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A Study of Bacterial Profiling on Currency Notes and Coins

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ABSTRACT

Paper currency notes and coins act as fomite, containing microorganism on their surface which is transferred from one person to another. Currency notes and coins are heavily contaminated by microbes, playing a chief role in the spread of microorganisms which include normal saprophytic micro flora to pathogenic microorganisms. Accordingly, several studies demonstrated the fact that currency notes has been identified as one of the principal vehicle that convey pathogens which lead to specific health hazard to community. A number of sources that may contribute to currency contamination include counting machine, atmosphere, during storage, usage, managing and production. For the undertaken research, a total of 12 samples were collected from different sources from public sector. Microbial analysis was performed by serial dilution conducted in TSB broth and the inoculated cultures transferred into the selective agar medium. Isolation and identification of bacteria was performed by gram staining, colonial morphology and biochemical characteristics. The current study revealed that the frequency of microorganisms recovered from currency as 66.66% *E.coli*, 33.33% *Shigella spp* and 100% was *S.aureus.* Antimicrobial susceptibility test performed for the confirmation of bacterial isolates. These all isolates are associated with potential infection. Currency notes and coins identified as a prospective health danger because pathogen would spread through circulation of notes and coins. By the help of personal hygiene standards we can reduce the risk of potential bacterial infection.

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Introduction

Pathogenic microorganisms are agents that attack the body and alter the immune system (1). They are prokaryotic and unicellular, causing serious life-threatening infections (2) microorganisms are ubiquitous in nature found in soil, radioactive waste, water, biomass and even organic matter. The habitat of microorganism the bodies of life forms, like plants and animals and also exist as a normal flora in the human body, and thrive on the skin and within the digestive tract. They also play a vital role in recycling of nutrients. While a body's immune system contribute to the elimination of these bacteria (3).

Microorganisms that are present in air, water, and food etc., are easily spreading from one person to another. The most common mechanism of the spread of pathogens is by fomites (4). Fomites or insentient objects play a major role in indirect spread of infections like diphtheria, trachoma, gastroenteritis, whooping cough and diarrhea cause by pathogenic microorganism. Currency contaminated by microbes might also represent as fomites, playing a key role in the communication of microorganisms (5). Money is used as a medium for goods exchange, payment of debts and for overdue expenses in financial activities. A number of sources that may contribute to currency contamination include; counting machine, the atmosphere, in course of storage, usage, managing or production. (6). Currency notes could

be contaminated by air droplets during coughing, sneezing, touching with previously contaminated hands or other components. People when they count the money they usually tongue-wet the currency notes for convenience which thereby contaminate their hands as well as currency notes. So, it is obvious that anything that gets on hands may be transferred to money and vice-versa (7). Currency notes are often handled by various groups of individual during transaction (8). Many disease causing microorganisms serve as likely sources of entero-pathogens that might survive on the currency notes and to be the reason of infections and potential sporadic cases of food borne diseases (9). Some studies showed that the bacterial survival on coinage and copper seems to be affected regarding their growth size. For this reason it has been concluded that coins begin to bear opportun¬istic bacterial pathogens, but contain very lesser amount of microorganisms (10).

Some previous studies show the occurrence of bacteria on Bank notes and coins of a large number of developed countries. Although the studies conducted from Pakistan, united state, India, Saudi Arabia, Nigeria, Kenya, Mexico, Burma, China and Turkey but few of all found significant amount of contamination on their currency. The major pathogens that are present on money are *Escherichia coli, Vibrio spp., Klebsiella. pneumonia , Serratia spp., Enterobacter spp., Salmonella typhi, Acinetobacter spp , Enterococcus spp., Staphylococcus aureus, Bacillus spp., Staphylococcus epidermidis, Streptococcus pneumoniae, Proteus spp., Pseudomonas aeruginosa, Shigella spp., Corynebacterium spp., Lactobacillus spp., Burkholderia spp., Micrococcus spp. and Alcaligenes* (12) .

Contact of a hand with a contaminated surface can effect in an inconsistent degree of pathogen transmission. Nosocomial pathogens act as a reservoir in hospitals materials such as beds and keyboards that fall in contact with the person and may transmit these microorganisms and also serve as infectious agent for cross transmission (13). Currency notes and coins are mainly carrying pathogenic microorganism on it. Moreover, various fomites in the operation theater which is another source of direct or indirect association with surgical methods were found to be diversely contaminated with familiar microbial pathogens (14). All these pathogens associated with threatening infection ranging from skin infection to food born infection.

