Research Article

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Evaluation of Pathogenic Bacteria Associated with the Nigerian's Currency

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ABSTRACT

Background: *The pathogenic bacteria causing various diseases in man and animals have divers' means and routs of infection. The clear understanding of the vehicle by which a disease is transmitted or spread is highly significant in controlling the disease; various diseases have been reported by different authors to have been contacted from communal water supply, fomites and other materials jointly shared or used by the people living in a community. Therefore, this study was designed to evaluate the kind of pathogens associated with the Nigerian's currency in order to educate the citizenry on the proper and the hygienic ways of handling money.*

Methods: *Swabbed samples the Nigerian's currency was collected from different occupational group of people in Ondo State namely: students, commuters, farmers, market people, artisans, office workers, butchers, and bankers. The samples were subjected to standard microbiology test techniques in order to identify the pathogens associated with the Nigerian's currency.*

Result: *Concerning the study data, one-way ANOVA was done using statistical software SPSS Version 20. The total viable microbial count of the Nigerian's Naira note ranged from 2.0 x 102 to 9.8 x 102 Coliform Forming Unit/ mil (CFU/ML) of the sterile distilled water used as the diluent. In this study, the result of the pathogenic microorganisms isolated is arranged in descending order as follow: Staphylococcus aurous (198%), Pseudomonad aeruginosa (178%), Salmonella typhi (60%), and Escherichia coli O157:H7 (56%).*

Conclusion: *This study shows that the Nigerian currency notes are contaminated with pathogenic microorganisms especially the enteric pathogens that can cause severe infection in susceptible individuals. Therefore, the teeming population should be informed on strict hygienic practices, such as hands washing after contact with money.*

Keywords

Evaluation, Nigerian's currency, Pathogen.

Introduction

Nigeria currency is the type of money used for commerce in the country. Pathogenic bacteria have been known to be transmitted by various objects collectively called 'fomites' thus, this study is therefore designed to evaluate the different pathogenic bacteria associated with the country currency and denominations. Over the last two decades especially in countries like Turkey, United State and Australia, data from various authors had shown that disease pathogens are transmitted by inanimate objects called fomites including money used in commerce [1]. Infectious dose of pathogens may be transferred to the mouth after handling such contaminated article like currency. According to the study carried out in 2010 by Oladayo in Abeokuta, Ogun State, the following bacteria species were isolated from the Nigeria currency: Klebsiella (21.6%), *E. coli* (13.2%), *Staphylococci* (12.8%) and *Pseudomonad* (5.6%). Similarly in another study conducted in Makurdi, Benue State, Nigeria, the following percentages of pathogens were recovered; *Escherichia coli* 80%, *Aerobacter* 59%, *Salmonella* 40.9%, Yeast cells 36.4%, *Streptococcus faecalis* 31.8%, *Staphylococcus aurous* 27.3% [2]. Currency may become contaminated with pathogens by direct contact with body secretions or fluids, contact with soiled hands, contact with aerosolized pathogens (large droplet spread) generated via talking, sneezing, coughing, or vomiting or contact

with air borne pathogens on the surfaces [3]. Up until 1987, the Center of Disease Control and the American Hospital Association focused on patient diagnosis due to the belief that nosocomial infections were not related to microbial contamination of surfaces [5]. There is now growing evidence that contaminated fomites or surfaces play a key role in the spread of pathogenic infection [4]. Therefore this study was designed to evaluate the pathogens associated with the Nigerian currency in order to get the citizen inform on how best to hygienically handle the money for health reason.

Methodology

Eight different denominations (5, 10, 20, 50, 100, 200, 500 & 1000) Naira of the Nigeria currency were sampled randomly from different occupational group of the people in Ondo state namely: Market people, artisans, office workers, bankers, students, commuters, farmers, and butcher. Each denomination was swabbed with moist swab-stick and kept in sterile transport medium in sample bottles and brought to the laboratory for analysis.

