



## Prevalence study of contaminated currency notes of slaughter houses in Nagpur

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**Abstract:** The survival of bacterial pathogens on paper currency in the slaughter houses and their transmission via the hands are often overlooked as various disease reservoirs. Therefore the objective of the present study is preliminary analysis of the bacterial pathogens on the currency notes circulating in slaughter houses of Nagpur city. Total 150 samples of currency notes of denominations Rs. 5, Rs. 10, Rs. 20, Rs. 50 and Rs. 100 were collected from slaughter houses. The cultures from the collected currency notes showed an active participation of 31 isolates representing 5 different types of bacterial species as *Pseudomonas* spp. 41.38%, *Escherichia coli* 20.69%, *Staphylococcus aureus* 17.24%, *Klebsiella* spp. and *Salmonella* spp. 10.34% each. The lower denomination currency notes appeared to be more highly contaminated with bacterial pathogens than higher denomination currencies. The mutilated currency notes had the highest prevalence of bacterial contamination (79.31%) than the non-mutilated currency notes (20.69%).

**Key words:** Paper currency, Slaughter houses, Bacterial pathogens

### INTRODUCTION

Paper currency is commonly handled by various categories of people during transaction (Oyero and Emikpe, 2007). Paper currency, can be contaminated by droplets during coughing, sneezing, touching with previously contaminated hands or other materials and placement on dirty surface. Paper currency notes which are transferred from one individual to other are known to carry bacteria on their surface and are responsible for transmitting them. Such practices transfer bacteria from currency notes to humans through food (Lamichhane *et al.*, 2009).

Mutilated currency notes are those which are not clearly more than one half of the original note and/or in such condition that the value is questionable and special examination is required to determine its value. Currency can become mutilated in number of ways. The most common causes are fire, water, chemicals, explosive, animal, insect or rodent damage (Oyero and Emikpe, 2007). Mutilated notes are usually moist and thus provide a good surface for bacterial growth. They provide favourable conditions such as substrate acquired from human body and due to handling as well as dust from the environment. Immunocompromised person stand the risk of

acquiring opportunistic infection, through handling of contaminated currency (Pope *et al.*, 2002). The bacterial pathogens infect the body through scratches on the hands or when the hand touches the mouth or nose (El-Din El-Dars and Hassan, 2005).

Money on which pathogenic microorganism might survive represents an often overlooked reservoir for enteric diseases. In most parts of the developed world, there is a popular belief than the simultaneous handling of food and money contributes to food related public health incidence. Over the last two decades, data indicating that simultaneous handling of dirty money could indeed be a cause of sporadic foodborne- illness cases (Goktas and Oktay, 1992). The survival of various microorganisms on money and their transmission via the hands of meat are often overlooked as various disease reservoirs. Therefore the objective of the present study is preliminary analysis of the bacterial pathogens on the currency notes circulating in slaughter houses of Nagpur city.

### MATERIALS AND METHODS

**Sample Collection:** A total of 150 samples of currency notes having denominations Rs. 5, Rs. 10, Rs. 20, Rs. 50 and Rs. 100 were obtained from

slaughter houses of Nagpur. The samples were graded using appearance and degree of dirtiness as mutilated and non-mutilated currency notes. Fifteen mutilated and fifteen non-mutilated currency notes of each denomination were collected. Out of 150 currency notes 75 were mutilated and 75 non-mutilated (Graph 7). Meat sellers handling the notes were asked to deposit them in sterile polythene bags. The samples were then transported immediately to the microbiology laboratory for bacteriological analysis. They were compensated with other currency of same denomination.

**Isolation and Identification of Bacteria:** A sterile cotton swab was dipped in the sterile physiological saline and rubbed on both the surfaces of currency note. The swab was inoculated in 5 ml of sterile nutrient broth and incubated for 6-8 hours at 37°C. Thereafter the broth cultures were plated on Mannitol Salt Agar, MacConkey Agar and Cetrimide Agar. The plates were incubated at 37°C for 24 hours. After incubation the isolated colonies were identified on the basis of morphological, cultural and biochemical characteristics (Collee and Marr, 1996) and results were compared with Bergey's Manual of Determinative Bacteriology, 9th edition.

