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Bacterial Contamination On Hand Touch Surfaces Of Public Buses in Chittagong City, Bangladesh

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Abstract: *Microbiological investigation into public hand touch surfaces has been gaining significant attention from researchers because contaminated surfaces may act as potential reservoirs of pathogens. The current study was designed to get information on bacterial contamination level on three predominant hand touch surfaces of public buses from densely crowded Chittagong city of Bangladesh. 45 swab samples from three hand touch surfaces: grab rail, armrest and vinyl seat of 15 buses were collected and analyzed. All samples were contaminated with numerous bacteria and grab rails were found to harbor significantly more bacteria than the other two surfaces. Besides magnitude of contamination, the study focused on recovery of three enteric pathogenic bacteria and methicillin resistant Staphylococcus aureus (MRSA). Among the enteric bacterial isolates 33 were identified as E. coli, 17 as Salmonella typhi and 11 as Shigella. Sensitivity patterns of enteric bacterial isolates were upsetting enough as almost all isolates exhibited resistance against ampicillin, amoxicillin, ceftriaxone and chloramphenicol. 12 MRSA isolates were recovered and the isolates did not show resistance against any test antibiotics except ceftazidime. The results indicate poor hygienic condition of the buses under study. Moreover presence of enteric bacteria and MRSA portent onset of community-acquired diseases. Though the study dealt with small number of samples and the results are representatives of only a minute fraction of overall transportation system of the city; our findings are auspicating enough in terms of public health concern which will spur concern from the nation's public health management system.*

Keywords: *Bacterial contamination; hand touch surfaces; public bus; enteric bacteria; MRSA*

I. Introduction

Transportation networking system is expanding continually to meet up the need of huge load of passengers and goods carried. At the same time this networking has drawn great attention from public health scientists as pathogenic microbes are now achieved a better way of amplification that is faster and in extensive number than before[1-5]. The past 500 years have provided numerous examples of how the establishment and expansion of worldwide transport networks has facilitated global pandemics of communicable diseases [6].The efficiency, speed and reach of modern transport networks puts people at risk from the emergence of new strain of familiar diseases or from completely new diseases [6], [7]. Current news of WHO warned us about the pandemic status of various diseases which is the reflection of the faster movement of pathogenic microbes. This issue would be a severe matter of concern if the pathogens are drug resistant. Several studies have already been conducted throughout the world focusing on presence and abundance of microbial contamination on public hand touch surfaces of bus, train, mobile phone, hand knob, ATM booth, hospital, shopping cart etc. Among the pathogens isolated from hand touch surfaces *Escherichia coli, Vibrio cholerae*, multi drug resistant *Staphylococcousaureus* and *Mycobacterium tuberculosis* are frequently being reported [8-12]. Chittagong, the port city of Bangladesh, is the prime hub of trade and business of the country; hence densely populated with people from almost all races, professions and classes. Like many other cities of the country Chittagong is suffering from adequate transportation. Lack of intra-city railway and unaffordable cost of other form of private transportation force people to use public bus services. Buses in service are being rarely cleaned and even if cleaned the procedure focuses only on sweeping of floors and windows [8], [14]. Unhygienic and humid condition of buses help to build up microbial load on touch surfaces and interpersonal transfer of microorganisms from such reservoirs may lead to mild to severe infection in human. In a developing country like Bangladesh, especially in overcrowded area of the country like Chittagong, transmission of pathogenic microorganisms through contact should receive due attention from researchers to decipher actual contamination

level. From the point of view of public health, to the best of our knowledge no through investigation into the microbiological contamination level has been conducted focusing solely on transportation system environment in Bangladesh. Propelled by popularity of public bus service as well as poor hygienic condition of bus, the current study was designed to get a snapshot of the microbial contamination level in some hand-touch surfaces of typical buses. Our target microbes are the group of enteric bacteria as well as the causative agent of severe skin infection: methicillin resistant *Staphylococcus aureus*. Swab samples were collected and analysed for target pathogens, and their antibiotic resistance patterns against some prescribed antibiotics had also been investigated.

II. Materials and Methods

1.1 Sampling Site

Samples were collected from public buses which were mostly used by students of the University of Chittagong for their transportation. Fifteen buses were selected for sample collection on random basis from which a total of 45 samples were collected. For each of these buses, samples were collected from three distinct locations: grab rail, armrest and vinyl seat.