Isolation of the pathogens

Collected samples of the each Naira note in the transport medium were incubated overnight. at 37°C. Ten-fold serial dilution of the bacterial suspension was made and cultured on plates count agar. Isolated colonies were later gram stained and grown on selective media known for the isolation of a specific pathogenic organism. *Staphylococcus aurous* was isolated by plating the colonies on Mannitol salt agar (MSA); *Escherichia coli* O157:H7 was isolated by plating the colonies on sorbitol MacConkey agar (SMA); *Pseudomonad aeruginosa* was isolated by plating on cetriminde agar; xylose lysine deoxycholate agar was used to isolate *Salmonella typhi*. The isolated organism was biochemically authenticated using API biomerieux diagnostic kits.

Results

The result of the microbial load of different denominations of the Nigerian's currency in this study can be seen in Table 1. The ₦50 note had the highest microbial load (9.8×10^2) Coliform Forming Unit / Mil of the sterile water used in the dilution, followed by ₦100 note (5.2×10^2), followed by ₦ 20 note, and ₦ 1000 note, while the ₦ 5 note had the lowest microbial load.

Different pathogenic microorganism in the Nigerian's currency isolated from different occupational groups in Ondo State can be seen in Table 2. Each pathogen is represented by numerical numbers (1, 2, 3, and 4), as legend. The four pathogens; *E. coli* O157:H7, *Staphylococcus aurous, Pseudomonad aeruginosa*, and *Salmonella typhi* were found in farmers as well as in market people and butchers. Three of the pathogens were found in artisans and commuters while the students had only two of the pathogens, that is *Pseudomonad aeruginosa* and *Staphylococcus aurous*.

Concerning the total percentage of the pathogens found in the Nigerian's currency, the result is shown in Table 3. *Staphylococcus aeruginosa* had the highest percentage (198%), followed by *Pseudomonad aeruginosa* (178%), and *Salmonella typhi* (60%) while *E. coli* O157:H7 had the lowest percentage.

The occurrence of different pathogens isolated from the Nigerian's currency denominations in Ondo State can be seen in Figure 1. The highest occurrence of *E. coli* O157:H7 (160%) among all the denominations sampled in this study was found in ₦5 note, followed by ₦100 (100%), ₦1000, ₦200 and ₦10 note (80%) respectively, while ₦20 and ₦50 notes had (40% & 20%) significantly. The highest occurrence of *Staphylococcus aurous* (400%) among the denominations was found in ₦20 note, followed by (320%) found in ₦1000 note, followed by (300%) found in ₦5 note, 280% was found in ₦500 note, 240% was found in ₦50 note, (200%) was found in ₦10 note, while the lowest 100% was found in ₦100 note. Moreover, the highest occurrence of *Salmonella typhi* (120%) was found in ₦ 5 and ₦500 notes, followed by 100% found in ₦10 note, trailed by 60% found in both ₦50 and ₦20 notes, the lowest occurrences in the ladder (40% and 20%) were found in ₦ 100 and ₦ 200 notes respectively. For *Pseudomonad aeruginosa*, the highest occurrence (360%) was found in ₦200 note, trailed by 300% found in ₦1000 and ₦10 notes respectively, followed by 200% found in both ₦500 and ₦5 notes, 160% found in ₦100 and ₦20 notes, while the lowest 80% was found in ₦50 note.

Currency in Nira (₦)	Sample collected	Microbial load in CFU/mil
₦ 5	5	2.0×10^2
₦ 10	5	4.2×10^2
₦ 20	5	5.0×10^2
₦ 50	5	9.8×10^2
₦ 100	5	5.2×10^2
₦ 200	5	4.4×10^2
₦ 500	5	4.0×10^2
₦ 1000	5	4.6×10^2

Table 1: Microbial load of different denominations of the Nigerian currency.

