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Survey of bacterial contamination and antibiotic resistance pattern of Bangladeshi paper currency notes in Mymensingh city

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Paper currency notes, which are transferred from one individual to another, are known to carry microorganisms on their surface. As people have to exchange currencies repeatedly to buy goods and services in their everyday life, risk of spreading infectious diseases may be enhanced. Thus, it is important to identify the bacteria associated with currency and evaluate their multidrug resistance pattern. Consequently, the following study was conducted to determine some common bacterial load and their antibiotic resistance pattern of Bangladeshi paper currency notes circulating in Mymensingh city. Forty paper currency notes, comprising eight denominations from five occupational groups (Fish seller, meat seller, egg seller, vegetable seller and grocer), were collected from Mymensingh city, Bangladesh and subjected to bacteriological analysis. Total viable count, total *Staphylococcus* spp., total *Salmonella* spp. and total *Escherichia coli* counts were calculated, ranging from log 7.48±0.50 to 8.48±0.60 log cfu/paper currency (pc), 5.58±0.42 to 6.10±0.58 log cfu/pc, 5.36 to 5.88±0.38 log cfu/pc and 5.40±0.20 to 5.84±0.20 log cfu/pc, respectively from all denomination paper currency notes. Among the tested notes, 85.83% were found to be contaminated with three different bacterial isolates. Among them, *Staphylococcus* spp. were found more frequent (95%) followed by *E. coli* (87.5%) and *Salmonella* spp. (75%). Furthermore, isolated bacteria were subjected to antimicrobial susceptibility test against 8 commonly used antibiotics. The entire microorganisms tested were found resistant to Amoxicillin, Ampicillin and Ciprofloxacin, but were susceptible to Azithromycin and Norfloxacin. Thus, the present study revealed that most currency notes are contaminated with different common bacteria, including antibiotic resistant ones, and this might pose a severe public health risk.

Key words: Paper currency notes, microbial load, antibiotic resistance, Bangladesh.

INTRODUCTION

Paper currency is widely utilized as a medium of exchange all through the world for trading (Sadawarte et al., 2014). In regular transaction, paper currency is being handled by different categories of individual with the

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unhygienic condition and in this way, polluted with different kinds of pathogenic microorganisms (Borah et al., 2012). The crude materials that are utilized for making paper currency assume a huge role in harboring microorganisms. As indicated by El-dars and Hassan (2005), the blend of cotton and linen used for making paper currency offers surface area for microorganisms to grow. Previous study demonstrated that lower denomination notes get higher microbial contamination since they stay longer in circulation and exchanged more frequently (Khalil et al., 2014).

Paper currencies are normally defiled by various ways like sneezing, coughing, contacting with tainted hands or materials and placement on grimy place like pockets, socks, shoes and under floor covering (Oyero and Emikpe, 2007). In some fish, poultry and vegetable markets, the salesperson handle cash and their particular sales item simultaneously evading hand washing between their works. This practice enhances the danger of cross-contamination of microorganisms between vendors and purchasers (Michaels, 2002). Microorganisms are frequently transmitted through water, air, food and fomites (Barolia et al., 2011). Paper currency contaminated by organisms might act as fomites, plays a significant role in the transmission of microorganisms and are therefore responsible for spreading communicable diseases (Sharma and Dhanashree, 2011). Paper currency notes, thus presents specific hazard to public health, as contagious diseases can spread through this paper currency (Lalonde, 2007). Most of the paper currency are imbued with disinfectants to restrain the growth of microorganisms; yet, just a few pathogens are isolated from paper currency notes as it persists in circulation for a long time (Hanash et al., 2015). Different pathogenic microorganisms that harbor in paper currency which are related to gastroenteritis, throat disease, pneumonia, urino-genital tract contamination, peptic ulcers and lung abscess have been accounted from various place of the world (El-dars and Hassan, 2005; Hosen et al., 2006).

