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BACTERIOLOGICAL EVALUATION OF NAIRA NOTES HANDLED BY STUDENTS DURING COVID -19 PANDEMIC IN DELTA STATE UNIVERSITY, ABRAKA

Jemikalajah D. Johnson[1], Anie O. Clement[2]*, Enwa F. Oghenemaro[2] and Agholor J. Chuka[1]

[1]Department of Microbiology, Faculty of Science Delta State University Abraka. Nigeria
[2]Department of Pharmaceutical Microbiology, Faculty of Pharmacy, Delta State University, Abraka, Nigeria.

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***Corresponding Author**
Anie O. Clement
Department of Pharmaceutical Microbiology, Faculty of Pharmacy, Delta State University Abraka, Nigeria.

ABSTRACT

This study investigated the bacteriological evaluation of Nigerian currency notes handled by students in Delta State University, Abraka. One hundred (100) swab samples were obtained from naira notes surfaces owned by students. Bacteria isolation and identification was carried out using standard microbiological techniques. The bacteria isolates were; *Staphylococcus aureus, Streptococcus* sp, *Bacillus* sp, *Escherichia coli, Salmonella* sp, *Klebsiella* sp, *Pseudomonas* sp and *Citrobacter* sp. Out of the 100 samples examined, the naira notes handled by males had the higher prevalence than the females. Among the isolates from males, *Staphylococcus aureus* (19%) was the most prevalent bacterial isolate while *Citrobacter* sp (2%) was the least. For females, *Staphylococcus aureus* (15%) was the most prevalent isolate while *Klebsiella* sp (2%) was the least prevalent. The habit of improper hygiene and poor handling of naira notes is responsible for the high level of bacteria isolated in this study.

KEYWORDS: Bacteriological evaluation, students, naira notes, Abraka.

INTRODUCTION

The Naira note is the federal republic of Nigeria official currency, that is issued and being regulated by the central bank of Nigeria (CBN) that was brought into the nation in the year 1945 and there have been some changes that have been made to several denominations that is used as legal tender, as a means of exchange of services and goods, debts settlements and also

for deferred payments in the economic activities (Ogba, 2007). There are many naira notes denominations comprising of ₦5 to ₦1000 notes. The Nigeria currency is classified into two main groups; the paper category which include 1000 to 100-naira notes that is comprised of 25% linen and 75% cotton and polymer category (50, 20, 10, 5-naira notes) are made of polymers such as Biaxially Oriented Polypropylene (BOPP) (Yakubu *et al.*, 2014). The currency notes contamination could result from various sources such as atmosphere during usage, storage, production or handling. During daily transactions, currency notes usually pass through a lot of hands and pathogens are attached on them (Matur *et al.*, 2010). Ogo *et al.* (2004) equally observed that th*e* source of contamination could result from inappropriate handling of money manners such as money spraying during occasions where such naira notes could be trampled upon when they are dropped on the floor or ground. Just a single incidence of contact with hand with a surface that is contaminated leads to a unpredictable degree of transfer of pathogen (Bernholz, 2003). Infectious transmission through contaminated hands among students is a common pattern seen in higher institutions and failure to perform appropriate hand hygiene practices has been recognized as a significant contributor to outbreaks of infectious diseases by the world health organization (WHO, 2009; Jemikalajah *et al*., 2021). Hand washing is critical in this era of covid-19 where human to human transmission is mainly through respiratory droplets from infected individuals, contact with contaminated objects and surfaces such as Naira notes (Imai *et al.*, 2020; Majumdar and Mandl, 2020; Jemikalajah *et al.*, 2021). Hands transmission was usually most successful with *Escherichia coli*, *Salmonella* sp*p*., *Staphylococcus aureus* (all 100 percent); *Candida albicans* (90 percent); rhino virus (61 percent); hepatitis A virus (HAV) (22 percent to 33 percent); and rotavirus (16 percent). As a result of overwhelming evidence of low compliance with hand hygiene, the risk from contaminated surfaces cannot be overlooked (Pope *et al.*, 2012).

Observational proof has recommended that the environment usually play an important role in the transmission of hospital acquired pathogens during outbreaks. This description has been for a variety of types of bacteria, including *Acinetobacter baumannii*, *Clostridium difficile* and MRSA. Nevertheless, the authors stressed that proof to support the very role of environmental contamination is not strong for all types of nosocomial pathogens (Pope *et al.*, 2012).

Majority of the persons does not put money in their wallets and attitude of squeezing of paper currency is usually common, most especially in the midst of market women, bus drivers, motorcyclists, and their conductors, butchers, restaurant operators and meat sellers. For example, women do place money underneath their brassier with sweat, under the carpet or rugs and men in their socks. Market men and women squeeze paper moneys and put them into their dirty pockets. Such money handling habits can introduce microbes to the notes. Similarly, storage of paper currency in polythenes, cotton, leather bags in humid and dark conditions also favor the growth of microorganisms (Girma, 2015).