1.2 Collection of sample

From each location, sample was collected by swiping a 4 cm^2 section by using sterile saline soaked cotton swab stick. Sample was collected in duplicate, the first swab was inoculated into buffer peptone water and used for enumeration of total viable bacteria whereas the other was taken in buffer peptone water for enrichment of inoculum. All samples were placed in cooler icebox and transported into the laboratory within twenty minutes for further microbiological analyses.

1.3 Enumeration of total viable bacteria

Serial dilutions were made according to standard procedure. Appropriate dilutions were plated on plate count agar and the plates were incubated at 37°C for 24 hours. The numbers of colonies were enumerated and the colony forming unit per $4cm^2$ ($CFU/4cm^2$) was calculated.

1.4 Isolation and identification of bacteria

1.4.1 Isolation and identification of enteric bacteria

From each of the enriched buffer peptone water tube, one loopful culture was streaked acrossMacConkey agar surface. Plates were incubated for 24 hours at 37°C. After incubation, both lactose fermenter and non-lactose fermenter colonies were isolated and purified. Presumptive *E. coli* isolates were screened and identified based on their physiological characters, biochemical behaviours as well as their hallmark characteristic growth on Eosine Methylene Blue (EMB) Agar. Similarly *Salmonella typhi* and *Shigella* species were screened out from the non-lactose fermenter isolates based on their growth characteristics on Bismuth Sulfate Agar (BSA), Brilliant Green Agar (BGA), Xylose Lysine Dextrose (XLD) agar and Salmonella-Shigella (SS) agar. Physiological and biochemical behaviours were also investigated to confirm their identity.

1.4.2 Isolation and Identification of methicillin resistant *Staphylococcus aureus*

For isolation of MRSA, aliquots from each enriched buffer peptone water culture were plated on blood agar and Mannitol Salt agar (MSA) supplemented with 1µg of Oxacillin/mL. The plates were incubated at 37°C for 24-48 hours. After incubation, colonies were isolated and purified. The isolates were confirmed as MRSA through culturing them on MSA and Baird Parker Agar. A series of physiological and biochemical studies were carried out intended for confirmation of identity.

1.5 Antibiotic susceptibility test

Antibiotic susceptibility tests for selected isolates were performed according to the method of Kirby Bauer [15]. Sensitivity of the enteric bacteria isolates antibiotics was assessed against commercially available standardized antibiotic discs of Ampicillin (10sµg), Amoxycillin (30µg), Ceftriaxone (30µg), Chloramphenicol (30µg), Ciprofloxacin (5µg), Gentamicin (10µg). Besides, Amikacin (30µg), Ceftriaxone (30µg), Ceftazidime (30µg), Ciprofloxacin (5µg), Oxacillin (1µg) and Trimethoprim-sulfamethoxazole (1.25µg) were used to determine the susceptibility pattern of MRSA isolates.

By using subculture of each isolate, desired bacterial suspension was prepared in nutrient broth for antibiotic susceptibility test and the turbidity of the culture was adjusted with the McFarland standard 0.5. A cotton swab was dipped in the culture preparation and streaked over the surface of the Muller-Hinton agar medium to

obtain uniform inoculums. The antibiotic discs were then placed on the surface of the seeded plates at appropriate arrangement by using sterile forceps and kept at 4°C for 30 minutes to diffuse antibiotic in the media. Then the plates were incubated at 37°C for 24 hours and the diameter of the clear zone of inhibition was measured, recorded and defined according to the standard table given by the CLSI.

III. Results and Discussion

1.6 Bacteria on the sampling surfaces

We collected a total of 45 swab samples from 3 distinct locations of each of the 15 public buses. Figure 1 represents the total bacterial counts (in the form of CFU/4cm^2) enumerated from collected swabbed samples. According to the figure it is evident that all locations were heavily contaminated with bacteria. Abundance of bacteria in non-porous, inert surfaces reflects poor hygienic condition of the buses. Among the locations, grab rails were found to be the most contaminated. Bacterial count on grab rail surfaces were ranged from (32-263)×10^4/4cm^2 area with a median value of almost 122×10^4/4cm^2 which means that more than half of the samples contain bacterial load higher than the median value. On the other hand, armrests were less contaminated than grab rails but slightly more contaminated than vinyl seats. Armrests swab samples' bacterial load ranged in (31-239)×10^4 whereas (30-186)×10^4 were enumerated from vinyl seat samples.

