



Review Article

Microbial flora in currency notes: an area of concern

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ABSTRACT

Currency notes are potential sources of bacteria and fungi that can cause various infections. Their role as fomites are not fully explored. Data from the scientific world is also scarce in this aspect. We here attempt to review the various types of currency notes and the common pathogenic microflora contaminating their surfaces. Possible solutions to this problem also remain to be discovered.

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1. Introduction

Microorganisms are ubiquitous and enter the human body through food, air, water and also through fomites.¹ In this respect currency notes act as very good fomites for transmission of infections, and usually get contaminated by microbes while coughing, sneezing or money counting by tongue-wet fingers.² This problem has been recognized since 1970 as observed in a study, where 13% of coins and 42% of currency notes, collected from laboratory personnel, were found to harbor potential pathogens.³

2. Role of currency notes as fomites

Inanimate objects like money can transmit pathogens causing Trachoma, whooping cough, diphtheria and gastroenteritis.¹ Dangerous multi-drug resistant nosocomial bacterial pathogens like Methicillin resistant *Staphylococcus aureus* (MRSA) and Vancomycin resistant *Enterococcus spp.* (VRE) are also commonly transmitted by these currency notes.¹ In this respect the fibrous surfaces of

cotton-based banknotes were found to be contaminated much more than the polymer-based newer currency notes since microbial adhesion was better.⁴ Since paper currency is widely circulated and used for all types of commerce, its chance of getting contaminated and transmitting pathogens is very high.⁵

3. Common microbes found contaminating currency notes

In a study from Pretoria, Republic of South Africa, the commonest bacteria found on currency notes and coins given as church offerings, taken together, were *Escherichia coli* and *Bacillus spp.*³ Smaller denomination notes were more contaminated with more colony counts.⁶ In another study from Pakistan, common bacterial strains from currency notes included *Klebsiella spp.*, Coagulase negative Staphylococci and *Pseudomonas aeruginosa*.¹ Apart from bacteria and fungi, currency notes can also transmit nematode pathogens like *Ascaris lumbricoides*, *Enterobius vermicularis*, *Trichuris trichiura* and *Taenia spp.*⁷ Parasitic contamination was found more commonly in notes collected from butchers.⁴

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4. Procedure to study microbial contamination of paper currency

Traditionally culture is the mainstay for such studies, but now 16S rRNA based approach and shotgun sequencing are being applied to study the microbes and their taxonomic distribution.⁸

5. Observations from India

Studies from India have shown that the common bacterial flora contaminating currency notes are usually *Bacillus spp.*, followed by Coagulase negative Staphylococci and *Micrococcus spp.*² This study was conducted by Pal et al, who also found that notes from hospital sources were contaminated more, while notes from banks were sterile.² A recent study by Elumalai EK et al found that *Proteus spp.*, *Vibrio spp.*, *Bacillus spp.*, *Klebsiella spp.* and *Salmonella spp.* were very commonly found on notes of Rupees 5/- and 10/- denominations.⁹

6. Our observation

We are also studying the colonization of currency notes by bacteria and fungi. According to our preliminary findings the commonest bacteria harboring the banknotes are *Bacillus cereus* and Coagulase negative Staphylococci. The notes are sourced from different areas like laboratories, faculty rooms and other areas.

7. Currency note contamination in the perspective of public health

In developing countries, almost 100% of currency notes are contaminated with microbes.⁴ In general, the paper currency notes contain 10 times more bacteria than polymer-based notes.⁴ These things have important bearing on transmission of disease and public health.

8. The possible solutions

Polymer-based currency notes can be a possible solution, as also going cashless. The newer polymer based currency notes have been found to be less contaminated with microorganisms than cotton-based notes, since cotton-based notes provide better surface for microbial adhesion.⁴

9. Future research

More such research needs to be carried out since this is an area of interest in public health.

10. Conclusion

The currency notes in circulation are very likely to get contaminated by pathogenic microorganisms, and paper

currency is more likely to get contaminated than polymer-based currency notes. Even the virus causing the ongoing pandemic, SARS-CoV2, can possibly be transmitted by currency notes, and hence hand hygiene has to be maintained after handling currency notes.¹⁰ These aspects should be studied well for future research in public health.

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13. Conflict of Interest

None.

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