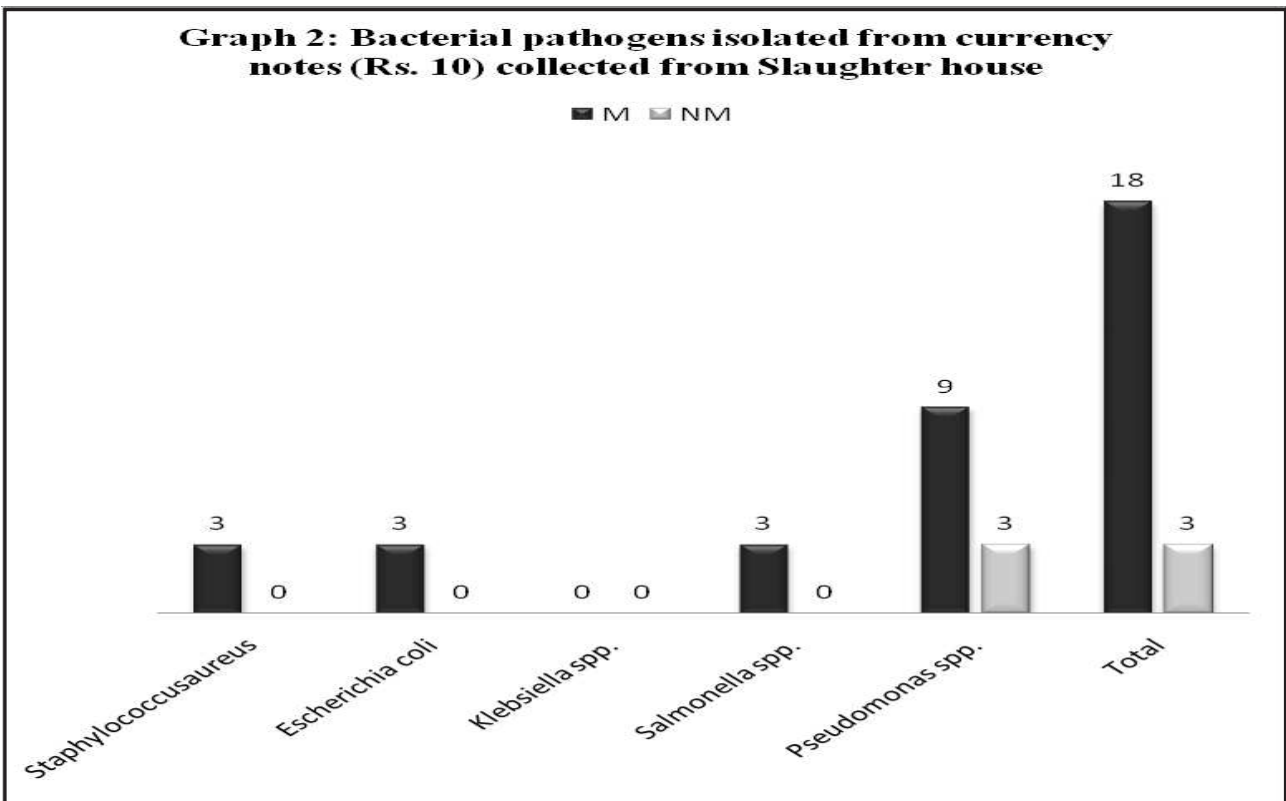
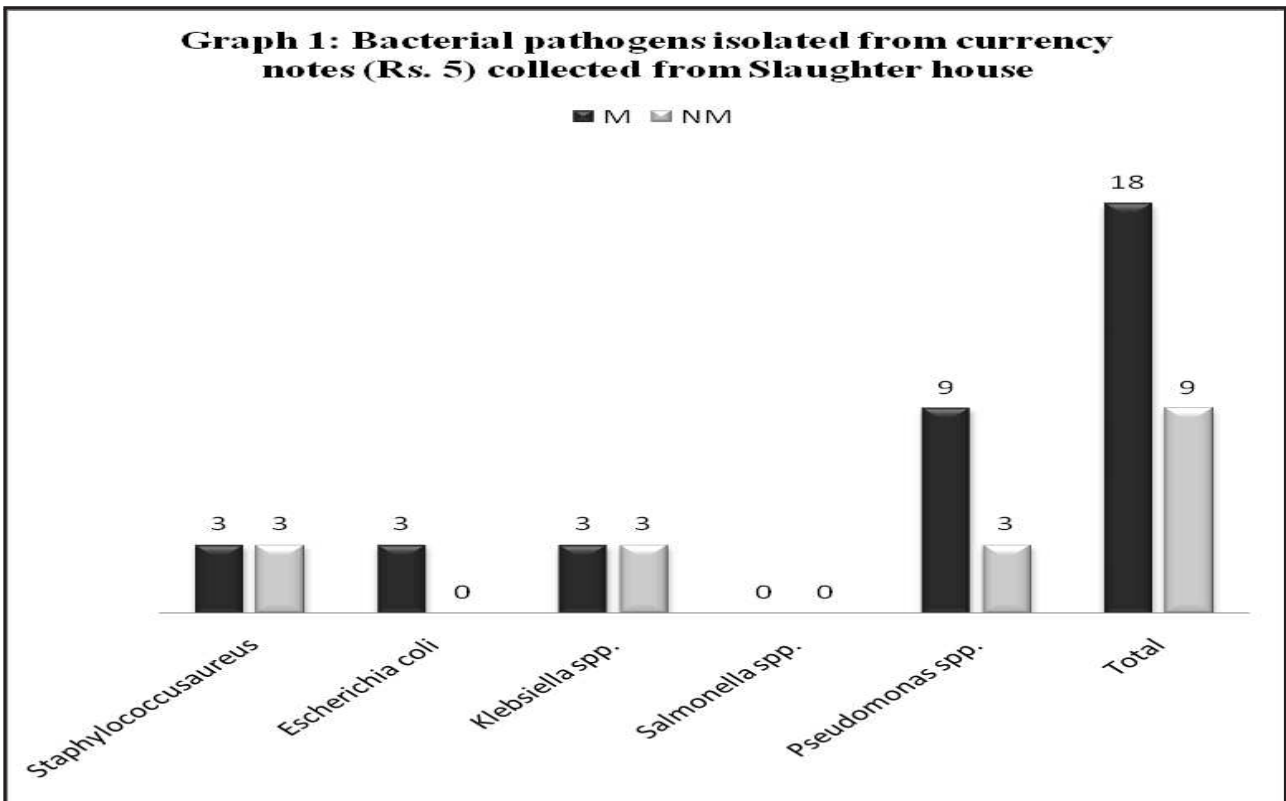
## RESULTS AND DISCUSSION