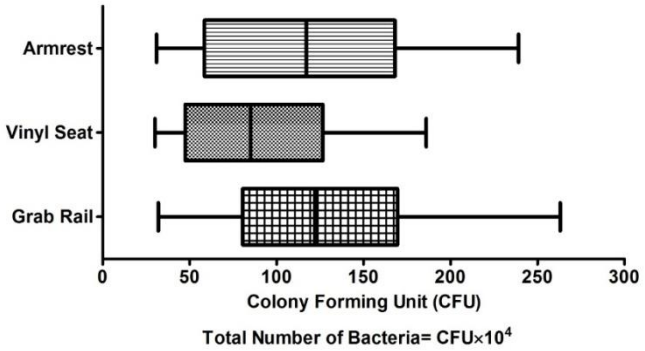

Fig. 1: Distribution of total viable bacteria over three sampling surfaces. Each Box-Whisker plot represents data on number of colony forming unit enumerated from 10^{-4} dilutions of swab samples from 4 cm^2 area of a given location.

Dunn's multiple comparison test ($p < 0.05$) indicated significant difference in bacterial load between grab rail and vinyl seat, and vinyl seat and armrest. However no significant difference between bacterial load on grab rail and armrest was found at $p < 0.05$.

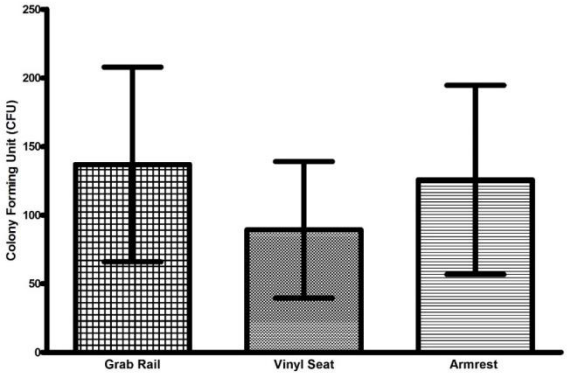

Fig. 2: Relative differences among bacterial load of the three sampling locations. Grab rail contained the greatest number of load followed by armrest and vinyl seat.

It is not surprising that the three hand touch surfaces of buses were teemed with bacteria. Several studies on bacterial presence on hand touch surfaces in buses, trains, mobile phones, door knobs, computer key boards have shown that though these surfaces are non-porous and non-nourishing items for microbial proliferation, substantial

number of bacteria is present on these sites[14]. Various mechanisms to explain presence of such high number of bacteria on those surfaces have been proposed. Abundance of bacteria in our sampling locations can be attributed to frequent skin contact due to popularity and over-crowdedness of the buses, absence of routine cleaning of public buses, poor public sanitation practice and lack of consciousness among passengers. Relative abundance of bacteria in the sampling sites may be explained in terms of frequency of skin contact. In a typical busy day, the number of sitting passengers on a bus is almost equal to number of standing passengers. Grab rail provides the only grab-support for standing passenger and therefore prone to frequent contact with palm skin which in turn contribute to increase in magnitude of microbial contamination. Similarly, armrests get direct contact with arm skin and palm; hence retain significant number of bacteria. However, frequency of getting contact is lower in the case of armrests while compared to grab rail. On the other hand, vinyl seats which get the less likelihood of contact with skin from the passengers are expected to retain low number of bacteria. In our study, theses locations were reported to harbour comparatively lower number bacteria than the other two locations. However, bacterial count on vinyl seat surfaces indicate that though they receive the less skin contact other mechanism may attribute to build up bacterial number. The result is alarming enough in terms of public health issue. Through hand and skin bacteria can find way to enter human body form contaminated material which may be detrimental for susceptible host. As grab rail, armrest or vinyl seat is made up of non-porous, non-absorbing, easy to swipe materials; transfer of bacteria from human sources can be blamed as major contributor in building up of microbial contamination level [14].

