

ISOLATION AND IDENTIFICATION OF PATHOGENIC BACTERIA AND FUNGI FROM INDIAN CURRENCY

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ABSTRACT

Microbial contamination plays a massive role in spreading diseases globally. Bacterial contamination of gram- positive, spore-forming bacteria, gram-negative rods, and fungus was tested on Indian rupee notes of various denominations. Bacteria and fungus were identified on almost all of the cash notes that were analyzed. Overall, our findings indicated that banknotes are contaminated with pathogenic germs and intestinal microorganisms and could be a source of severe infection. The present study recommends that paper currency be converted into plastic currency notes to avoid infections.

Keywords: Contamination, fomites, Indian currency notes, infectious diseases, bacteria, fungi.

1.0 INTRODUCTION

The banknotes either paper currency or coins are essential for goods and services worldwide. The word money is originated from a temple of hera located on Capitoline one of Rome's seven hills. The currency notes mostly passed from hand to hand or from one individual to another can be contaminated with potentially pathogenic bacteria and fungi by many different ways that may spreads infectious diseases. At the beginning of the seventies banknotes and coins were reported as carriers of potentially pathogenic microorganisms (Jiang and Doyle, 1999; Khin *et al.*, 1989). The risk of transmission of pathogenic micro- organisms and diseases by currency was reported world- wide but most of these studies were performed in the tropical or subtropical regions of the world (Ahmed *et al.*, 2010; Enemour *et al.*, 2012). In the late 1800s and early 1900s, scientists began to theorize that the transmission of money was associated with the transmission of dis-

ease. Modern scientific techniques have confirmed these theories and have shown that viable pathogenic organisms (bacteria, and fungi) can be isolated on the surfaces of both paper and coin currency. Coins contain copper which can hindering growth of microbes, paper currency offers a large surface area as a breeding ground for pathogens. microbes may persist on it for longer period. the older the paper note the more accumulation of microbes occurs (El-Dars and Hassan,2005). The banknotes are contaminated by people who are living unhygienic life like handling currency with unclean hands or by placing them on dirty surfaces, they can also be contaminated by droplets during coughing or sneezing and also storage of these contaminated notes in polythenes, cotton, leather bags in humid and dark places also help the growth of microorganisms. also attitudes such as the wetting of hands or fingers with saliva or use of contaminated water to lubricate the hand in counting money and use of food contaminated fingers in handling

currency notes may not only enhance the contamination of currency notes but may also increase the risk of infection from contaminated at low hygiene levels of community or society. Currency is identified as public health hazard as pathogen spreads by circulating of banknotes. The tested Indian currency was found to be contaminated with a large number of microorganisms including potential pathogens that may cause diseases in healthy individuals and also immunocompromised individuals. The isolated bacteria species was gram positive, staphylococcus aureus, staphylococcus epidermidis, staphylococcus saprophyticus and spore forming bacteria such as bacillus subtilis, bacillus pumilus also members of the family enterobacteriaceae, mycobacterium tuberculosis, vibrio cholerae, and few gram negative rods. some different types of fungi were also isolated like penicillium sp, cladosporium sp, fusarium sp, trichoderma sp, aspergillus sp and yeast. The study was conducted to isolate the microbes present in each of the sample of currency notes and to analyse the load of microbes and their characterization to create public awareness and personal hygiene after handling currency notes and to study the effectiveness of sanitizers and hand washes against potential pathogens. it was observed that high values of India currency are less contaminated because high values are less exchangeable in the community than low values of currency.

1.1 Isolation of bacteria: To isolate and identify the microorganisms present on the surfaces of both paper and coin currency notes circulating in India by sterile cotton swab dipped in the sterile distilled Water and rubbed currency notes surfaces and inoculate onto the nutrient agar and potato dextrose agar (PDA) for each note and to analyse the load of microbes and their characterization also to create public awareness and personal hygiene after handling currency notes and to study the effectiveness of sanitizer and hand washes against potential pathogens.

2.0 ISOLATION AND IDENTIFICATION OF MICROBES

The isolation and identification of microbes is done using standard techniques Gilchrist, M. (1993). The

Bacteria and fungi were isolated from currency notes by rubbing sterile cotton swabs on both (central parts)sides of the notes and inoculate the cotton swab on 1% peptone water broth and incubated at 37c for overnight then observed for bacteria colonies (Kawo et al., 2009), and on solid media like , blood agar and MacConkey agar or placing the currency notes in 100 ml of nutrient broth and potato dextrose agar, (Singh, 2002), to isolate fungi microscopic slides were prepared after 1 week of fungi growth mounted on lactophenol cotton blue and fungi species were identified under compound microscope (Bruge et al.1977). for differentiation of pathogenic bacteria, the gram stain and acid fast stain impart different colours to different bacteria or bacterial structures.

2.1 Morphological and biochemical characterization of the isolates: The isolated bacteria were classified by Cappuccino et al., 2007 based on their morphology, staining and biochemical studies. Gram's staining was carried out to investigate the morphology and Gram's reaction of bacterial isolates. These biochemical tests were carried out: MR (methyl red) test, VP (Voges- Proskauer) test, Indole production test, Catalase test, Citrate utilization test, Starch hydrolysis.

