BACTERIAL CONTAMINATION AND ANTIBIOGRAM OF ISOLATES FROM THE HANDS OF UNDERGRADUATE STUDENTS AND FOMITES AT NNAMDI AZIKIWE UNIVERSITY NNEWI CAMPUS ANAMBRA STATE

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Abstract

Background: Health professionals are at high risk of acquiring bacterial contamination and are potential sources of health-acquired infections as well as community acquired infections. This study determined the bacterial contamination and antibiogram of isolates from the hands of undergraduate students and fomites at Nnamdi Azikiwe University, Nnewi Campus, Nnewi Anambra State.

Methods: A cross-sectional study was conducted between April and July 2022 in different Departments of Faculty of Health Sciences and Technology. A total of 112 swab samples from hands of students of health profession and 20 seats were swabbed using a simple-rinse method. The isolated Bacterial colonies were counted and species were identified using standard bacteriological techniques. Antibiotic susceptibility testing was performed using a disk diffusion technique. Chi-square test was done to ascertain the association between variables.

Results :The proportion of *E.coli* was found to be 17.9%, followed by *klebsiella pneumonia* with prevalence of 11.9%, while *Salmonella* and *Proteus* spp were 10.3% and 8.3% respectively. The relationship between the number of bacterial isolated from hands and seat was significant (P=0.01), (X^2=8.7.). The overall multidrug-resistant rates among *E.coli, Klebsiella pneumonia, Proteus species, Salmonella* species were 50%, 43%, 43%, 43% and 35% respectively.

Conclusion: There is low prevalence of pathogenic enteric bacteria among students in the study area.

Key Words: *Enteric bacteria, students, fomites, hands, Nnewi.*

Introduction

The hands are the chief organs for physical manipulation of the environment. As a paired organ, the hand is controlled by the opposing brain hemisphere[1] and enables one to do all manner of things. The hand serves as a medium for the propagation of microorganisms from place to place and from person to person. Although it is nearly impossible for the hand to be free of microorganisms, the presence of pathogenic bacteria may lead to chronic or acute illness. Human's hands usually harbour microorganisms both as part of body normal flora as well as transient microbes contacted from the environment[2]. The natural habitat of microorganisms like Staphylococcus is the human skin and can therefore be passed from one person to another[2]. Many food-borne diseases and pathogenic microorganisms are spread by contaminated hands[2]. One common way by which organisms that are not resident in the hand are picked up is by contact with surfaces such as table tops, seat surfaces, door knob or handles, banisters, toilet handles and taps in restrooms[3].

Other surfaces such as classroom surfaces have been shown to play a role in the transmission of human pathogens either directly, by surface-to-mouth contact, or indirectly, by contamination of fingers with microorganisms from the gut and subsequent hand-to-mouth contact[3]. Several studies have shown that classroom surface carries and spread of Salmonella bacteria which causes salmonellosis[3]. *Campylobacteriosis*, like many gastrointestinal human diseases, has its ecology in which the propagation of human infection and disease depends on pathogen survival and finding new hosts to replicate and sustain the pathogen population[3]. Environmental factors that influence the size of the pathogen reservoirs include temperature, nutrient availability, and moisture availability during the period the pathogen population is moving through the environment between infected and susceptible hosts[4]. University students are exposed to higher risks of diarrheal disease by consuming contaminated water and food and contact with surfaces. If proper treatment not given, this can prove fatal, particularly to university students under 18 years old [4]. Many of these illnesses occur unnecessarily since the fecal-oral routes of disease transmission are easily

Materials And Method

Study area

Nnewi is the second largest city in Anambra State in South Eastern Nigeria, and is a metropolitan city comprises of two local government areas, Nnewi North and Nnewi South. Nnewi North is commonly referred to as Nnewi central, and comprises four autonomous Villages: Otolo, Uruagu, Umudim,and Nnewichi

Study Design

A total of one hundred and twelve (112) samples collected from classrooms seat surfaces and hands surfaces of students were used for this study. The seats were randomly selected from different Departments in the Faculty of Health Sciences and Technology. Thereafter, each of the seat surfaces and hand surfaces of students were carefully swabbed using sterile swab stick. Each of the swab sticks was inoculated on M*acConkey* and *Salmonella, Shigella* Agar and incubated at 37 degree Celsius for 24 hours. Afterwards, the colony growth were read and coliforms isolated based on their media characteristics. The isolated colonies (coliforms) were preserved as pure colonies on nutrient broth. The colonies isolated were differentiated and identified into their separate species using specific biochemical tests such as; Indole, motility test for *E. coli*, catalase and dextrose fermentation test for *salmonella* and *shigella*.

Sampling Technique

Seats and students hands were randomly selected using stratified sampling technique. *A sample size of 112 was used to carry out this research.*

Sample collection.

Sample was collected using sterile moist swab sticks to swab the hands and seats surfaces. The swab sticks was secured immediately into their containers and labelled properly with date and identification number for ease of identification. The swab sticks were then taken to the laboratory for processing within 30 minutes of collection.

Sample processing and identification of pathogen

Each swab sample was inoculated on sterilized blood agar, MacConkey agar and Chocolate agar plates respectively and incubated at 37 C for 24 hours. Each plate was examined for evidence of growth and the isolates identified by gram staining and standard biochemical tests; Indole production, Citrate utilization, Urease test, Methyl-Red (MR) Test, and Voges-Proskauer (VP) Test.