1.7 Enteric bacteria from the samples

Our study focused on identification of three representative enteric bacteria: *E. coli, Salmonella typhi* and *Shigella* from the collected samples. Identification started with isolation of bacterial isolates from the samples and streaking them across MacConkey agar surfaces. Lactose fermenter colonies were suspected as *E. coli* and jet black colonies with green metallic sheen in EMB agar platewere presumptively selected. Confirmatory identification was based onthe cultural, morphological and biochemical behaviors of the presumptive isolates. (Table 1,2,3,4). On the other hand, non-lactose fermenter colonies were cultured on several differential and selective media aimed at isolating presumptive *Salmonella typhi* and *Shigella* isolates. Likewise identification of *E. coli*, identification of *Salmonella typhi* and *Shigella* isolates were confirmed through a series of intended cultural, morphological and biochemical investigations.

Figure 2 represents relative distribution of the number of target enteric bacteria over each of the three sampling locations. About 33 *E. coli* isolates, 17 *Salmonella typhi* isolates and 9 *Shigella*isolates were recovered from the samples.

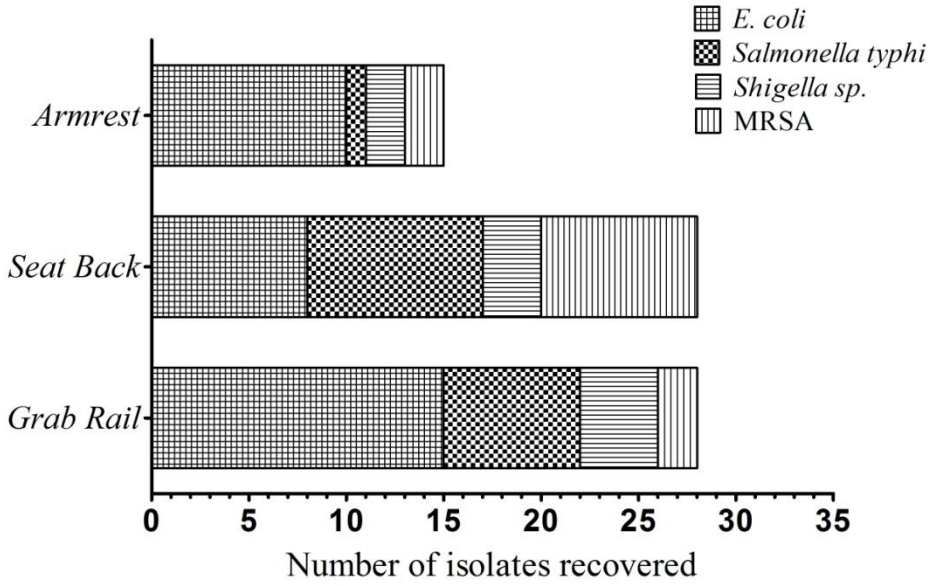

Fig. 3: Distribution target pathogenic bacteria over the sampling locations. Total number of isolates: *E. coli*=33, *Salmonella typhi*=17, *Shigella*=9, MRSA=12

Susceptibility of the target enteric bacteria against some prescribed antibiotics were investigated. Among 33 *E. coli* isolates, almost all the isolates were found to exhibit resistance against representative β-lactums: ampicillin and amoxicillin. Moreover, 30 isolates were resistant against antibacterial action of the third generation cephalosporin: ceftriaxone, and all the isolates showed resistance against chloramphenicol. However, all isolates were susceptible to ciprofloxacin and gentamycin. Similar sensitivity pattern was observed for *Salmonella typhi* isolates. *Shigella* isolates were also reported for remarkable resistance against ampicillin and amoxycillin though no resistance against ceptriaxone, chloramphenicol and gentamycin was observed. The findings are alarming enough as these isolates are the most pronounced agents for enteric diseases in humans. Most of the time the presence of this bacteria in touch surfaces is indicative of fecal-oral transmission as well as lack of proper sanitation and hygienic practice. Passengers who travel by buses under study may be infected with the bacteria through a number of ways among which ingestion through food may be the most common route of entry of the pathogens. Resistance against available antibiotics is a growing concern all over the world. Patterns of resistance against test antibiotics exhibited by the isolates omen onset of serious diseases once the organisms find their way toward infection. Our findings recommend washing hands with suitable disinfectants after travelling in public buses to avoid chance of transmission of these enteric pathogens.

