Antimicrobial resistance and typing of *Salmonella* isolated from street vended foods and associated environment

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Abstract The present study was carried out to find out the occurrence and types of *Salmonella* present in street vended foods and associated environment, and their resistance pattern against various antibiotics. About 1075 street vended food and associated environment samples were processed for isolation and confirmation of different *Salmonella* spp. by targeting gene specific *invA* gene and serotype specific *Sdf I*, *Via B* and *Spv* genes by PCR. Selected *Salmonella* isolates were screened for antibiotic resistance by using Baur–Kirby disk diffusion test. Out of 1075 samples, only 31 (2.88%) isolates could be amplified the *invA* gene of which 19 could be recovered from meat vendors; 8 from egg vendors while remaining 4 from milk vendors. Though, majority of *Salmonella* recovered from raw foods the ready-to-eat food like chicken gravy and rasmalai also showed its presence which pose a serious public health threat. Overall, 19, 6 and 1 isolates of *S. Typhimurium*, *S. Enteritidis* and *S. Typhi* could be detected by PCR while remaining 5 isolates could not be amplified suggesting other type of *Salmonella*. Selected *Salmonella* isolates were completely resistance to Oxacillin (100%) followed by Cefoxitin (30.43%) and Ampicillin (26.10%). Thus, it is observed that the street vended foods of animal origin and associated environment play an important role in transmission of food borne pathogens including *Salmonella*.

Keywords Antibiotic resistance · *Salmonella* · Street food · Typing

Introduction

Street vended foods are those foods which are readily and easily available on the road side for immediate consumption in almost all cities all over the world. These foods are relished and consumed throughout the world not only because of their unique taste and flavor but also due to their easy availability. Majority of the human population depends on these street foods for their nutritional fulfillment due to its convenience, cheaper rate and taste by compromising the quality and safety. Further, there is a growing demand for foods of animal origin especially by the younger generation. However, these foods are prepared by majority of the poor people who are uneducated and have limited knowledge about sanitation and hygiene. Hand and dish washing are usually done in plastic containers and sometimes without soap due to lack of running water (Kwiri et al. 2014). Further, the health risk also increases with the use of poor quality raw materials (meat, eggs or fishes) which might be contaminated with faeces (manure, both of human and animal origin) or unsafe water (used during irrigation and cleaning) (Beuchat 2002; Johannessen et al. 2002). Availability of potable and microbiologically safe drinking water is also needs to be compromised by these poor people. Further, vending operations in many places have been observed to carry out at dirty places even near public toilets and garbage dumping grounds. In addition to this, the water logging situation and faulty drainage systems in some Indian cities may further add many microbial contaminants. Huge rodent and pest population may also contribute many pathogens in these street foods. Use of contaminated raw food, handling of foods with contaminated hands, mixing of cooked item with uncooked items, dirty water used for washing and cleaning purpose, improper cooking

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temperature leads to contamination of food products with various pathogens which causes food borne infections like diarrhea, cholera, typhoid fever and food poisoning (Dawson and Canet, 1991).

Most of incidence of food borne outbreak caused by *E. coli*, *S. aureus*, *Salmonella*, *Campylobacter*, *Listeria* and *Clostridium* spp. However, among several food borne bacterial pathogens, *Salmonella* species has long been recognized as an important food borne pathogen and a major public health burden worldwide (Hungaro et al. 2013). Although, as many as 2610 serovars of *S. enteric* have been identified, the most common serotypes attributed to food borne outbreaks are *S. Typhimurium* and *S. Enteritidis* which account for more than 75% of reported cases and over 2300 serovars were identified within subspecies I (Guibourdenche et al. 2010; Schlundt et al. 2004). *Salmonella enterica* subsp. *enterica* which is one of the leading causes of zoonotic food-borne disease worldwide (Toboldt et al. 2013). Many of these serotypes appear to contaminate various types of foods. However, only a small fraction of the thousands of described subspecies I serovars frequently cause disease in humans and domestic animals. Incidence of disease caused by different serovars varies over time and evolution is further punctuated by the emergence of epidemic and multidrug resistant variants (Stevens et al. 2009). Emergence of antibiotic resistance among different species of bacteria was on the rise in last few decades (Davies and Davies 2010). This problem poses great threat to public health in case of bacteria of zoonotic importance transmitted from food animals and their products. In this context, contaminated street foods of animal origin serve as an important threat to public health. Further, the extensive use of antibiotics in food production system also favors antibiotic resistance. However, information is limited about the presence of different serotypes of *Salmonella* and their antibiotic resistance profile in various types of street foods especially foods of animal origin. Therefore, the present study was carried out to find out the different serotypes of *Salmonella* and their antibiotic resistance profile in street vended foods and associated environment in Bareilly and Delhi cities.

