



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL  
OF ADVANCED RESEARCH

## RESEARCH ARTICLE

### ASSESSMENT OF PERIO PATHOGENIC BACTERIAL CONTAMINATION OF INDIAN PAPER CURRENCY NOTES IN CIRCULATION: A POTENTIAL PUBLIC HEALTH HAZARD.

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#### Manuscript Info

##### Manuscript History:

Received: 14 January 2016  
Final Accepted: 25 February 2016  
Published Online: March 2016

##### Key words:

chronic periodontitis , paper, fomites ,bacteria , saliva.

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#### Abstract

##### Back ground :-

Paper currency , an exchangeable fomite is constantly subjected to contamination. The objective of this study is to identify periodontal pathogens on currency notes due to salivary contamination in chronic periodontitis patients.

##### Materials and methods :-

A total of 100 currency notes of denominations Rs 10, Rs 20, Rs 50, Rs 100 in circulation were randomly collected from chronic periodontitis patients and were asked to count the currency notes using saliva as is done routinely. This contaminated currency notes placed in sterile envelopes and were taken to laboratory immediately .

##### Results :-

Total 100 Indian currency notes were collected and included in the study which were subjected for standard microbiological tests , among those 58% were contaminated , both with pathogenic and non pathogenic organisms. Aerobic bacteria found were Bacillus species(6) , Staphylococcus aureus (10) , Coagulase negative staphylococci (8), Diptheroids (4) , Candida species (2) , E.coli (2) and anaerobic bacteria include Porphyromonas gingivalis (10) , Actinobacillus species (6), Prevotella intermedia (2), Fusobacterium nucleatum (2) , Streptococcus salavarius(2) .

##### Conclusion:-

From this present study it is concluded that Indian currency notes are contaminated with pathogenic and non-pathogenic organisms in chronic periodontitis patients.

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#### Introduction:-

Paper currency is widely exchanged for goods and services in most countries worldwide. Paper currencies are extensively used and each currency is exchanged many times during the time it circulates. Paper currency can be contaminated by droplets during coughing, sneezing, application of saliva on currency notes during counting, touching with previously contaminated hands or other materials and placement on dirty surface .These routes of transmission are of great importance in the health of many populations in developing countries, where the frequency of infection is a general indication of local hygiene and environmental sanitation levels (1). The environment plays an important role in transmission of microbial agents to humans, with many environmental materials serving as

vehicles (2). The possibility that currency notes might act as environmental vehicles for transmission of potential pathogenic microorganisms was suggested in 1972 by Abrams and Waterman. Paper currency provides a large surface area as breeding ground for pathogens (3).

Periodontitis is a disease that affects the tooth supporting tissues (periodontium) and is characterized by loss of periodontal attachment including the alveolar bone. The etiology of the disease is multifactorial and bacterial deposits play an essential role in the pathogenesis. The bacteria that are involved in periodontitis accumulate in the sub-gingival plaque that comprises predominantly of Gram-negative strict anaerobic rods. Among them *Porphyromonas gingivalis*, *Prevotella intermedia*, *Fusobacterium nucleatum*, *Bacteroides* spp., *Selenomonas* spp. have been associated with chronic or refractory periodontitis. However, some anaerobic, gram positive microorganisms such as *Peptostreptococcus micros* and *Eubacterium* species have recently been implicated in chronic periodontitis (4).

Money, whether in the form of coins or paper notes is perhaps the most widely handled article by people every day throughout the world. Since people from all classes of life handle them, they are bound to get contaminated either from environment or person handling them (5). Many people tongue wet their fingers when counting money thereby, contaminating their fingers as well as currency notes. So, it is obvious that anything that gets on hand may be transferred to money and vice versa (6). There are only few studies conducted to detect oral health risk associated with handling of currency notes. This study is to assess periopathogenic bacterial contamination of Indian paper currency notes in circulation.

## Materials and methods:-

**Study design:-** This study was a cross sectional study

**Study setting:-** The study was conducted in College of Dental Sciences, Department of Periodontics, Davangere for a period of 2 months ( December 2014- Jan 2015) .

## Participants:-

The study population included 100 patients with chronic periodontitis. (According to international workshop for classification of periodontal diseases, 1999) of age (25-50), includes 50 males and 50 females randomly selected.

Patients were made aware of the procedure and the purpose of the study. Informed and written consent of all subjects was taken for the study and the approval was granted by the Institution Ethical Board.

A total of 100 currency notes denominations 10rs(25), 20rs(25), 50rs (25), 100rs(25) collected randomly from circulation and these notes were sterilized {Autoclave i.e, placing the currency notes in zip lock covers and wrapping in a pouch and kept for sterilization} prior to start of study (figure 1) . Chronic periodontitis patients were asked to count notes using saliva as is done routinely. One contaminated currency note was asked to deposit in sterile envelopes from each patient and were taken to the laboratory immediately.



**Fig 1:** Sterilized currency notes.

**Microbiological assessment :-**

The specimen were inoculated on Brain Heart Infusion broth ( figure 2) and subculture was done on the Blood agar (figure 3) with Anaerobic supplement HiMedia, by streak plate method and kept in Anaerobic work station at 37C for 48 -72 hrs.