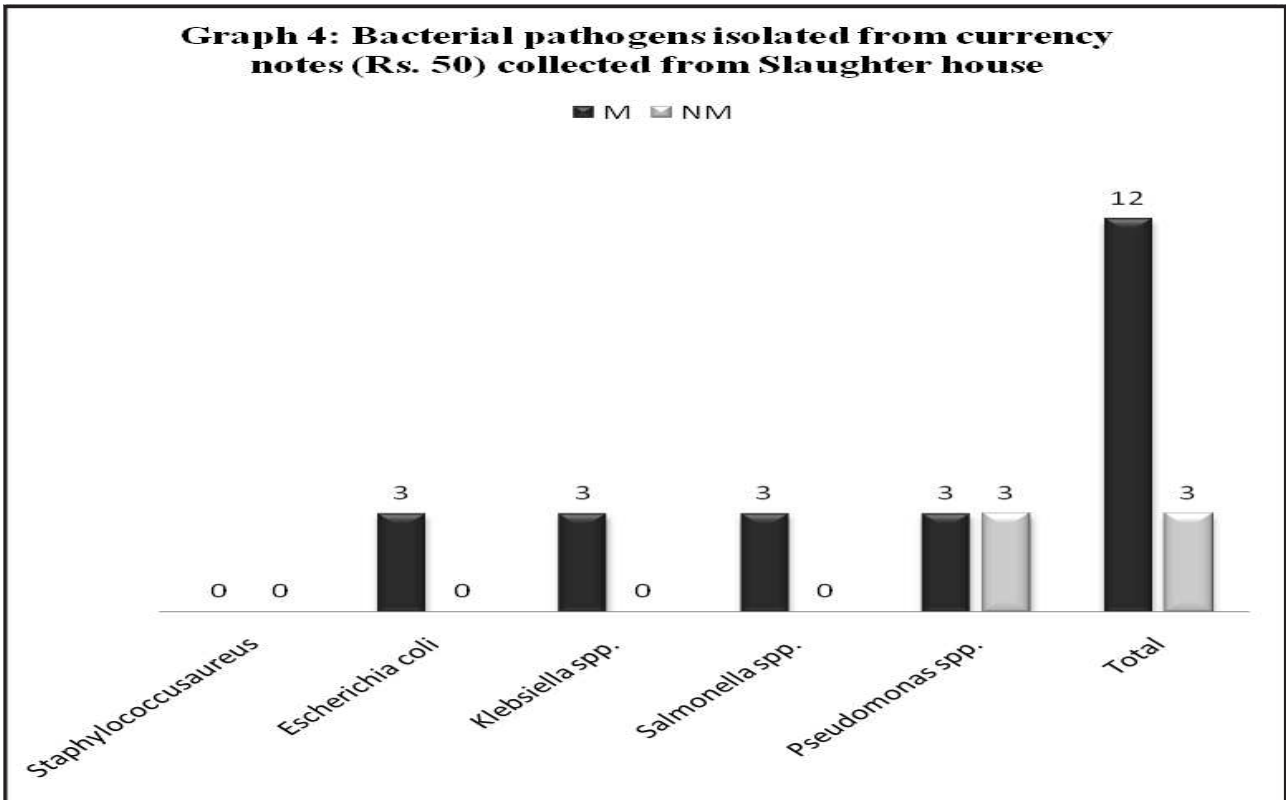
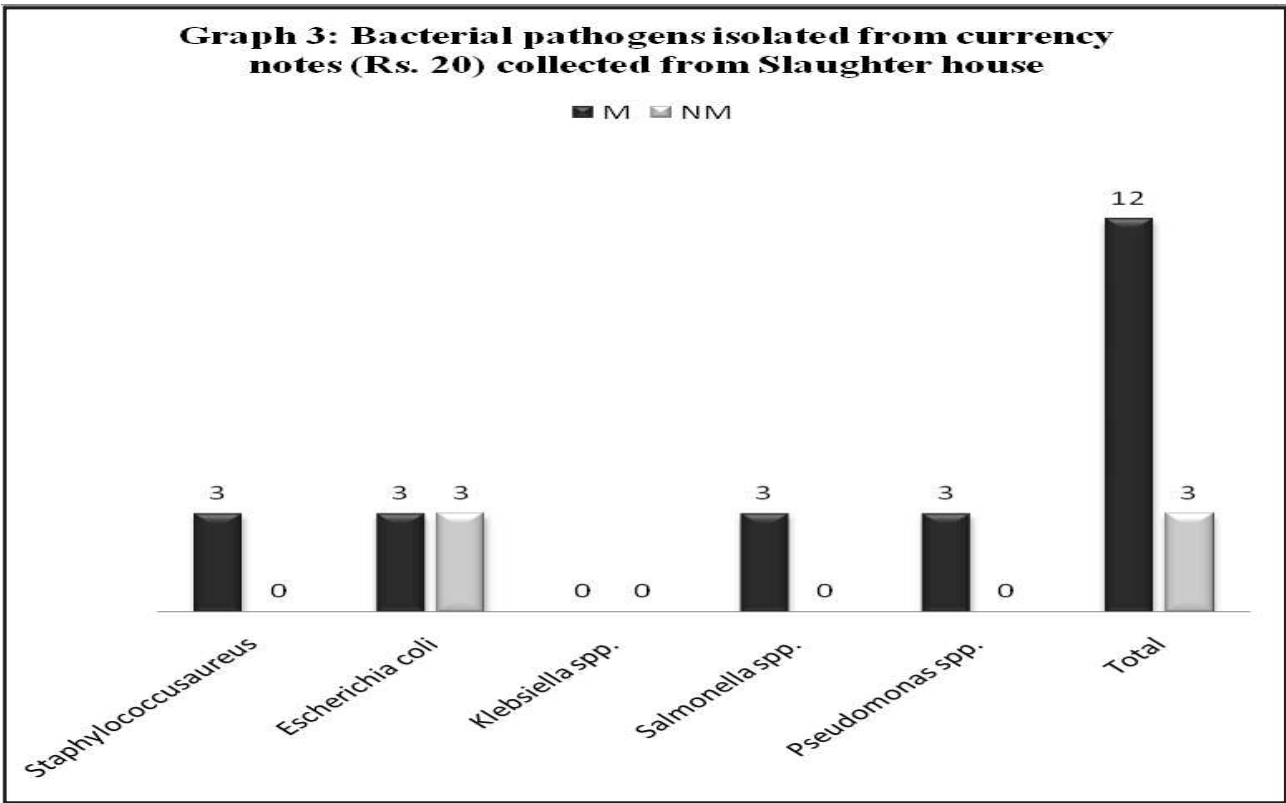
A total of 150 currency notes of denominations Rs. 5, Rs. 10, Rs. 20, Rs. 50 and Rs. 100 were collected from slaughter houses. Out of which 72 (48%) currency notes were found to be contaminated with bacterial pathogens. The 150 currency samples include 75 mutilated currency notes and 75 non-mutilated notes. It has been found that 69 (79.31%) mutilated and 18 (20.69%) non-mutilated currency notes were found to be contaminated with bacterial pathogens (Table 1 & Graph 7). Paper currency offers a larger surface area as a breeding ground for pathogens. Microbes may persist on it for longer periods. The older the paper note the more accumulation of microbes occurs (El-Dars and Hassan, 2005). A significant direct relationship was found between the physical condition of the paper notes and bacterial contamination: the dirtier and more mutilated the note was, the more contaminated it became (Uneke and Ogbu, 2007). Storage of these notes in polythene, cotton, leather bags in humid and dark conditions also favour the growth of bacteria on these notes (Al-Ghamdi *et al.*, 2011).