Table 1: Physiological and Biochemical behaviour of *E. coli* isolates

Category	Test	Behaviour of the isolates																																
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Biochemical behaviour	Indole	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	MR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	VP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Citrate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	H_2S production	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nitrate reduction	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	ONPG	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Urease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Catalase	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Gelatinase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lipase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Acid from glucose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Gas from glucose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Lactose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Maltose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Mannitol	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Sorbitol	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Sucrose	+	+	-	+	-	-	-	+	-	-	+	+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	+	+	-	-	-	-	-
	Raffinose	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physiological behaviour	Motility	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Yellow pigment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: "+" indicates positive result; "-" indicates negative result

Table 2: Cultural, Physiological and Biochemical behaviour of *Salmonella typhi*isolates

Category	Test	Behaviour of the isolates																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Biochemical behavior	**Indole**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	MR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	VP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Citrate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	H_2S production	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Nitrate reduction	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	ONPG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Urease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Catalase	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Gelatinase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lipase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Acid from glucose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Gas from glucose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lactose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maltose	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Mannitol	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Sorbitol	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Sucrose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Raffinose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physiological behavior	**Motility**	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Yellow pigment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Growth on selective media	**Black colonies on BSA**	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Red/Yellow colonies on XLD	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Pink white colonies on BGA	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Note: "+" indicates positive result; "-" indicates negative result

Table 3: Cultural, Physiological and Biochemical behaviour of *Shigella*sp. isolates

Category	Test	Behaviour of the isolates								
		1	2	3	4	5	6	7	8	9
Biochemical behavior	**Indole**	+	-	-	-	-	+	-	-	-
	MR	+	+	+	+	+	+	+	+	+
	VP	-	-	-	-	-	-	-	-	-
	Citrate	-	-	-	-	-	-	-	-	-
	H_2S production	-	-	-	-	-	-	-	-	-
	Nitrate reduction	+	+	+	+	+	+	+	+	+
	ONPG	-	-	-	+	+	-	-	-	+
	Urease	-	-	-	-	-	-	-	-	-
	Catalase	+		+			+		+	
	Gelatinase	-	-	-	-	-	-	-	-	-
	Lipase	-	-	-	-	-	-	-	-	-
	Acid from glucose	+	+	+	+	+	+	+	+	+
	Gas from glucose	-	-	-	-	-	-	-	-	-
	Lactose	-	-	-	-	-	-	-	-	-
	Maltose	-	-	-	+	+	-	-	-	+
	Mannitol	-	+	-	+	+	-	+	-	+
	Sorbitol	-	-	-	-	-	-	-	-	-
	Sucrose	-	-	-	-	-	-	-	-	-
	Raffinose	-	-	-	+	+	-	-	-	-
Physiological behavior	**Motility**	-	-	-	-	-	-	-	-	-
	Yellow pigment* **	-	-	-	-	-	-	-	-	-
	MacConkey Agar	+	+	+	+	+	+	+	+	+