Primary plates were examined with the help of hand lens and each colony type recorded. Each type of colony was picked up and subcultured aerobically as well as anaerobically by gas pack method. Only those organisms which failed to grow aerobically were taken as anaerobes. If no growth in both aerobic and anaerobic conditions after 48 hrs, then it will be observed for 7 days under standard microbiological procedures to give negative reports. The anaerobic bacteria are identified by standard microbiological techniques.



**Figure 2:** Brain Heart infusion broth.



**Figure 3:** Blood agar.

**Statistical tests :-**

Data was entered and tabulated in excel spreadsheet and subjected to frequency distribution analysis using SPSS version 21, Chicago, Los Angels.

## Results :-

Total 100 Indian currency notes were collected and included in the study which were subjected for standard microbiological tests , among those 58% were contaminated , both with pathogenic and nonpathogenic organisms. (Table 1 and table 2).

**Table 1:** No.of isolates and aerobic bacteria

Aerobic bacteria	No. of isolates
Bacillus sp	6
Staphylococcus aureus	10
Coagulase negative staphylococci	8
Diphtheroids	4
Candida sp	2
Ecoli	2
	32

**Table 2:** No .of isolates and anaerobic bacteria

Anaerobic bacteria	No. of isolates
Porphyromonas gingivalis	10
Actinobacillus sp	6
Prevotella intermedia	2
Fusobacterium nucleatum	2
Streptococcus Salivarius	6
	26

## Conflict of interest and source of funding statement :-

The authors declare that they have no conflict of interests. No external funding, apart from the support of the author's Institution was available for this study.

## Discussion:-

Currency notes, pass on from one hand to another and during the course of transit, many kinds of microorganisms contaminate them which include normal saprophytic micro flora and pathogenic microorganisms. Hence they are the potential carriers of pathogenic microorganisms and act as source of inoculums for the transmission of minor to major diseases. Ahmed et al (2010) stated that the paper currency notes were commonly contaminated with pathogenic microorganisms and this contamination played a significant role in the transmission of potentially harmful microorganisms for different diseases. Gilchrist, (1993) stated that Various diseases such as diphtheria, trachoma, gastroenteritis, whooping cough and pathogenic agents causing diarrhoea are known to be transmitted through fomites . In this study, some strains of Streptococcus and Staphylococcus were identified which are known to have developed resistance to conventional antibiotics (WHO 2000). Escherichia coli, is usually nonpathogenic but some strains can cause serious food poisoning in humans. Among the pathogenic bacteria isolated include Porphyromonas gingivalis, Actinobacillus species, Prevotella intermedia, Fusobacterium nucleatum which are mostly associated with periodontal disease.

The moderate anaerobes could be exposed to room atmosphere for 60 to 90 min without appreciable loss of viability (7). All facultative bacteria survived more than 72 hr of exposure to atmospheric oxygen (8). The isolation of bacterial agents from currency notes in this study reported here confirmed that currency might be a vector playing an important role in the transmission of pathogenic microorganisms in the community. The risk is by no means restricted to residents of the country in question; it might even be greater for tourists, and visitors from other countries, who may not be immune to the pathogens.

Inability to quantify the cell numbers of the bacterial agents and failure to take into account the possible presence of other categories of potential pathogens, such as viruses and fungi that might contaminate currency notes are some of the limitations observed in this study, which may be the work for future research. Furthermore, we could not confirm that the identified pathogens could be transmitted from person to person because of the exchange of paper currency. We could only recommend that the paper notes used in this country are more vulnerable for the

transmission of bacterial diseases and more complex study be undertaken, using molecular biology tools, to achieve and confirm their level of vulnerability. The results of the study reported here suggest that paper currency might be contaminated with bacteria. Therefore handling of paper currency deserves special attention.

### **Conclusion:-**

Indian currency notes are contaminated with pathogenic and non-pathogenic organisms in chronic periodontitis patients. So public health hazards to the individual and community with the contamination of currency notes being high, one must exercise caution while handling them. However, further studies to be conducted to correlate with currency notes contamination and transmission of periodontal disease.

### **Recommendations:-**

Strategies to reduce the contamination of currency, especially where environmental conditions favor the abundance of many pathogens, are recommended. Such strategies could include the introduction of plastic currency, which can be washed easily, as was done in Australia (the first country to do so) in 1988 (9). Washing hands thoroughly by food handlers, whether at a restaurant or at home; after handling currency and before handling food. Regular disinfection of currency deposited in banks by ultraviolet light or formalin vapors (10), regular withdrawal of damaged notes by federal authorities, and, most important, the improvement of personal hygiene. Handling of money deserves special attention. The practice of licking or applying saliva to the fingers while counting paper money is worth mentioning as an important potential route of exposure to bacteria and enteric pathogens, it should be avoided. Money handling machines like ATM should be made to sanitize money by destroying the microbes by heat or short exposure to antimicrobials. The paper or coatings used for currency notes should be with antimicrobial properties. There should be public awareness of the fact that currency notes could be source of infection and could be dangerous to health.

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