A few investigations in different parts of the world have been conducted and the outcome uncovered high rate of microbial contamination of paper currency notes in circulation. *Escherichia coli, Salmonella* spp., *Enteroccci* spp., *Klebsiella* spp., *Shigella* spp., *Mycobacterium tuberculosis, Vibrio cholera, Bacillus* spp., *Staphylococcus* spp., *Pseudomonas* spp., *and Corynebacterium* spp. were isolated and identified from the currency notes in different previously conducted studies (Moosavy et al., 2013; Akond et al., 2015; Boidya et al., 2015; Hanash et al., 2015; Firoozeh et al., 2017). Some of fungal species were also recovered from paper currency notes such as *Aspergillus* spp., *Rhizopus* spp., *Penicillium* spp. etc. (Barro et al., 2006; Shahram et al., 2009).

Antimicrobial resistance (AMR) is now considered as one of the most serious global threats to human health as evidenced by the WHO's report on antimicrobial resistance (WHO, 2018). Recently, multidrug resistance capabilities of microorganisms have turned out to be a major worry to public wellbeing and numerous infections have become harder to treat (Uddin et al., 2013). According to previous studies (Akond et al., 2015; Mukharjee et al., 2017) various microorganisms isolated from paper money showed drug resistance to normally used antibiotics. Firoozeh et al. (2017) found high resistance rates of *Staphylococcus* spp. and *Enterococci* spp. against tetracycline, ampicillin and erythromycin isolated from paper currency.

All class of individuals, including children habitually handles paper currencies and therefore the contaminated notes play a significant role in spreading of diseases. Most of the people in rural and urban region take food without washing their hands after handling money and saliva is used to count the money, increasing the chance of getting infection (Hosen et al., 2006). In Bangladesh, majority of people do not appropriately wash hand and are ignorant of various transmissible diseases caused by pathogenic microorganisms in currency handling (Akond et al., 2015). Just as there are a few reports on the microbial contamination of paper currency in the world, reports on Bangladesh are also scanty (Hosen et al., 2006; Ahmed et al., 2010). Considering the above stated facts, this study was conducted to investigate the presence of some common bacteria and their antibiotic resistance pattern in Bangladeshi paper currency notes, circulating in Mymensingh city.

MATERIALS AND METHODS

Collection of paper currency notes

Forty old (40) Bangladeshi paper currency notes, eight denominations including BDT (Bangladesh Taka) 2, BDT 5, BDT 10, BDT 20, BDT 50, BDT 100, BDT 500 and BDT 1000 were collected randomly from five different occupational groups including vegetable seller, meat seller, fish seller, egg seller and grocer at Kamal-Ranjit (KR) market, Bangladesh Agricultural University (BAU), Mymensingh from June to December 2017. Individual occupational groups were convinced with satisfactory explanation about the significance of the study to exchange the currency. To ensure aseptic collection, individuals were requested to drop the cash into the sterile zipper bag and were compensated with the same currency collected. The bags were immediately transported to the Microbiology laboratory of the Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh for bacteriological analysis.

Preparation of samples

Each paper currency notes were put, aseptically, in a conical flask containing 10 ml phosphate buffered saline (PBS) for 30 minutes to separate the adhered microbes over the note surface. Then, the notes were taken out aseptically, utilizing sterile forceps and washed. The contents of conical flasks were used to determine bacterial load and detection of bacteria. The currency was reused after drying.

Bacterial culture and enumeration

Total viable count (TVC)

Total viable count (TVC) was performed by inoculation of paper currency samples diluted in PBS. Stock solution of 10^{-1} dilution was prepared by mixing 1 ml of washed sample content in 9 ml of sterile PBS. Ten serial fold dilution (10^{-1} to 10^{-6}) were prepared for each preceding dilution. A 0.1 ml aliquot from each dilution was inoculated onto the center of Petri dishes of nutrient agar (NA) and spread by a glass stick smoothly. Then it was kept in incubator at 37°C for 24 h in an invert position. After 24 h of incubation, colonies on NA were counted and recorded in cfu/paper currency of samples.