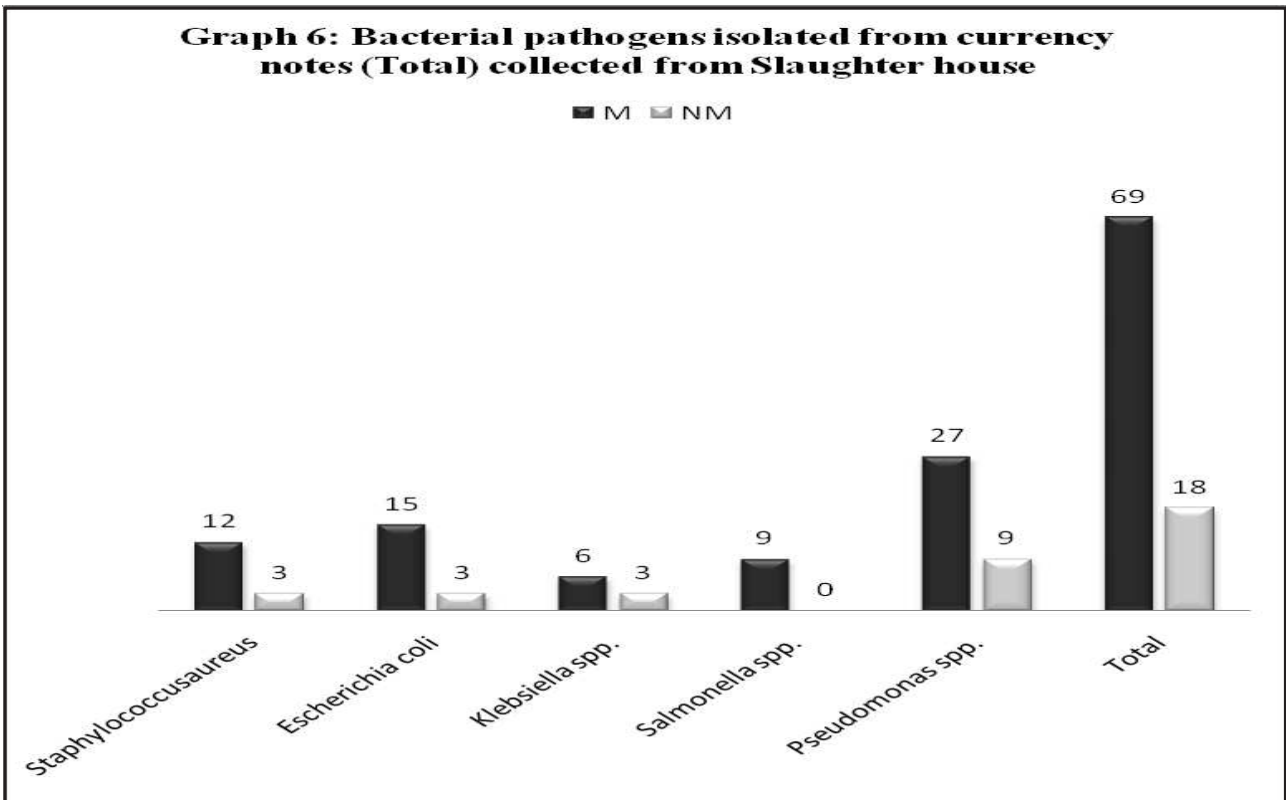
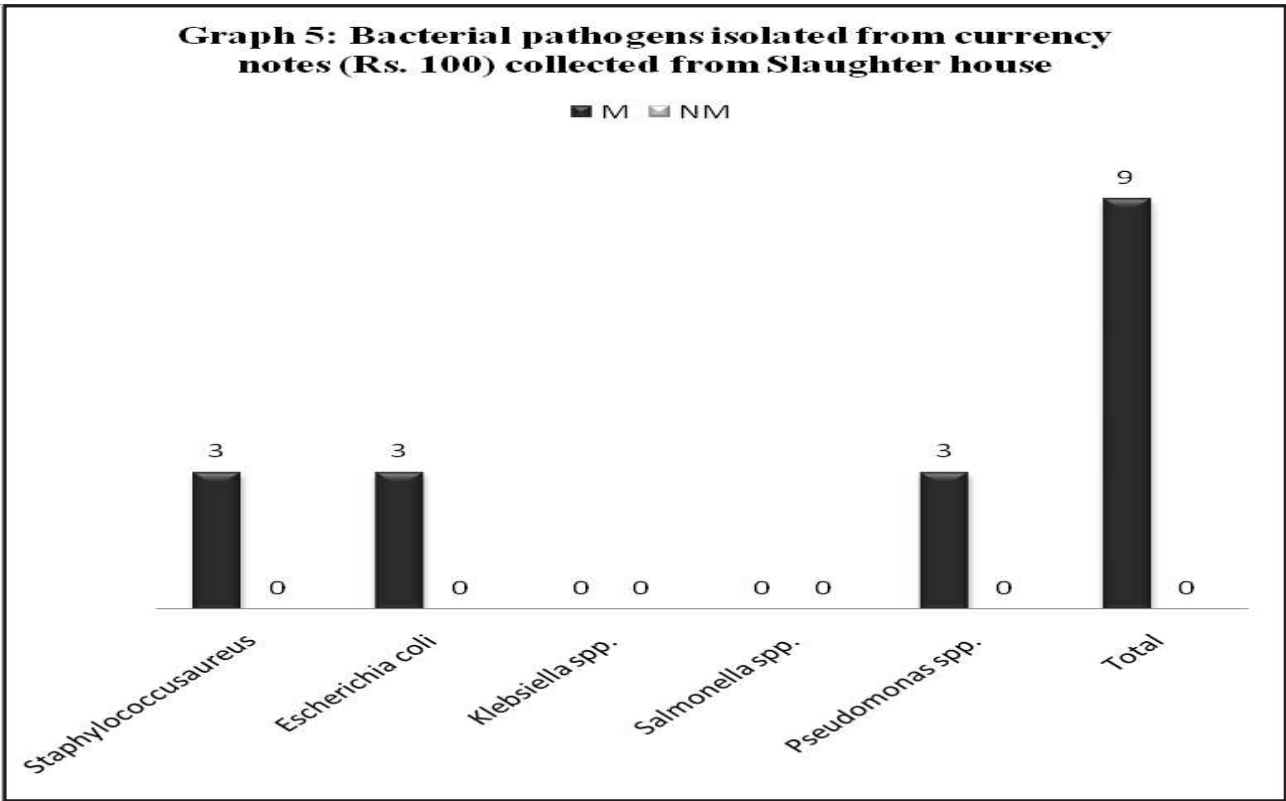
The cultures from the collected currency notes yielded 87 isolates representing 5 different types of

