



PREVALENCE OF PATHOGENIC MICROORGANISMS ON INDIAN CURRENCY NOTES COLLECTED FROM GONDIA DISTRICT OF MAHARASHTRA

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ABSTRACT Currency notes represent a universal medium for the transmission of bacteria in the environment and among humans. Paper currency notes are used to exchange goods and services and the circulation from one individual to another which potentially spreads microorganisms. The present study aimed to isolate and identify the level of contamination by microbial pathogens and the possible disease risk associated with of the Indian currency notes. The potentially pathogenic bacteria found on these Indian currency notes, are *E. coli*, *S. aureus*, *Proteus sp.*, *Klebsiella sp.*, *Pseudomonas* and *streptococcus* which may cause a wide variety of diseases through food poisoning, wound, skin infections, respiratory and gastrointestinal problems to life-threatening diseases such as meningitis and septicaemia. Considering our findings, it seems that the disinfection of currency in banks by ultraviolet light, supersonic, and chemicals means, would decrease the risk of transmission of infection. Replacement of the traditional methods of trading with electronic money transactions would of course be another good solution for the problem.

KEYWORDS

Currency notes, Hygiene, Transmission of diseases, Microbial Pathogens

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INTRODUCTION:

Currency used as measuring units in a trade deal offers it as a medium for the exchange of goods and services, settlement of debts, overdue disbursements in economic activities, and make it a store of value for savings (Borah *et al.* 2012; Basavarajappa *et al.* 2005) and unlike coins, paper banknotes provide a large surface area for bacterial attachment and proliferation (Vriesekoop *et al.* 2000; Umeh, 2007). In India, there is a habit of counting the currency by saliva instead of the regular procedure of counting with water in a sponge moreover can be contaminated by droplets during coughing, sneezing, touching with previously contaminated hands or other materials, and placement on the dirty surface (Ogbu *et al.* 2007). Thus currencies act as a tool for easy transfer of bacterial and cross-contamination takes place (Sushil Kumar *et al.* 2011; Hosen *et al.* 2006; Alemu, 2014).

Research has shown that paper currency offers a larger surface area as a breeding ground for pathogens and the survival of various microorganisms on money and their transmission via the hands of food vendors is often overlooked as an enteric disease reservoir (Angelakis *et al.* 2014). Microbes may persist on it for longer periods hence the older the paper note the more accumulation of microbes (Ghamdi *et al.* 2011) and are of considerable likelihood to be contaminated with disease-causing microorganisms especially if handled with unclean hands or kept in dirty or contaminated surroundings (Narayan *et al.* 2015; Michaels B, 2002). There is a possibility that currency notes might act as environmental vehicles for the transmission of potentially pathogenic microorganisms. Contamination from the skin, anal region, wounds, nasal secretions, and aerosols generated by sneezing and coughing are potential sources of microorganisms transfer to currency notes during handling (Neel, 2012; Emikpe *et al.* 2012). Therefore, the aim of the current study was designed to find out the prevalence of Pathogenic microorganisms on the Indian currency notes and possible associated risk factors collected from various communities that is a potential vector of various bacterial pathogens and their susceptibility to antibiotics.

MATERIALS AND METHODS:

The present study deals with prevalence of pathogenic bacteria on Indian currency, which leads to the source for microbial transmission causing infectious diseases to represent public health hazards to the community and individuals. A total of 60 Indian currency notes (Rs.10, Rs.20, Rs.50, and Rs.100) were collected from the various communities of the Gondia district such as vegetable vendor, flower vendor, auto-rickshaw puller, kirana shops, juice vendors, poultry seller, medical shops, railway ticket counter, hospitals, dairies, bank counters, fish market, restaurants, panipuri vendors and tea stalls etc. directly into a

sterile zip lock polythene bag and transferred to microbiology laboratory for subsequent analysis. Each currency note was aseptically transferred into an individual culture tube containing 10 ml of sterile lactose broth and the culture tube was vigorously shaken for 2 minutes. The currency was removed and the resulting lactose broth served as a test sample with Durham's tube and incubated for 24 hours at 37°C. After incubation, the lactose broth showed with acid and gas production considered positive for further study. Positive Lactose broth culture (0.1 ml) spread on the selective CLED cultural media by spread plate method and all the Petri plates were incubated at 37°C for 24-48 hours. Typical colonies of microorganisms were isolated and were identified based on Morphological and Biochemical techniques by standard methods.