Statistical analysis

Chi-square test was done to ascertain the association between variables at level of significance of $p = \geq 0.05$

Results

From the prevalence of *Enterobacteriecae* isolated from hands and seat surfaces, the results showed that out of the 112 samples collected, E.*coli* had the highest prevalence 60 (17.9%) followed by *Klebsiella pneumonia* 40(11.9%), *Proteus* 28(8.3%), and the least isolated *Salmonella* 10(3.0%) (Table 1). 20 samples from the left hands, 23 from the right hands and 17 form the seat surfaces yielded the growth of *E.coli.* 15 samples from the left hands, 16 from the right hands and 9 from the seat surfaces yielded *Klebsiella Pneumonia*. *Proteus species* were isolated from 13 swabs from the left hands, 7 swabs from the right hands and 8 from the seat surfaces, while the growth of *Salmonella* were detected from 5, 2, and 3 swabs from, left hands, right hands and seat surfaces respectively (Table 2).There is significant difference in the number of bacterial isolated from the hands and seats with p-value 0.01 and X^2 value of 8.7. **Table 3:** Antibiogram of bacterial isolates from the hands of medical students and formite. All the isolates demonstrated varying degree of susceptibility and resistant to the tested antibiotics.The overall multidrug-resistant rates among *E.coli, Klebsiella pneumonia*, *Proteus species*, and *Salmonella* Species were 50%, 43%, 43%, 43% and 35% respectively.

Table 1: Prevalence of bacterial isolates

Bacterial isolates	Frequency	Prevalence
E.coli	**60**	**17.9**
Klebsiella	**40**	**11.9**
Proteus	**28**	**8.3**
Salmonella	**10**	**3**

Table 2: Correlation between different sites of sample collection

Bacterial isolates	Left hand sample	Right hand sample	Seat sample	chi-square	p-value
E.coli	**20**	**23**	**17**	**8.7**	**0.01**
Klebsiella	**15**	**16**	**9**		
Proteus	**13**	**7**	**8**		
Salmonella	**5**	**2**	**3**		
No growth	**59**	**64**	**75**		

t -value is significant at =0.05

Table 3: Antibiogram of bacterial isolates from the hands of medical students and formite

Bacterial isolates	OFX	CPX	PEF	AU	SXT	CN	CEP	AMX	N	S	LEV	NA	CTRX	LYN	Overall MDR (%)
E.coli	S	S	S	S	R	S	S	S	R	R	R	R	R	R	50
Klebsiella	S	S	S	S	R	S	R	S	R	R	S	R	S	R	43
Proteus	S	S	S	S	R	S	R	S	R	R	S	R	S	R	43
Salminella	S	S	S	S	R	S	S	R	S	S	S	R	R	R	35

MDR= Multidrug resistant; S= Sensitive;R= Resistance;
OFX=Ofloxacin; CPX=Ciproflaxacin PEF= Reflacine;
AU= Augmentin; CN= Gentamycin; AMX= Amoxil;
N= Ampicillin S= Streptomycin; CEP= Ceporex;
LEV= Levosloxacin; NA = Nalidicic acid
CTRX= Ceftriaxone; LYN= Lynlomycin;
SXT= Cotrimoxazole

Discussion

The results revealed that *E.coli* which is an enteric pathogens had the highest prevalence rate of 17.9% followed by *klebsiella pneumonia* 40(11.9%). Bassey *et al*. [6] in their study also documented high prevalence of *E.coli* followed by *Klebsiella* sp. Others are Proteus 28(8.3%), and the least isolated Salmonella 10(3.0%). The low prevalence of these isolates might be because an average student especially in medical school understands the implication of dirty environment and as thus observe personal hygiene to an extent. The presence of these organisms in the study area might be as a result of students transferring microorganisms form different locations into the lecture hall. The implication of this is that it's presence in the study area might result from faecal contamination of hands of students. This study also revealed that potentially pathogenic Enterobacteriaceae are present in different sampled fomites. The findings from this study affirmed earlier report that inanimate surfaces harbours pathogenic organisms[7]. The occurrence and survival of organisms on inanimate surfaces is greatly influenced by their ability to inhabit and thrive on dry surfaces [8]. This intrinsic feature is due to the presence of surface molecules (flagella, pili and polysaccharide capsule) and the production of extracellular matrix (adhesion molecules and biofilms) [9,10].

The association between the number of bacterial isolated from hands and seat was significant, this finding proves that faecal -oral transmission is one of the means of disease transmission[3].

The sensitivity results indicated that most of the bacterial isolates were sensitive to the majority of the antibacterial agents utilized in the study.

Escherichia. coli showed highest resistance rate to all the tested antibiotics with overall multi drug resistance rate of 50%. This agrees with the result of the study by Bassey *et al*., 2022. *Escherichia coli* is known to produce Extended Spectrum β-Lactamses[11]. These enzymes inactivate the potencies of antibiotics; this explains its exceptional insensitivity to some of antibiotics as seen in this study. Sensitivity to gentamycin recorded in this study agrees with another study [12]. Susceptibility to ciprofloxacin in this study corroborates the finding of a similar study [6] which reported 47.9% sensitivity. Resistance and sensitivity of Klebsiella to Nalidixic acid and Ciprofloxacin(CPX) respectively in this study, disagrees with findings of [6] who recorded 100% susceptibility of Klebsiella to nalidixic acid and 7.4% resistance to CPX.

The high resistance rate observed among members of Enterobacteriaceae in this study supports earlier assertion that majority of multidrug resistant isolates in clinical and environmental samples are Gram negative bacteria [13, 14]. Gram negative bacteria possessed outer membrane in addition to cell wall. This membrane prevents many substances from entering into the cell [15].

CONCLUSION

Inanimate surfaces of classroom seats and hands of students habour members of enterobacteriaceae but at low prevalence. Most of the isolates demonstrated multidrug resistant to commonly used antibiotics.

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