2.2 Source responsible for contamination of paper currency: Microorganisms are known to spread via air, water, food and so on. An important mechanism of the spread of pathogens by fomites. The contamination currency notes go in circulation and contaminate the hands of others. Wetting hands or fingers with saliva or using contaminated water to lubricate the hand when counting money could result in the transfer of parasites and bacteria from that medium to the notes. Paper currency notes may also be contaminated by droplets during coughing sneezing and placing money on dirty surfaces. Under humid and dark conditions, storage of these notes under polythene, cotton or leather bags also favours the growth of fungal and bacterial species. on them (Barolia et al., 2011). Microbial contaminants may be transmitted directly by contact with each other by hand. The pathogens found on these currency notes may cause a wide variety of diseases from food poisoning wound and skin In-

fections, Microorganisms on the skin can be transferred from cashiers, salespeople and the general public to the currency notes that they handle (Badviet et al., 2010), and also respiratory and gastrointestinal problems to life threatening diseases such meningitis and septicaemia. many coins contain copper which can hindering growth of microbes, paper currency offers a large surface area as a breeding ground for pathogens. microbes may persist on it for longer period. The older the paper note the more accumulation of microbes occurs (El-Dars and Hassan, 2005). As a result, hand hygiene is considered critical for preventing food outbreaks and transmission of infectious diseases (Oyero et al., 2000), and some various yeast and fungi were isolated from paper currency. The most commonly isolated fungal species was *aspergillus niger*, followed by *aspergillus flavus*, *candida spp.*, *penicillium spp.* and *rhizopus spp.* (Rote et al, 2010). Some other studies in India indicate that the existence of microbial pollutants and fungi such as *aspergillus niger* and *fusarium spp* have been assessed for currency notes from different occupational groups. Most bacteria species implicated included members of the family *enterobacteriaceae*, *mycobacterium tuberculosis*, *vibrio cholerae*, *bacillus* species, *staphylococcus sp.*, *micrococcus sp.* and *corynebacterium sp.* Most likely contaminants of paper money are environmental organisms like Gram-positive flora (especially *bacillus sp.*) and those from human normal skin flora like *staphylococcus*.

3.0 FUTURE DIRECTIONS AND RECOMMENDATIONS

Preventing the spread of microbes is based on creating public awareness and personal hygiene after handling currency notes because currency notes provide an indirect route for hand to hand contamination which increases the possibility of the transmission of potential pathogenic microbes. The transmission of these microbes is identified as a public health hazard. People should be aware of the risk of handling currency notes at low hygiene levels and should also be educated about the importance of hygiene especially after handling currency notes. The safety measures should be clearly

mentioned and explained in a very simple way to be understood and followed by everyone all over the world.

3.1 Preventive measures: Creating a public awareness on how to handle money to reduce transmission of bacteria and hand contamination.

3.2 Hand washes: The hands should be washed with soap or disinfected hand washes immediately after handling the banknotes in order to prevent and stop the transmission of pathogenic microbes from one individual to another. We should be serious about our health and caution on how to handle the banknotes and living a hygienic life.

3.3 Re-sterilization points at banks: The banknotes should be re-sterilize in banks to minimize the risk of transmission of pathogenic microorganisms. re-sterilizing of Indian currency with disinfectants chemical in banks after a few months or should make a point where can replace old notes with new banknotes.

3.4 Replacement of payment methods with: Replacement of payment methods with digital money could be a better solution to the problem. Because digital money is less infected and expands the usage of Credit Cards as an alternative. Manufacture improves Indian banknotes manufactured by adding antibacterial and antifungal agents. It can reduce transmission of microorganisms.

4.0 PLASTIC NOTES

India currencies are paper notes but according to some studies plastic notes are more safe paper notes. We should avoid the use of paper currency during taking food and also not takes food on newspaper by vendor, Baker and Canteen patron and other food products which ready-to-eat food sellers should be educated to avoid possible cross contamination between currency notes and the food they sell, Hygienic importance of dishwashing waters, utensils, hands and pieces of money from street food processing sites in Ouagadougou (Burkina Faso) (Barro, et al., 2006 Todd, et al., 2008). The machines like ATMs should be made to sanitize money by destroying the microbes by heat or short exposure to antimicrobials. The paper or coatings used should be with antimicrobial

properties for currency notes. It is very important for Banks and business organizations to make use of machines made for the purpose of counting money and avoid using saliva for wetting the notes.

5.0 CONCLUSION

The Indian banknotes in circulation that were tested were found to be contaminated with pathogenic microorganisms which play an important role in transmission of diseases from one individual to another; the currency notes must be handled with

caution and there should be public awareness of the fact that currency notes can be a source of infection and dangerous to individual health. Also re-sterilization points at banks and replacement of payment methods with digital money could be a better solution of the problem or expand the usage of Credit Cards as an alternative.

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