

# Examination of AntibioGram Level for Isolated Microorganisms from the Indian Currency Notes and Coins

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**Abstract:-** Money is one of the most exchangeable mediums in our world and always subject to contamination by pathogenic microbes and hence could serve as a vehicle for transmission of infectious diseases. This study was conducted to assess the prevalence of contamination by pathogenic microbes in currency notes and coins, and determine the susceptibility of the isolated organisms towards antibiotics. This study was carried out using 10 samples of Indian currencies and coins of various areas, which were collected randomly from chicken shops, vegetable shops in and around Coimbatore city, Tamilnadu. Bacterial and fungal prevalence was determined using culture-based techniques, and method. All Indian banknotes were found to be contaminated with pathogenic bacteria as well as fungi. Experimental assessment revealed the presence of *Staphylococcus aureus*, *Proteus mirabilis*, *Streptococcus spp.*, *Escherichia coli*, *Enterococcus spp.*, *Bacillus cereus*, *Pseudomonas aeruginosa*, *Candida albicans*. All studied Indian currencies and coins were contaminated with pathogenic microorganisms and play a significant role in the transmission of bacterial infections. As money acts as a universal medium for transmission of infectious microbes, a great care must be taken while handling it.

**Keywords:-** Currency Notes, Coins, Microorganisms, Contamination, Antimicrobial Activity.

## I. INTRODUCTION

People in the whole world exchange money on a daily basis, thus circulating notes plays an important role as a potential vehicle for the transmission of bacterial and fungal infections especially in immune-compromised people. Money may be contaminated during transaction, handling, storage, and upon contact with dirty surfaces. Unhygienic practices such as wetting fingers with saliva prior to money counting can introduce an array of microbes to the notes and coins. These routes of transmissions have a great impact on public health in developing countries like India, where the frequency of bacterial infection has been increasing. Pathogens including bacteria and fungi have been identified as common contaminants isolated from currencies in different areas. The prevalence of these bacterial and fungal species could lead to outbreaks of many infections. The main role of Antimicrobial susceptibility testing is to detect possible drug resistance in common pathogens and to assure susceptibility to drugs of choice for infections. Only few studies have reported about the microbial contamination in currencies and this lacks the public awareness of infectious diseases. This paper provides basic health consciousness in people and to study the antimicrobial susceptibility patterns of pathogenic isolates.

## II. STUDY OBJECTIVES

- To isolate microbes from currency notes and coins.
- To characterise isolated microbes.
- To check the antibiogram level of isolated microbes.

**III. MATERIALS AND METHODS**

*A. Study area*

The study was conducted in different parts of Coimbatore, Tamilnadu, India where various samples of currencies and coins were randomly collected. The experimental assessment of samples was done in Dr.N.G.P. Arts and Science College, Coimbatore.

*B. Sample collection*

A total of 10 currency notes and coins were collected from vegetable shops, chicken stalls, banks ,bus conductors,fish stalls,students,tea shops,hotels,mutton stalls, housekeepers as shown in table.1.For the collection of samples every individuals were requested to drop the samples to a sterile polythene zip bags and then they are labelled according to the sample number .The zip bags were then sealed and immediately transported to the laboratory for

further processing. The fresh banknotes were collected from the bank and kept as control.



Fig.I Currency sample

TABLE I. LOCATION OF SAMPLE COLLECTION

Sample	Location of collection
1	chicken stalls
2	vegetable shops
3	banks
4	bus conductors
5	fish stalls
6	students
7	tea shops
8	hotels
9	mutton stall
10	house keepers

*B. Isolation of microbes present in currency notes and coins*

The samples from each currency were taken with a sterile cotton swab was then dipped in saline water. This was rubbed on both the sides of the sample notes and coins for the inoculation onto Nutrient agar and potato dextrose agar.The plates were incubated at 37°C for 24 hours.After incubation plates were observed for colonies.

*C.Identification of bacteria*

The isolated colonies were stained by gram staining as shown in the table.3 and were then isolated by swab methods using enrichment, differential and selective media and further characterized by biochemical reactions as shown in the table.4

*D.Characterization under selective media*

Based on the results obtained from the above tests, the isolated colonies were plated in selective media such as EMB agar, MSA agar, Mac Conkey agar etc.

*E. Identification of fungi*

The growth of fungi on Potato dextrose agar (PDA), was examined after 1-week using prepared microscope slides. The prepared specimens were mounted on lactophenol cotton blue and identification of the such as brain heart infusion agar, candida medium etc. fungal species was performed with the aid of a microscope. Further characterization was done in selective agar.

**IV. ANTIMICROBIAL SUSCEPTIBILITY TEST**

The antimicrobial activity was studied by Kirby Bauer agar well-diffusion method on Muller-Hinton agar and the zone of inhibition was measured as shown in table.5

TABLE II. LOAD OF MICROBES COUNT

S. No	Sample	Bacterial population*10 <sup>3</sup> CFU
1	chicken stall	70
2	vegetable shops	65
3	banks	50
4	bus conductors	80
5	fish stalls	75
6	students	55
7	tea shops	65
8	hotels	55
9	mutton stalls	75
10	house keepers	75