Isolation and determination of Staphylococcus* spp. *load

Staphylococcus spp. was enumerated and isolated by incubating the sample in Mannitol-salt agar (MSA). After 24 h of incubation at 37°C, golden yellow colonies were counted and recorded as presumptive *Staphylococcus* spp. in cfu/paper currency. Presumptive *Staphylococcus* spp. colonies on MSA were sub cultured onto freshly prepared MS agar plates and confirmed by Gram's staining where it appeared as cocci shaped grapes like cluster and coagulase test (Murray et al., 2003).

Isolation and determination of Salmonella* spp*. load

Serial dilution of 10^{-1} to 10^{-5} was made in case of *Salmonella* spp. as it can be enumerated in lower dilution than *Staphylococcus* spp. For determination of *Salmonella* load, 0.1 ml aliquot from each dilution was spread on Salmonella-Shigella agar (SSA), followed by 24 hour incubation at 37°C. Colonies that appeared as black center were counted and recorded in cfu/paper currency of samples (FDA, 1992).

Isolation and determination of E. coli load

E. coli detection was carried out using eosin methylene blue (EMB) agar. For enumeration, same serial dilutions prepared for *Salmonella* were spread on EMB agar, followed by 24 h incubation at 37°C. After incubation, metallic sheen colonies were counted on EMB and recorded as presumptive *E. coli.* Metallic sheen colonies were also sub cultured onto freshly prepared EMB agar and confirmed by Gram's staining. On Gram's staining pink colored rod-shaped appearance on microscope proved that was *E. coli* (FDA, 1992).

Antibiotic sensitivity test

Antimicrobial drug susceptibility test against eight commonly used antibiotics in this area included amoxicillin (30 µg), ampicillin (25 µg), azithromycin (30 µg), ciprofloxacin (5 µg), gentamycin (10 µg), norfloxacin (10 µg), tetracycline (30 µg) and erythromycin (5 µg) were performed using disc diffusion method or Kirby-Bauer method (Bauer et al., 1966). The zones of growth inhibition were compared with the zone-size interpretative table standard for *Staphylococcus* spp.*, Salmonella* spp. and *E. coli* provided by Clinical and Laboratory Standards Institute (CLSI, 2016).

Data analysis

All data were managed by incorporating in SPSS software (SPSS-20.0). Descriptive analysis was performed to determine mean and frequency.

RESULTS

Total viable count (TVC)

Table 1 shows the highest total viable count (TVC) of 8.96 log cfu/pc recorded from BDT 10 note collected from egg sellers and lowest value of 6.85 log cfu/pc from BDT 1000 note collected from grocer. According to different occupational groups, the highest (TVC) value of mean log 8.40±0.56 cfu/pc was found in egg seller and lowest value of mean log 7.44±0.32 cfu/pc in grocer. Based on different denomination of paper currency notes, the average (TVC) value ranged from 7.48±0.50 to 8.48±0.60 log cfu/pc; whereas highest one was recorded from BDT 100 notes and lowest one from BDT 1000 notes, respectively.

Staphylococcal count

According to Table 2, the *Staphylococcus* spp. count was highest with 6.89 log cfu/pc in BDT 100 note and lowest value of 5.23 log cfu/pc in BDT 2 note collected from meat seller and egg seller, respectively. Regarding occupational groups, the *Staphylococcus* spp. count was highest with 6.35±0.59 log cfu/pc in fish seller followed by the lowest, 5.40±0.22 log cfu/pc in egg seller. According to different denomination of paper currency notes, the average value of *Staphylococcus* spp. ranged from 5.58±0.42 to 6.10±0.58 log cfu/pc; whereas highest one was recorded from BDT 50 notes and lowest one from BDT 1000 notes, respectively.

Salmonella spp. count

Table 3 presents that the *Salmonella* spp. count of 6.41 log cfu/pc was observed in BDT 10 note collected from egg seller and lowest value of 5.34 log cfu/pc from BDT 20 note collected from meat seller. Among different occupational groups, the highest *Salmonella* spp. count of mean log 5.82±0.37 cfu/pc was estimated in egg seller and lowest value of mean log 5.61±0.06 cfu/pc in fish seller. Regarding different denomination of paper currency notes, the average value of *Salmonella* spp. ranged from 5.36 to 5.88±0.38 log cfu/pc; whereas the highest one was recorded from BDT 10 notes and lowest from BDT 1000 notes, respectively.