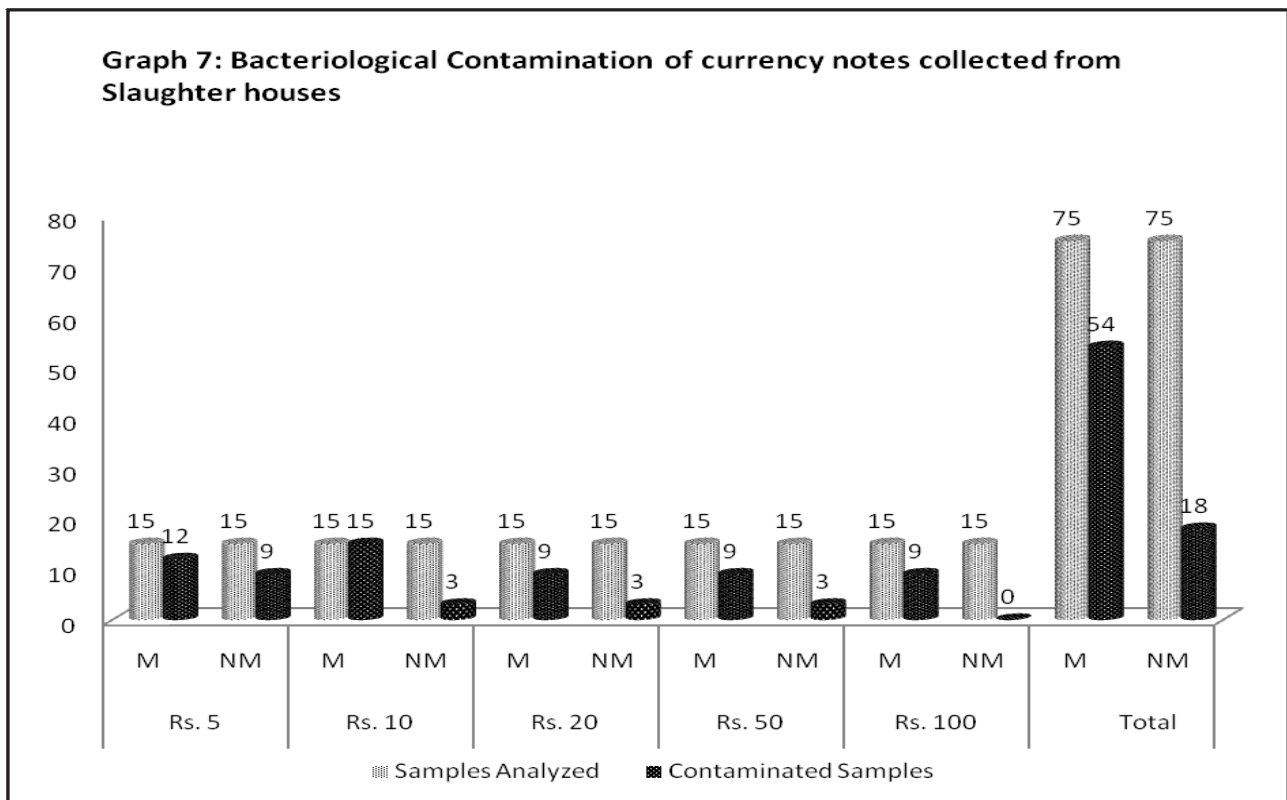
**Table 1: Total Bacterial pathogens isolated from currency notes collected from Slaughter houses**