Earlier studies have revealed that the virus is capable of surviving for a period of time depending on the surfaces: human hands (510 minutes), Paper (3-4 hours), Copper (4 hrs), fabrics (6-12 hrs), metal surface (12 hrs), and cardboard (up to 24 hrs). And even up to 72 hours on stainless steel and plastics (CNBC, 2020; Van Doremalen *et al*., 2020). The virus are retained on these surfaces for a long period awaiting to be picked up by hands of people when surfaces are touched and then touch their ears, eyes; nose or mouth, from where the virus can find its way into the respiratory tract of the human victims and initiates an infection. There are some evidences that the virus is also shed for longer period in faecal matter, so poor toilet hygiene is a predisposing factor to COVID-19 (BBC News COVID-19, 2020). It is heat labile and doesn't tolerate sunlight rays. It gets inactivated at temperature of 26.27^{0}C in vitro; hence the climate of each geographical region affects its transmissibility. The viral envelop is sensitive to organic solvent, thus, alcohol-based sanitizer are used for prevention and control (Liu *et al*., 2020). Because of the mode of transmission of the virus, facemasks and regular hand washing were recommended as means of preventing the human to human transmission. Nonetheless, facemasks are easy to use and as well more at ease to wear compared with the respirators, however they cost less. The original intention of using facemasks was to aid in protecting surgical wounds from staff-generated nasal and oral bacteria (Lai *et al.*, 2012; Romney, 2001). In recent times facemasks have found much more usage in municipal cities where there is frequent and evitable close contact among the people, mostly inside public transportation facilities, workplaces and shopping malls. This study is aimed at the bacteriological evaluation and determination of the prevalence of bacterial isolates on Naira notes handled by students in Delta State University, Abraka.

MATERIALS AND METHODS

Materials

Foil paper, Beakers, Measuring cylinders, Weighing balance, Hand gloves, Glass slides, Microscope, Masking tape, Incubator, Sterile pipette, Cotton wool and spirit, Inoculating loop.

Study area

This project was carried out in the Department of Microbiology, Delta State University, Abraka, Delta State. Abraka is located between 6^{o}C to 15^{o}C North and 5^{o}C to 50^{o}C East of Delta State, Nigeria as shown in Figure 3.1. The University being a multi-campus university of three campuses is located within a distance of approximately 200 km apart. Presently, having a population of student of about 36,000 (in the 2007/08 session), the University offers several programs ranging from the diploma, full-time certificate and degree courses to part-time and even weekend degree programs.

Study design

This study is experimentally designed using a sterile swab dipped in peptone water.

Sample collection

One hundred (100) swab samples were obtained from naira notes surfaces owned by the female and male students by random selection in Delsu, Abraka.

Methodology

Samples were analyzed using culture technique as described by Cheesebrough (2004). Media include MacConkey agar and blood agar were prepared in accordance with instruction of manufacturer.

Culture of samples

The plates were inoculated and incubated aerobically at 37^{o}C for 24hrs. After incubation, bacterial growth was identified based on various biochemical and morphological tests (Cheesebrough, 2004).

RESULTS

One hundred (100) surfaces of naira notes owned by students were swabbed. Bacteria were isolated and then identified using standard microbiological procedures. The bacterial isolates were; *Staphylococcus aureus, Bacillus* sp, *Streptococcus* sp, *Pseudomonas* sp, *Escherichia*

coli, *Klebsiella* sp, *Salmonella* sp and *Citrobacter* sp. Out of the hundred 100 samples examined, the naira notes that were handled by male folk had the higher prevalence than the females. Among the isolates from males, *Staphylococcus aureus* (19%) was the more common bacterial isolate while *Citrobacter* sp (2%) was the least. For females, *Staphylococcus aureus* (15%) was the more common isolate while *Klebsiella* sp (2%) was the least prevalent.

The bacterial isolate of Naira notes among students is shown in Table 1. Out of 100 samples screened, *Staphylococcus aureus* was the most common while *Salmonella* sp and *Citrobacter* sp were the least prevalent.

Table 1: Bacterial isolates of naira notes among students.

Bacterial isolates	No. of samples	No. (%)naira note positive	No. (%)naira note negative	% prevalence
Staphylococcus aureus	100	34 (34)	66 (66)	34
Streptococcus sp	100	13 (13)	87 (87)	13
Bacillus sp	100	9 (9)	91 (91)	9
Escherichia coli	100	28 (28)	72 (72)	28
Salmonella sp	100	2 (2)	98 (98)	2
Klebsiella sp	100	9 (9)	91 (91)9	9
Pseudomonas sp	100	4 (4)	96 (96)	4
Citrobacter sp	100	2 (2)	98 (98)	2

From table 2, bacterial isolates recovered from currency notes among male and female students showed that males had the higher occurrence of bacterial isolates when compared with females' students. *Staphylococcus aureus* was the most prevalent for both male and females. *Salmonella* sp, *Citrobacter* sp, *Pseudomonas* sp was not isolated from females.

Table 2: Bacterial isolates recovered from Naira notes among male and female students.