E. coli count

According to Table 4, the *E. coli* count was highest of 6.26 log cfu/pc in BDT 50 note and lowest value of 5.18 log cfu/pc in BDT 100 note collected from meat seller and egg seller, respectively. The *E. coli* count was highest with 5.68±0.18 log cfu/pc in fish seller in relation to other occupational groups. According to different denomination

Table 1. Total Viable Count (TVC) on Bangladeshi paper currency notes collected from five occupation groups in Mymensingh city.

Occupation group	Denomination (BDT)								Mean log cfu±SD/paper currency
	2	5	10	20	50	100	500	1000	
Fish seller	7.99	8.81	8.68	7.88	8.25	8.94	7.83	7.10	8.19±0.61
Meat seller	8.20	8.11	7.81	7.65	8.60	8.26	8.88	7.99	8.19±0.40
Egg seller	8.81	8.70	**8.96**	8.65	7.95	8.85	7.68	7.60	**8.40±0.56**
Vegetable seller	8.60	8.20	8.64	8.20	8.58	8.85	7.80	8.35	8.35±0.38
Grocer	6.08	7.70	7.62	7.63	7.75	7.52	7.38	**6.85**	**7.44±0.32**
Average±SD	8.14±0.67	8.31±0.45	8.34±0.59	8.00±0.43	8.23±0.38	**8.48±0.60**	7.91±0.57	**7.48±0.50**	

Table 2. *Staphylococcus* spp. count on Bangladeshi paper currency notes collected from five occupation groups in Mymensingh city.

Occupation group	Denomination (BDT)								Mean log cfu±SD/paper currency
	2	5	10	20	50	100	500	1000	
Fish seller	6.51	6.70	6.64	6.57	6.88	6.67	5.51	5.32	**6.35±0.59**
Meat seller	6.86	6.34	5.48	6.30	6.36	**6.89**	6.18	6.20	6.33±0.44
Egg seller	**5.23**	5.26	5.45	5.36	5.82	5.30	-	-	**5.40±0.22**
Vegetable seller	5.96	5.60	5.30	5.51	6.11	5.70	5.26	5.48	5.61±0.30
Grocer	5.48	5.79	5.65	5.45	5.34	5.26	5.49	5.32	5.47±0.18
Average±SD	6.01±0.68	5.94±0.58	5.70±0.54	5.84±0.56	**6.10±0.58**	5.96±0.77	5.61±0.40	**5.58±0.42**	

Table 3. *Salmonella* spp. count on Bangladeshi paper currency notes collected from five occupation groups in Mymensingh city.

Occupation group	Denomination (BDT)								Mean log cfu±SD/paper currency
	2	5	10	20	50	100	500	1000	
Fish seller	5.58	5.56	5.57	-	5.62	5.70	-	-	**5.61±0.06**
Meat seller	5.95	-	5.51	**5.34**	6.04	5.52	6.26	-	5.77±0.36
Egg seller	6.08	5.60	**6.41**	5.98	5.56	6.11	5.46	5.36	**5.82±0.37**
Vegetable seller	5.79	5.58	6.08	5.83	5.60	5.53	-	-	5.74±0.21
Grocer	5.95	5.60	5.85	5.93	5.28	-	-	-	5.72±0.29
Average±SD	5.87±0.19	5.59±0.02	5.88±0.38	5.77±0.29	5.62±0.28	5.71±0.27	5.86±0.56	5.36	

of paper currency notes, the average value of *E. coli* varied from 5.40±0.20 to 5.84±0.20 log cfu/pc; while the highest one was recorded from BDT 10

Table 4. *E. coli* count on Bangladeshi paper currency notes collected from five occupation groups in Mymensingh city.