Organism	Rs.5		Rs.10		Rs.20		Rs.50		Rs.100		Total		Grand Total	
	M	NM	M	NM	M	NM	M	NM	M	NM	M	NM		
<b>Samples Analyzed</b>	15	15	15	15	15	15	15	15	15	15	75	75	150	% Bacteria
<b>Contaminated Sample</b>	12	9	15	3	9	3	9	3	9	0	54	18	72	48%
<b><i>Staphylococcus aureus</i></b>	3	3	3	0	3	0	0	0	3	0	12	3	15	17.24%
<b><i>Escherichia coli</i></b>	3	0	3	0	3	3	3	0	3	0	15	3	18	20.69%
<b><i>Klebsiella spp.</i></b>	3	3	0	0	0	0	3	0	0	0	6	3	9	10.34%
<b><i>Salmonella spp.</i></b>	0	0	3	0	3	0	3	0	0	0	9	0	9	10.34%
<b><i>Pseudomonas spp.</i></b>	9	3	9	3	3	0	3	3	3	0	27	9	36	41.38%
<b>Total</b>	18	9	18	3	12	3	12	3	9	0	69	18		
<b>Grand Total</b>	27		21		15		15		9				87	
	31.03%		24.14%		17.24%		17.24%		10.34%		79.31%		20.69%	