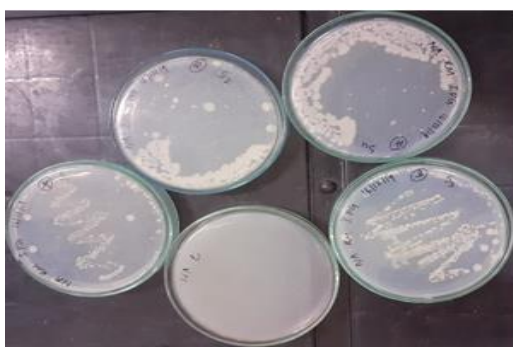


Fig II. Isolated colony bacterial plates

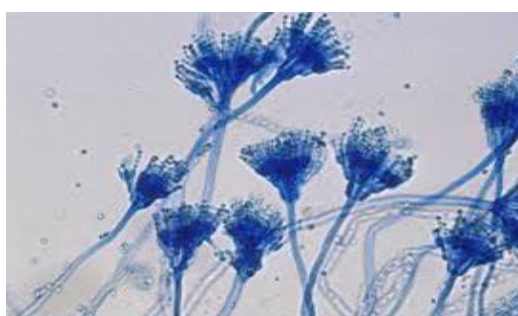


Fig III. LPCB mount in *Candida albicans*

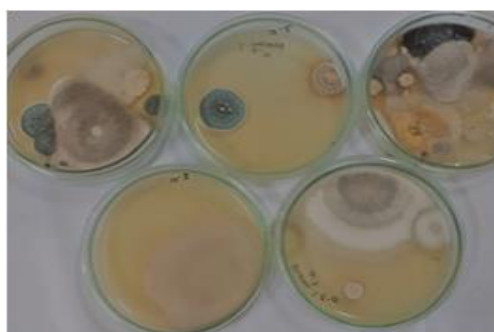


Fig IV. Isolated colony fungal plates

TABLE III. BIOCHEMICAL TESTS AND GRAM'S STAINING OF THE ISOLATED COLONIES

S. no	Organisms	Indole	MR	VP	Citrate	H <sub>2</sub> S	Catalase	Motility	Oxidase	Gram's staining
1	<i>Staphylococcus aureus</i>	-	-	-	+	-	+	+	+	+
2	<i>Proteus mirabilis</i>	-	-	+	+	-	+	+	-	-
3	<i>Streptococcus spp</i>	-	-	+	-	-	-	+	-	+
4	<i>E. coli</i>	+	+	-	-	-	+	+	-	-
5	<i>Enterococcus spp</i>	-	+	-	-	-	-	-	-	+
6	<i>Bacillus cereus</i>	-	+	-	+	+	+	+	+	+
7	<i>Pseudomonas aeruginosa</i>	-	+	+	+	-	+	-	-	-

TABLE.IV ANTIBIOTIC SENSITIVITY TEST

Bacterial species	Antibiotic disc used	Sensitive (%)	Resistance (%)
Sample-1	Ciprofloxacin	100	0
	Chloramphenicol	4	96
	Cefazolin	0	100
	Ceftazidime	99	1
	Amikacin	97	3
Sample-2	Amoxycillin	0	100
	Ampicillin	0	100
	Bacitracin	0	100
	Methicillin	22	88
	Erythromycin	100	0
Sample-3	Ampicillin	60	40
	Chloramphenicol	20	80
	Ciprofloxacin	15	85
	Erythromycin	10	90
	Gentamicin	1	99
Sample-4	Kanamycin	72	28
	Gentamicin	92	8
	Amikacin	98	2
	Cefazolin	65	35
	Oxacillin	0	100
Sample-5	Amoxicillin	0	100
	Erythromycin	38	62
	Gentamicin	60	40
	Ciprofloxacin	85	15
	Cotrimoxazole	85	15

Sample-6	Ciprofloxacin	70	30
	Gentamicin	60	40
	Vancomycin	50	50
	Penicillin	25	85
	Erythromycin	40	60
Sample-7	Cefoxitin	91	9
	Clindamycin	69	31
	Erythromycin	18	82
	Gentamicin	58	42
	Vancomycin	100	0

## V. RESULTS AND DISCUSSION

The Indian paper currency and coins were contaminated by bacteria and fungi. In this study, positive controls from the places having high probability of contamination as in and around Coimbatore along with a public transport, vegetable shop, and Tea shops were taken. Contamination was also related to the physical condition of the currency; the high aging paper currency had the highest, moderate aging paper currency had lesser and new paper currency having lowest prevalence of contamination. Results reveal that, almost 100% of all the currency obtained from the various sources was contaminated with bacteria, fungus and parasite. Most of the currency had more than one microbial contaminant. Different types of microbial contaminant were found on currency. In addition, the microbial load on paper currency is much higher than coins.

10 isolates from the collected paper currencies and coins yielded 8 different types of bacterial and fungal species. Assessment revealed the active participation of microbes such as *Pseudomonas aeruginosa*, *Bacillus cereus*, *Enterococcus spp.*, *E. coli*, *Streptococcus spp.*, *Proteus mirabilis*, *Staphylococcus aureus* and *Candida albicans*. The occurrence of *E. coli* is higher in number shows the poor hygienic condition due to faecal contamination. The antimicrobial pattern of isolated colonies was shown in the above table.

## VI. CONCLUSION

This study had several limitations due to its sample size and geographical boundaries. It did not record the presence of another category of potential pathogens such as viruses that might contaminate currency. While there is no conclusive scientific study that links the spread of the current strain of Coronavirus to contaminated currency notes, the World Health Organization (WHO) has advised taking measures to maintain proper hygiene while handling notes. This study has determined the nature, type and presence of microbial contamination but also the sensitivity patterns on currency. Public awareness of handling paper currency in the right way became essential for the safety of human health. Currency sterilization needs at every level to prevent transmission of infection by ultraviolet radiation and hygienic handling of currency. (Communication number: DrNGPASC 2020-21 BS044)

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