However, because of the lack of statistical importance, occurrence of invalidate factors or lack of randomization, the disinfection and hygiene preventive studies regulate thus far could not establish a definitive underlying determinants. An important evaluation for preventing food-borne diseases is hygiene training for food handlers. Many food markets greatly rely on the interchange of money for food. Due to lack of appropriate hand hygiene that causing the condition uncertain. Additionally, food-handling tools can ease prevent cross-contamination present between currency and food through contact with the hands it might be probable to lessen the cross contamination by the training of workers, who cannot wash hands between venture. For that reason the reduction of food borne illnesses through the transmission of these pathogens on currency, regular vaccination of food handlers for Hepatitis A Virus infection can lessen the spread of food borne infection caused by Hepatitis A Virus (15).

Materials and Method

Sample Collection and Preparation: The 12 samples of notes and coins are taken from different sources. The samples (coins and notes) were aseptically placed in to a sterile tube containing 10ml TSB broth to dislodge the micro organisms and then removed the notes and coins. Serial dilution was made up to ten fold dilutions in TSB broth to obtain the discrete colonies.

Plating and Culturing: 0.1ml was taken from 10-1 dilution and by using streak plate method inoculates the culture on Nutrient agar, Blood agar and MacConkey's agar, these plates were then incubated at 31 ºC for 24 hours.

Identification of Microorganisms: The colonies were identified by microscopic examination and physical examinations by interpreting colony morphology and Biochemical tests such as IMVIC, Catalase and Coagulase tests.

Results

Table I: The percentage of the isolated microorganisms form the currency notes and coins

Organisms	Percentage
Shigella spp	33.33%
E.coli	66.66%
S.aureus	100%

Table II: Antibiotic Susceptibility Test for confirmation of organism

Organisms	Zone Of Inhibition	Results
S.aureus	20mm and 22mm	Sensitive

In the present study, 12 samples are subjected to microbial analysis includes the culturing all the notes and coins obtained from various sources from public sector were contaminated with bacteria. Three different species were isolated. Escherichia coli were isolated from 8 samples as (66.66%), *Shigella spp* from 4 samples as (33.33%) and *Staphylococcus aureus* from 12 samples as (100%) shown in (Figure 1) and (Table I). The colonial morphology of *E.coli* on MacConkey's agar appear as pink color lactose fermenting colonies as shown in (Figure 2) and non lactose fermenting colonies indicated the presences of Shigella (Figure 3). The growth on Nutrient agar shows yellow pigmented pin pointed colonies and beta hemolysis on Blood agar indicated the presence of *S.aureus* (Figure 4). For the further confirmation, biochemical test were performed for gram negative bacteria include; TSI and cirtate and for *S.aureus* catalase and coagulase were performed. The TSI for *E.coli* interpreted as butt and slant (acidic) gas production is positive and H_2S negative and citrate utilization test is also negative. The TSI of *Shigella spp* interpreted as slant (alkaline), butt (acidic) and gas production and H_2S negative and citrate utilization test is also negative. For *S.auerus* coagulase and catalase test is positive. The gram reaction of *E.coli* and Shigella are gram negative rods and *S.aureus* are gram positive cocci in bunches. For the further confirmation of *S.aureus*. The antibiotic susceptibility test was performed on MHA by using Novabiocin. The zone of inhibition is 20mm and 22mm which indicated the presences of *S.aurues* because it is sensitive to Novabiocin (Table II).

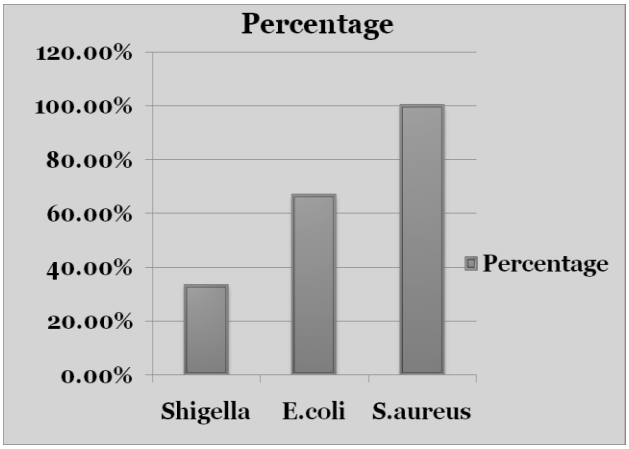

Fig 1: The microorganisms isolated from currency notes and coins

Fig 2: (Lactose fermenting colonies of *E.coli* on Macconkey agar)