Bacterial isolates	No. of samples	NO. (%) Naira notes positive (male)	NO. (%) Naira notes negative (male)	NO. (%) Naira notes positive (female)	NO. (%) Naira notes negative (female)
Staphylococcus aureus	100	19 (19)	81 (81)	15 (15)	85 (85)
Streptococcus sp	100	9 (9)	91 (91)	4 (4)	96 (96)
Bacillus sp	100	5 (5)	95 (95)	4 (4)	96 (96)
Escherichia coli	100	18 (18)	82 (82)	10 (10)	90 (90)
Salmonella sp	100	2 (2)	98 (98)	0 (0)	100 (100)
Klebsiella sp	100	7 (7)	93 (93)	2 (2)	98 (98)
Pseudomonas sp	100	4 (4)	96 (96)	0 (0)	100 (100)
Citrobacter sp	100	2 (2)	98 (98)	0 (0.0)	100 (100)

From Figure 2, occurrence of isolates of bacteria were presented in descending order; *Staphylococcus aureus* (33.66%); *Escherichia coli* (27.72%); *Streptococcus* sp (12.87%); *Bacillus* sp (8.91%); *Klebsiella* sp (8.91%); *Pseudomonas* sp (3.96%); *Salmonella* spand *Citrobacter* sp (1.98%) respectively.

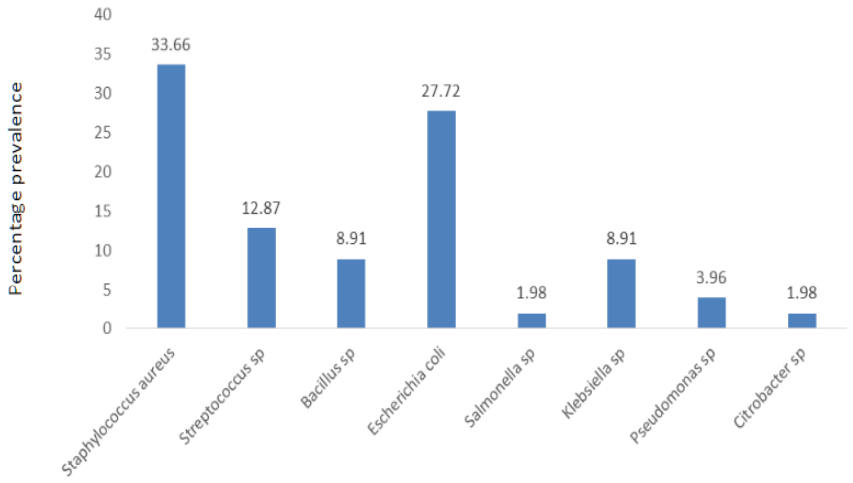

Figure 2: Prevalence of bacterial isolates.

DISCUSSION

This study revealed that naira notes used by students of Delsu, Abraka were contaminated with a variety of bacteria such as *Staphylococcus aureus, Streptococcus* sp, *Salmonella* sp, *Bacillus* sp, *Escherichia coli, Citrobacter* sp *Klebsiella* sp, *Pseudomonas* sp were isolated. The existence of these organisms on naira notes is indicative that naira notes can provide a means of bacteria spread, some of which are pathogenic and can cause serious illnesses. The present study is not unlike to the work of Umeh *et al.* (2007). In their work, they isolated *Staphylococcus aureus, Streptococcus* sp, *Salmonella* sp, *Bacillus* sp, *Escherichia coli*. This finding is equally in supports of the reports from other regions of the globe that legal tender notes are normally contaminated by organisms which cause a great deal of sickness as earlier observed by Pope *et al*., (2002); Siddique, (2003) and El-Dars and Hassan, (2005) including tuberculosis (Basavarajappa *et al*., 2005).

The prevalence of isolates of bacterial showed currency notes that are handled by males had a higher prevalence than females. *Staphylococcus aureus* was reported to be the most common bacterial isolate. This could be as a result of *Staphylococcus aureus* being a common bacterium, usually present as the human normal flora. The organism might become

pathogenic if found outside the normal microbiota or resident commensal. Similarly, the result of Yazah *et al.* (2012) showed that *Staphylococcus aureus* (22.5%) was the commonest bacteria isolated from the naira notes in their research which was conducted in Maiduguri, Borno State. However, this percentage value of *Staphylococcus aureus* (22.5%) isolated, in their study was much lower than the recorded *Staphylococcus aureus* (33.6%) in our present study. This may be attributed to high hygiene standard and environmental differences.

Furthermore in this study, the bacterial isolates prevalence according to gender showed that Naira notes from male students was higher when compared to their female counterpart. This could be as a result of the fact that female students practice more personal hygiene practices than males. Most male students barely wash their hands even after using the toilet where as the females often wash their hands after using the restroom and after carrying out domestic chores as observed by Goktas and Oktay (2012).

In conclusion, this study has shown that the naira notes that were handled by Delta State University Students were contaminated by bacteria. *Staphylococcus aureus* was the most offending organism especially in this period of Covid -19 in which frequent hand washing and sanitization is among the policy of the disease elimination. These findings showed that, the microbial contamination is slightly lower the previous studies, therefore, there is little improvement in compliance to hand washing policy. We therefore recommend proper personal care in the handling of naira notes.

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CONFLICT OF INTEREST

None.

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