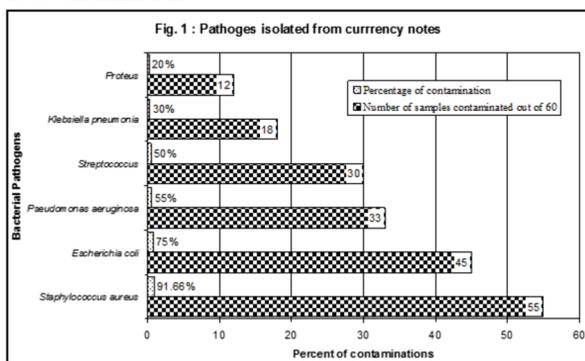
RESULTS AND DISCUSSIONS:

The present study represents public health hazards to the community and individuals caused by Indian currency which was collected from the Gondia district of Maharashtra. In Lactose broth, all 60 samples showed positive results with acid and gas formation. The positive lactose broth samples were followed by cultural identification on CLED medium which showed 45 currency notes contaminated with *Escherichia coli*, 18 with *Klebsiella pneumonia*, 33 with *Pseudomonas aeruginosa*, 55 with *Staphylococcus aureus*, 30 with *Streptococcus*, and 12 with *Proteus* respectively. Further, the identification of bacteria followed by morphological and biochemical characteristics by standard methods..

Microorganisms	Number of currency notes contaminated out of 60	Percentage of contamination
<i>Staphylococcus aureus</i>	55	91.66%
<i>Escherichia coli</i>	45	75%
<i>Pseudomonas aeruginosa</i>	33	55%
<i>Streptococcus</i>	30	50%
<i>Klebsiella pneumonia</i>	18	30%
<i>Proteus</i>	12	20%

The higher contamination of Indian currency is due to the six different types of microorganisms namely *Staphylococcus aureus* (91.66%) followed by *Escherichia coli* (75%), *Pseudomonas aeruginosa* (55%), *Streptococcus* (50%), *Klebsiella pneumonia* (30%), and *Proteus* (20%) (Table 1). Goktas and Oktay (1992) isolated aerobic spore-forming *Bacilli* (91%), *Staphylococcus epidermidis* (63.3%), *Staphylococcus aureus* (4.2%), *Enterococcus* (24.1%), alpha haemolytic *streptococcus* (4.1%), *Streptococcus pneumonia* (1.7%), *Corynebacterium* (7.5%), *Lactobacilli*

(10.8%), *Klebsiella pneumoniae* (31.7%), *Enterobacter* (19.2%), *E. coli* (17.5%), *Proteus* (1.7%), *Pseudomonas aeruginosa* (0.8%), *Shigella flexneri* (0.8%) from paper money samples of one hundred twenty currency notes. Elumalai *et al* (2012) concluded that all of the 30 notes were contaminated with eight different types of bacterial species viz *E. coli*, *Proteus mirabilis*, *Vibrio* sp., *S. aureus*, *Pseudomonas* sp., *Salmonella* sp., *Bacillus* sp., and *Klebsiella* sp. It was found the common occurrence of some bacteria isolated from currency notes regardless of their sources; those included *E. coli*, *S. aureus*, and *Pseudomonas* sp. This is expected, as lower denomination notes pass through more hands than the higher denomination during petty, daily monetary transactions and are often tattered, dirty. The present study suggested that Indian paper currency notes are highly contaminated with pathogenic microorganisms and this contamination may play a significant role in the transmission of infectious diseases (Weinstein *et al*, 2004). Indian currency is commonly contaminated with pathogenic bacteria and this contamination may play a significant role in the transmission of infectious diseases (Elemam *et al*, 2016). It is recommended that dirty and tattered notes should be deposited in the bank and discarded by the banks. Reserve Bank of India should also be planning to launch the currency notes made in plastic due to their washable and longtime durability (Boidya *et al*, 2015). Hence, great care must be taken while handling money during the preparation and handling of food to avoid cross-contamination.



CONCLUSION:

Indian currency notes are commonly contaminated from pathogenic and non-pathogenic microorganisms that represent risks and public health hazards to the community and individuals. As per the results of this present study, the suggestion may be made to people to improve their health consciousness by washing hands as a part of our Swachh Bharat Abhiyan after handling money notes or coins, prevent babies from handling currency notes, and avoid the use of saliva during the counting of currency notes as well as avoid placing money in the mouth, sticking currency notes in brassieres and biting off corners of banknotes (Ahmed *et al*, 2017). Thus it recommended that currency notes must be handled with caution as notes could be a source of infection and dangerous to health. Considering our findings, it seems that the disinfection of currency in banks by ultraviolet light, supersonic, and chemicals means, would decrease the risk of transmission of infection. Replacement of the traditional methods of trading with electronic money transactions would of course be another good solution for the problem.

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