Note: "+" indicates positive result; "-" indicates negative result

Table 4: Cultural, Physiological and Biochemical behaviour of MRSA isolates

Category	Test	Behavior of the isolates											
		1	2	3	4	5	6	7	8	9	10	11	12
Biochemical behavior	**Indole**	-	-	-	-	-	-	-	-	-	-	-	-
	MR	-	-	-	-	-	-	-	-	-	-	-	-
	VP	+	+	+	+	+	+	+	+	+	+	+	+
	Citrate	+	+	+	+	+	+	+	+	+	+	+	+
	H_2S production	-	-	-	-	-	-	-	-	-	-	-	-
	Nitrate reduction	+	+	+	+	+	+	+	+	+	+	+	-
	ONPG	-	-	-	-	-	-	-	-	-	-	-	-
	Urease	+	+	+	+	+	+	+	+	+	+	+	+
	Catalase	+	+	+	+	+	+	+	+	+	+	+	-
	Oxidase	-	-	-	-	-	-	-	-	-	-	-	-
	Coagulase	+	+	+	+	+	+	+	+	+	+	+	+
	Gelatinase	+	+	+	+	+	+	+	+	+	+	+	+
	Lipase	+	+	+	+	+	+	+	+	+	+	+	+
	Acid from glucose	+	+	+	+	+	+	+	+	+	+	+	+
	Gas from glucose	-	-	-	-	-	-	-	-	-	-	-	-
	Lactose	+	+	+	+	+	+	+	+	+	+	+	-
	Maltose	+	+	+	+	+	+	+	+	+	+	+	+
	Mannose	+	+	+	+	+	+	+	+	+	+	+	-
	Mannitol	+	+	+	+	+	+	+	+	+	+	+	-
	Sorbitol	-	-	-	-	-	-	-	-	-	-	-	-
	Sucrose	+	+	+	+	+	+	+	+	+	+	+	+
	Raffinose	-	-	-	-	-	-	-	-	-	-	-	-
Physiological behavior	**Growth on 10% NaCl**	+	+	+	+	+	+	+	+	+	+	+	+
	Growth at 15°C	+	+	+	+	+	+	+	+	+	+	+	-
Growth on selective media	**Golden yellow colony on MSA media**	+	+	+	+	+	+	+	+	+	+	+	+

Note: "+" indicates positive result; "-" indicates negative result

Table 5: Antibiotic sensitivity patterns of the enteric bacteria against test antibiotics

Name of the isolate	Total number of isolates	Antibiotic																	
		Ampicillin (10µg)			Amoxicillin (30 µg)			Ceftriaxone (30 µg)			Chloramphenicol (30 µg)			Ciprofloxacin (5 µg)			Gentamicin (10 µg)		
		R	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***
Escherichia coli	33	31	2	0	32	1	0	30	2	1	33	0	0	0	0	33	0	0	33
Salmonella typhi	17	17	0	0	17		0	16	1	0	17	0	0	0	0	17	0	0	17
*Shigella*sp.	9	9	0	0	9	0	0	0	0	9	0	0	9	0	7	2	0	0	9

Table 6: Antibiotic sensitivity pattern of the MRSA isolate against test antibiotics

Name of the isolate	Total number of isolates	Antibiotic																	
		Amikacin (30µg)			Ceftriaxone (30µg)			Ceftazidime (30µg)			Ciprofloxacin (5µg)			Oxacillin (1µg)			Trimethoprim-Sulfamethoxazole (1.25µg)		
		R	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***	***R***	***I***	***S***
Staphylococcus aureus	12	0	0	12	0	0	12	11	1	0	0	0	12	12	0	0	0	0	12

1.8 Methicillin Resistant *S. aureus* from the samples

Aiming at isolation of MRSA, oxacillin resistant colonies from MannitolSalt Agar were subjected to selective screening utilizing blood agar, MSA with oxacillin and Baird Parker agar media. Presumptive isolates exhibiting characteristics growth on those media were identified on the basis of their cultural, morphological and biochemical profiles. 12 isolates were identified and their antibiotic susceptibility pattern was investigated. The isolates were susceptible to amikacin, ceftriaxone, ciprofloxacin and trimethoprim-sulfamethaxazole, however resistance was reported against ceftazidime and oxacillin. Presence of MRSA in touch surfaces is far more disquieting than presence of enteric bacteria because MRSA can find its route of entry into the human body through skin and subsequent skin infection may occur [16-20]. However susceptibility pattern of the isolates indicates that the isolates can be controlled by administration of commonly prescribed drugs. Over the last ten years MRSA has attained significant concern from public health investigators due to its upsetting resistance against antibiotics. Furthermore attention has been moved to community-acquired infection from nosocomial infection as MRSA is continuously reported to exist in community areas, public places as well as common hand touch surfaces[21]. Due

concern should be given to understand distribution of the bacteria in public areas and associated risk factors to curb interpersonal transmission and subsequent health hazard.

IV. Conclusion

The current study generated some important findings related to the microbiological contamination types and magnitude in public buses of Chittagong city of Bangladesh. To prevent possible health hazards and maintaining good hygienic conditions require attention from researchers, governments, owners of the buses as well as increased personal hygienic practices from users. The study represents a snapshot only, through investigation on the microbiological parameters on various parts of bus and other types of transportation system should be carried out to get real pictures of transportation environment intended for protecting and upgrading health of the city dwellers.

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