and finally, the second floor is comprised of conference rooms and few offices hence no much persons come to this floor all the time which could be the reason for lowest numbers of bacteria isolated from the staircase hand rails. This is in concurrence with the findings of [14].

It was shown that *Staphylococcus aereus* 12(30%), had the highest percentage of occurrednce in the samples, which also tallies with findings of [18], while the least occurrence was *Proteus* spp 6(12.0%). The presence of these pathogenic organisms re-occurring in this study has attributed to the fact that these bacteria could cause disease and infection to students and staff on campus. From the antibiogram profile of this research, it was also revealed that augmentin and gentamycin were the most effective antibiotics to treat infections caused by these organisms because none of the isolates were resistant to these antibiotics, which differs from the findings of [10], where they discovered tetracycline as the most potent antibiotics in their study. To better protect public health on

campus, it is vital to highlight the need for, effective disinfection of staircase rails with ethanol to minimize the hazard caused or to reduce bacterial contamination that may come in contact with the Rails of the stair case on campus.

Conclusion and Recommendation

Conclusion

This study has revealed the presence of the following bacterial isolates, *Staphylococcus aereus*, *Escherichia coli*, *Staphylococcus epidermidis* and *Proteus* spp from the staircase handrails in FLS. The presence of these pathogenic organisms in this study has attributed to the fact that these organisms can cause disease and infection to students and staff of Ambrose Alli University, thus individuals should maintain their personal health at a high level to avoid contacting these bacteria.

Recommendations

- The Rails of the stair case must be cleaned with disinfectant at regular intervals.
- Students should avoid holding the rails of the staircase when walking through the walk way.
- The use of hand rails made of a heavy metal such as; silver or copper reduce bacteria contamination.
- The use of self-disinfecting technology on the hand rails minimize the attachment of microbes or delay the development of bioflim.
- Students and Staff should always wash their hands regularly and use hand sanitizers always.

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