Occupation group	Denomination (BDT)								Mean log cfu±SD/paper currency
	2	5	10	20	50	100	500	1000	
Fish seller	5.69	5.76	5.72	5.79	5.75	5.89	5.58	5.28	**5.68±0.18**
Meat seller	5.70	5.72	5.75	5.36	**6.26**	5.46	5.48	5.63	5.67±0.27
Egg seller	5.48	5.68	5.66	5.70	5.95	**5.18**	5.38	5.28	**5.50±0.20**
Vegetable seller	5.67	5.60	5.95	5.11	5.51	5.68	-	-	5.59±0.28
Grocer	5.59	5.66	6.15	5.20	5.48	-	-	-	5.62±0.34
Average±SD	5.63±0.09	5.68±0.06	5.84±0.20	5.43±0.30	5.73±0.31	5.55±0.31	5.48±0.10	5.40±0.20	

Table 5. Prevalence of *Staphylococcus* spp., *Salmonella* spp. and *E. coli* on Bangladeshi paper currency notes in Mymensingh city.

Microorganism	Fish seller (n=8)	Meat seller (n=8)	Egg seller (n=8)	Vegetable seller (n=8)	Grocer (n=8)	Total (n=40)
Staphylococcus spp.	8 (100%)	8 (100%)	6 (75%)	8 (100%)	8 (100%)	**38(95%)**
Salmonella spp.	5 (62.5%)	6 (75%)	8 (100%)	6 (75%)	5(62.5%)	**30 (75%)**
E. coli	8 (100%)	8 (100%)	8 (100%)	6 (75%)	5(62.5%)	**35(87.5%)**
Total	(21)87.5%	(22)91.67%	(22) 91.67%	(20)83.33%	(18)75%	**(103)85.83%**

notes and lowest one from BDT 1000 notes, respectively.

Prevalence of bacteria

Table 5 demonstrates that 85.33% paper currency notes were contaminated with at least one of the organisms tested. Prevalence of *Staphylococcus* spp. was highest (95%) followed by *Salmonella* spp. (75%) and *E. coli* (35%) on paper currency notes.

Antibiotic sensitivity test

Thirty-eight bacterial isolates of three organisms comprising 20 *Staphylococcus* spp., 10 *Salmonella* spp. and 8 *E. coli* isolates were isolated through Gram's staining and biochemical test. All isolates were subjected to antimicrobial susceptibility test against 8 commonly used antibiotics. Table 6 represents the detail results of antibiotic sensitivity test of previously mentioned organisms. *Staphylococcus* spp. was found resistant to ampicillin (100%), amoxicillin (100%), and ciprofloxacin (80%) and sensitive to gentamycin (90%), azithromycin (80%), tetracycline (80%), erythromycin (80%) and norfloxacin (60%). All the isolates of *Salmonella* spp. showed resistant to ampicillin (100%), ciprofloxacin (87.5%), gentamycin (75%), erythromycin; whereas sensitive to azithromycin (87.5%), tetracycline (75%) and norfloxacin (75%). *E. coli* were shown resistant to ampicillin (100%), amoxicillin (100%) and almost resistant to ciprofloxacin (80%), erythromycin (70%) and gentamycin (60%). Most drugs like azithromycin, norfloxacin and tetracycline were found to be sensitive to *E. coli.*

DISCUSSION

Microbial load of total mean bacterial count, *Staphylococcus* spp. *Salmonella* spp. and *E. coli* counts were ranged from 7.48±0.50 to 8.48±0.60 log cfu/pc, 5.58±0.42 to 6.10±0.58 log cfu/pc, 5.36 to 5.88±0.38 log cfu/pc and 5.40±0.20 to 5.84±0.20 log cfu/pc, respectively from all denomination paper currency notes. The highest mean TVC of 8.40±0.56 log cfu/pc counts were obtained from egg seller and the lowest 7.44±0.32 log cfu/pc from grocer. The highest mean

Table 6. Antimicrobial resistance pattern of bacterial isolates from Bangladeshi paper currency notes Mymensingh city.