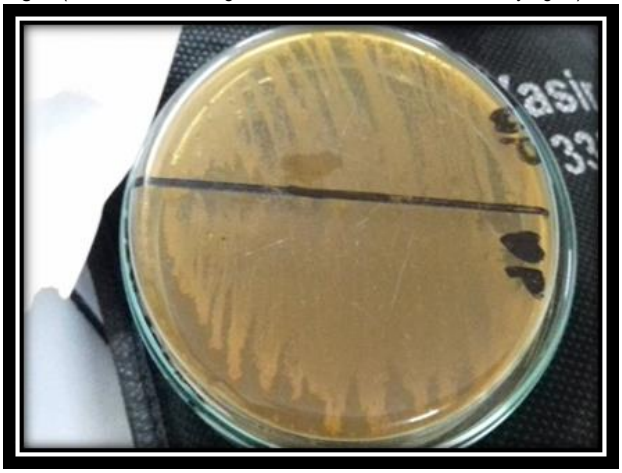

Fig 3: Non-lactose fermenting colonies of *Shigella spp*. on Macconkey agar.

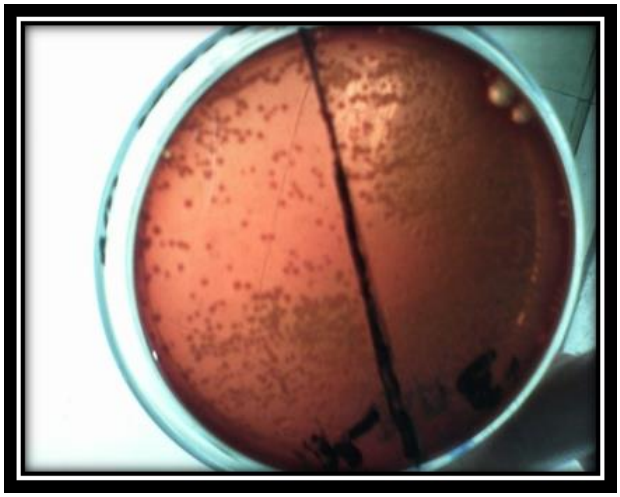

Fig 4: Colonies of *S.aureus* are surrounded by a zone of beta hemolysis.

Discussion

The recent study was conducted in accordance to investigate the isolation & identification of bacterial pathogens on the circulation currency notes & coins. Total of 12 samples were preceded for this purpose. Isolation and identification of pathogenic bacteria i.e. *S.aureus*, *E.coli* & Shigella was conducted. However, these bacteria are associated with potential and pathogenic diseases or infection. Many people do not concern about their sullied fingers when they deal with money; the butcher with their hands contaminated with bloody fingers, the street food vendors with their wetly-oily fingers and others collect or hold the paper currency with contaminated hands, these all conditions can lead to the contamination of currency with pathogenic microorganisms. It is quiet common that individuals who handle the notes discharge some of their body's normal flora on the currency note leading to the dissemination of microbes between the handlers. Moreover, the contamination of the notes can be detected through dust, soil, water, micro flora of the different handlers (hand, skin, etc.). Some people usually use their saliva when tally the notes. Majority of people does not bring money in wallets and pinching of paper currency is common, especially among market women, motorcyclists, bus drivers and bus conductors, butchers and meat sellers, restaurant operators, etc. currency notes made up of cotton provide a fibrous surface, which bear great opportunity for bacterial attachment, and more long a currency notes stays in circulation, the more chances of contamination are there. On the other hand, the occurrence of a significant amount of copper in coined metal alloys appears to be restricting the bacterial survival on coins (11). Currency notes and coins identified as a likely health hazard due to the spread of pathogen through circulation of notes and coins but because of public education on proper handling and caution of currency notes and coins are advocated in association to minimize currency contamination (15).

Conclusion

It can be concluded that currency is potential source of contamination such as pathogenic bacteria and the people are getting microorganisms form the currency notes easily that causing the serious problems among people. Awareness is highly recommended related to the improvement of personal hygiene and money handling practices to reduce the risk of infection.

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