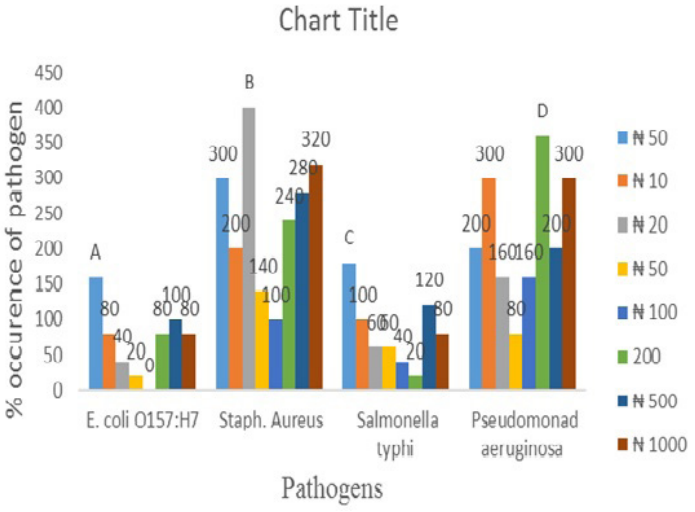

Figure 1: Percentage occurrence of different pathogenic microorganisms in the Nigerian's denominations

Mean with different alphabet outside end of the bars are significantly different P>0.5.

Occupation	Sample collected	Pathogen
Commuters	5	1, 2, 3
Students	5	3, 2
Artisans	5	2, 3, 4
Tailors	5	2, 4
Bankers	5	2, 3
Butchers	5	1, 2, 3, 4
Market people	5	1, 2, 3, 4
Farmers	5	1, 2, 3, 4

Table 2: Different pathogenic microorganism in the Nigerian's currency isolated from different occupational groups.
Key: 1=*E. coli* O157: H7, 2=*Staph. aurous*, 3=*Pseudomonad aeruginosa*, 4=*S. typhi.*

Pathogens	No of sample collected	Total %
Staph. Aurous	5	198
Pseudomonad aeruginosa	5	178
Salmonella typhi	5	60
E. coli O157:H7	5	56

Table 3: Summary of percentage pathogens isolated from the Nigerian's currency in Ondo State.

Discussion

The evaluation of pathogens bacteria associated with the Nigerian's currency was carried out in this study. The enteric pathogens, *E. coli* O15:H7, *Staphylococcus aurous*, *Salmonella typhi* and *Pseudomonad aeruginosa* were isolated from different denominations sampled in this research. The percentage of the pathogens found in this study, that is, 198% for *S. aurous*, 18% for *P. aeruginosa*, 60% for *S. typhi*, and 56% for *E. coli* O157:H7 was higher than the one carried out in the University of Agriculture Makurdi, reported by Umeh et al., which were; *Staphylococci spp.* 2.3%, *Salmonella spp.* 40%, and *E. coli* 80%. The discrepancies could be due to the method of isolation, the hygienic status or practices of people resident in the studies areas which are quite different from one another and moreover the precision in experimental procedures. In the work of Umeh et al., the pathogens were not identified to species level, but in this study, it was identified to strains level.

The result of this study authenticates the users of the Nigerian's currency and denomination that is human being because all the pathogens isolated from this money are the bacteria found in human. This implies that the currencies were contaminated with the microbes obtainable in the boy of the end users. From the results of this study, it was discovered that the percentage occurrence of *S. aurous* and *P. aeruginosa* were highest than other pathogens, this could be due to the fact that *S. aurous* and *P. aeruginosa* are prevalent in the surface area of human body than other group of these pathogen [1,5,6]. Moreover, it was also noted that the occurrence of these pathogens in Nigerian's denomination was also proportional to the occupational status of the users. For instance, farmers, market people and butchers had all the pathogens present in the money or currency they used. This could be due to environmental factors making some pathogen more preponderant than the rest [3,7].

Conclusion and Recommendation

The evaluation of pathogenic bacteria in the Nigerian's currency carried out in this study has showed that pathogens, most especially the enteric ones that could cause severe infection in both man and animals are associated with the money even at a very high percentage. Therefore, the citizenry should be well informed on proper ways to handle them and the strict hygienic practices they should be involved after touching money like thorough washing of hands before eating foods. Moreover government should educate the people on how to keep and spend the money. The syndrome of pasting money on the faces in the ceremony should as a matter of urgency is discouraged as this practice could post a critical health hazard to the people.

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