Organisms	Antibiotics tested							
	No (%) of resistance							
	AMP	GEN	CIP	AZM	TE	NX	E	AMX
Staphylococcus spp.(n=20)	20(100)	2(10)	16(80)	4(20)	6(20)	8(40)	20(20)	20(100)
Salmonella spp.(n=8)	8(100)	6(75)	7(87.5)	1(12.5)	2(25)	2(25)	6(75)	5(62.5)
E. coli(n=10)	10(100)	6(60)	8(80)	2(20)	4(40)	3(30)	7(70)	10(100)

Legends: AMP=Ampicillin; GEN=Gentamycin; CIP=Ciprofloxacin; AZM=Azithromycin; TE=Tetracycline; NX=Norfloxacin; E=Erythromycin and AMX=Amoxicillin

Staphylococcus spp. count of 6.35±0.59 log cfu/pc and lowest value of 5.40±0.22 log cfu/pc were recorded for fish seller and egg seller respectively. The highest mean *Salmonella* spp. count of 5.82±0.37 log cfu/pc was observed in egg seller and lowest of 5.61±0.06 log cfu/pc was observed in fish seller. The highest mean *E. coli* count of 5.68±0.18 log cfu/pc and lowest value 5.50±0.20 log cfu/pc were recorded for fish seller and egg seller, respectively. The previous authors observed more or less similar findings. Feglo and Nkansah (2010) observed the highest mean viable bacterial count of 4.60 log cfu/Note, the GH¢5 4.25 log cfu/Note, and then the GH¢10 had 3.44 log cfu/Note in Ghanaian currency notes. Akond et al. (2015) also found the load of *Salmonella* spp., *Shigella* spp., *Vibrio* spp., *Pseudomonas* spp. and *Staphylococcus* spp. ranging between 0 to 8.39 log cfu/cm^2; 0 to 8.17 log cfu/cm^2; 7.88 to 9.20 log cfu/cm^2; 7.65 to 8.91 log cfu/cm^2 and 7.12 to 7.55 log cfu/cm^2, respectively in Bangladeshi paper currency notes. The presence of *Staphylococcus* spp. on Bangladeshi paper currency notes could be due to rubbing off or surfing from a skin flake. Its natural inhabitant is the human body and is easily transferred to other persons during handling of paper currency notes. As saprophytes, in some cases, they are found elsewhere like air, water, milk and fomites. It can enter into the body through breaks, cuts and abrasions (Umeh et al., 2007). *Salmonella* spp. and *E. coli* are the two enteric pathogens recovered from Bangladeshi paper currency might play a huge role in scattering various infections. These microorganisms can cause cholera, diarrhea, septicemia and urinary tract infection (Ahmed et al., 2010).

The results of the study revealed that 85.83% tested paper currency notes were found to be contaminated by *Staphylococcus* spp. with 95% followed by *E. coli* (87.5%) and *Salmonella* spp. (75%). Firoozeh et al. (2017) reported 77.7% bacterial contamination in 337 Iranian paper currency notes, which is slightly lower than the present study. Akon et al. (2015) observed higher bacterial contamination of 93.70% in 506 Bangladeshi paper currency notes. Yazah et al. (2012) revealed *Staphylococcus aureus* (22.5%), *Escherichia coli* (12.5%) and *Klebsiella* spp. (5%) from 160 different Nigerian paper note that are comparatively lower than the current study. Paper currency notes collected from fish seller, meat seller, egg seller, vegetable seller and grocer were contaminated with *Staphylococcus* spp. at the rate of 100, 100, 75, 100 and 100%, with *Salmonella* spp. at the rate of 62.5, 75, 100, 75 and 62.5%, and with *E. coli* at the rate of 100, 100, 100,75 and 62.5% respectively.