bacterial species. Identification showed an active participation of these five species in descending order of percentage as *Pseudomonas* spp. 41.38%, *Escherichia coli* 20.69%, *Staphylococcus aureus* 17.24%, *Klebsiella* spp. and *Salmonella* spp. 10.34% each (Table 1) (Graph 1, 2, 3, 4, 5). Currency notes are possible vehicles through which bacterial pathogens can be transmitted to humans (Goktas and Oktay, 1992; Pope et al., 2002; Xu et al., 2005). From this study, the bacterial isolates that were isolated were associated with oral, nasal, skin and faecal contamination. This is an indication that money contamination is associated to unhygienic practice of people. These practices include indiscriminate sneezing, coughing and defecation with indecent handling of currency notes (Singh et al., 2002). Meat sellers use their bare hands which they occasionally wash in a bowl of water. This is not a flowing tap water but a stagnant bowl of water which is kept for as long as the meat remains, until it is sold out to another overlooked reservoir.

The isolation of *Staphylococcus aureus* on the currency notes could have been contamination from the normal skin flora (Saeed and Rasheed, 2011),

*Escherichia coli* and *Klebsiella* spp. are enteric microorganisms that are potential pathogens especially when they change their habitat and may cause significant infections in those with depressed immune systems. Occurrence of *Pseudomonas* spp. and *Salmonella* spp. reflected the faecal pollution which appears as a result of poor hygienic attitude in the community. These organisms can cause diarrhoea and urinary tract infections besides skin, burn and septicaemic infections (Oyero and Emikpe, 2007). Out of the 5 different denominations of the currency notes selected for the study Rs. 5 has the highest bacterial pathogens (31.03%) followed by Rs. 10 (24.14%), Rs. 20 and Rs. 50 (17.24%) each and Rs. 100 (10.34%). The lower denomination currency notes such as Rs. 5 (31.03%), Rs. 10 (24.14%) appeared to be more highly contaminated with bacterial pathogens than higher denomination currencies like Rs. 100 (10.34%) (Table 1) (Graph 1, 2, 5). These lower denomination paper money are used frequently for different normal daily activities. Higher denominations are not used as frequently as lower denominations (Ahmed et al., 2010). Other studies have shown the more paper currency stays



in circulation the higher the risk of becoming contaminated (Al-Ghamdi *et al.*, 2011).

The study revealed a significant association between bacterial contamination and the type and condition of the currency with high rate of contamination on mutilated currency notes than non-mutilated currency notes. The mutilated currency notes had the highest prevalence of bacterial contamination (79.31%) than the non-mutilated currency notes (20.69%). It supports the finding that non-mutilated currency notes are particularly dangerous (Table 1 & Graph 6). This finding has very important health and economic implications, especially in underdeveloped and developing tropical nations of the world (Siddique, 2003).

## CONCLUSION

Currency notes could be a source of contamination and infection. The slaughter houses currency notes in circulation were found to be contaminated with different types of bacterial pathogens. Meat sellers should be educated and have awareness to avoid possible cross contamination between currency notes and meat by avoiding handling currency notes as they sell. There should be public awareness of the fact that currency notes could be a source of infection and dangerous to health. Dirty and mutilated notes should be withdrawn from circulation from time to time.

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