The highest level of (91.67%) contaminants were recovered from meat seller and vegetable seller in comparison to other groups. The findings of the present study supports the findings of Ahmed et al. (2010), who also found that taka collected from fish sellers, meat sellers, vegetable sellers, food vendors and shop keepers were contaminated with *E. coli* at the rate of 69.23, 69.23, 63.63, 50 and 50%; with *Salmonella* spp. at the rate of 42.85, 38.46, 18.18, 0.0 and 0.0% and *Staphylococcus aureus* at the rate of 7.14, 53.84, 9.09, 16.67 and 33.33%, respectively. In Iran, Shekarforoush et al. (2009) also isolated *E. coli, S. aureus and Bacillus cereus* with the prevalence of 13.2, 32.5 and 10.8%, respectively of the 120 Iranian currencies.

The denomination of paper currency notes has a strong correlation with the level of contamination as higher denomination notes had the less contaminant. The outcomes appeared in Table 1-4 indicated that all the paper currency notes had bacterial contamination. BDT 50, BDT 100, BDT 500 and BDT 1000 had lower microbial load in compare to BDT 2, BDT 5, BDT 10 and BDT 20. The vast majority of the general people of Bangladesh among every monetary class frequently utilizes lower paper currency notes in daily activities. Higher paper currency notes are not used as oftentimes as lower category notes. Probably this is the reason while there is higher microbial load in lower paper currency notes. Paper currency notes collected from fish seller, meat seller, egg seller and vegetable seller had the highest percentage of contamination. Since they do not follow the proper hygienic measure during handling of currency, that is the significant concern particularly in regard to wellbeing status of the population. Similar findings were reported by Ahmed et al. (2010) who observed that only BDT 2, BDT 5 and BDT 10 contained high bacterial load. Ali et al. (2015) additionally discovered same results in Pakistani currency notes as the lower denominations had more than higher

denominations.

Nowadays, antimicrobial resistance has become a burning issue throughout the world. Indiscriminate use of antibiotics has leads to treatment failure and augment health cost (Sharma and Dhanashree, 2011). Paper notes are usually contaminated with pathogenic microorganisms in circulation, of which most of them are resistant to commonly used antibiotics reported elsewhere (Firoozeh et al., 2017). Transmission of these antibiotic resistance microorganisms from one individual to another through paper currency may cause serious public health hazards. In the current study, bacteria isolated from Bangladeshi paper currency notes were subjected to antimicrobial susceptibility test against 8 commonly used antibiotic; revealing that most of the antibiotic likes amoxicillin, ampicillin and ciprofloxacin were non-effective against *Staphylococcus* spp. *Salmonella* spp. and *E. coli,* whereas it is sensitive to azithromycin and norfloxacin. This study completely agrees with the previous study conducted by Ali et al. (2015) who observed higher resistance of *Salmonella* spp. against gentamycin and amoxicillin. The resistance of all isolates of the present study to amoxicillin, ampicillin and ciprofloxacin support the studies of Akond et al. (2015) and Oluduro et al. (2014). Therefore Bangladeshi paper currency notes might have a significant relationship in spreading of antibiotic resistant organisms. Multi drug resistant bacteria represent a major threat to human survival and continued existence in connection to bacterial contamination and illness. Thus, increased number of antibiotic resistant bacteria in Bangladeshi currency notes reflects a frightful circumstance for health strategy makers. The outcomes from this investigation demonstrates that Bangladeshi paper currency notes in circulation are contaminated with several bacteria, most of which are resistant to commonly prescribed antibiotics which represent risks to individuals handling paper currency notes.

Conclusion

All the paper currency notes analyzed in this investigation were found to be tainted with at least one or two microscopic microorganisms including *Staphylococcus* spp., *Salmonella* spp. and *E. coli* where most of them are resistant to commonly used antibiotic and in addition pose public health hazard to the individual handling paper money. Thus, care must be taken with caution during the preparation and handling of food to stay away from contamination. Individual cleanliness should be maintained to reduce risk of infection particularly for those who frequently handle food and money. Fish sellers and butchers, as well as other common people should be educated to avoid possible cross contamination between currency notes and food. Regular microbial testing of paper currency notes should be established for large-scale substitution of tainted currency. Children must be kept away from dealing with money notes and adults should abstain from utilizing saliva during counting of currency notes. Introduction of plastic currency notes might be an alternative to paper currency notes, as it can be washed easily.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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