Materials and methods

Collection of food and associated environmental samples

In present study, six vendors each of meat and meat products, egg and egg products, and milk and milk products were selected from different locality representing the particular area viz. Delapeer, Civil lines, Izatnagar,

Rajendar nagar, Air force station and Izatnagar railway station in Bareilly, Uttar Pradesh, and Nizamuddin, Old Delhi, Anand Vihar, Karol baugh, Okhala, Kalkaji DDA flats and Jamiyanagar areas in Delhi metropolitan city. A total of 1075 samples of foods of animal origin and associated environmental samples consisting of handswab (54), Plate swab (54), Table swab (54), Cloth swab (54), Raw chicken (6), Cooked chicken Gravy (6), Raw chicken masala (6), Raw kabab (6), Cooked chicken (12), Salad (30), Chutney (30), Sauce (6), Raw Paneer momo (6), Raw chicken momo (6), Raw egg (18), Boiled egg (18), Omelette (18), Rasmalai (12), Pedha (6), Burfi (18), Channa (12), Kala Jamun (6), Boiled milk (6), Curd (18), Paneer (12), Milk Cake (6) were collected from Delhi (157) and Bareilly (918) at different intervals in the evening from the month of September, 2014 to May, 2016. Each food sample was collected in sterile polythene bag or glass/plastic container by adopting standard aseptic conditions. Swab samples were collected aseptically in 10 ml maintenance media (0.85% NSS + 0.1% peptone) by rubbing the moisten swab on 10 × 10 cm surface of plate, cloth, table individually, while whole palm of the vendor was rubbed for hand swab sample. All the samples were transported in cold chain. It took about 6–8 h to reached the laboratory for samples collected from Delhi while 1–2 h for Bareilly. All these samples were immediately processed after being received at the VPH laboratory.

Isolation and identification of *Salmonella* spp

All the samples were processed for isolation of *Salmonella* spp. as per the method prescribed in Manual of methods of analysis of foods (FSSAI, 2012). Morphologically suspected colonies from Hektole enteric agar (HEA) plate were then inoculated in Triple Sugar Iron (TSI) agar and Lysine Iron Agar (LIA) slants with standard procedure and incubated at 35–37 °C for 24–48 h. Typical reaction of alkaline (red) slant, acid (yellow) butt with or without H₂S production (blackening in butt) in TSI, and alkaline (purple) slant, alkaline (purple) butt with H₂S production (blackening in butt) in LIA was considered as presumptive positive for *Salmonella* spp. These cultures were further tested by Gram staining, biochemical tests (Indole, MR-VP and Urease test) and PCR assay targeting *invA* gene (FSSAI 2012; Rahn et al. 1992). All the confirmed isolates were preserved on nutrient agar by storing at 4 °C for further characterization.

PCR assay for detection of *Salmonella* specific *invA* gene

The PCR targeting *invA* genes of *Salmonella* was optimized as per the method described by Rahn et al.

(1992). The *invA* gene of *Salmonella* contains sequences unique to this genus and has been proved to be a suitable PCR target with potential diagnostic application (Pathmanathan et al. 2003). This gene is recognized as an international standard for detection of *Salmonella* genus (Jamshidi et al. 2008). The details of primers, genes targeted and the amplicon sizes of different genes are mentioned in Table 1. DNA extraction was carried out by boiling lysis method for detection of various genes in different isolates of *Salmonella* (Theron et al. 2001). The PCR reaction mixture for amplification of targeted gene consisted of 12.5 µl of 2× PCR master mixtures (Thermo Scientific, USA), 1 µl (10 pmol/µl) of each forward and reverse primers (Eurofins, India), 2 µl of DNA template and 8.5 µl nucleus free water to make final volume up to 25 µl. After adding all the components, the tubes were briefly spun and loaded on to thermocycler (Eppendorf, India) with the cycling conditions sets as initial denaturation of 94 °C for 5 min, followed by 30 cycles each of denaturation at 94 °C for 1 min, annealing at 51 °C for 1 min and extension at 72 °C for 1 min and final extension at 72 °C for 7 min. Agarose gel electrophoresis of amplified PCR products was carried out using 1.5% agarose gel in 0.5× TBE buffer in horizontal submarine gel electrophoresis system and photographed in gel documentation system (Sambrook and Russel 2001).

PCR assay for *Salmonella* typing

Typing of *Salmonella* isolates for identification of *Salmonella* Enteritidis, *Salmonella* Typhi, and *Salmonella* Typhimurium was also carried out using multiplex PCR assay (De Freitas et al. 2010). A 304 bp fragment of the *SdfI* gene, chromosomal region related to invasiveness and infection of poultry and eggs (ENTF and ENTR primers) was selected for serotype Enteritidis. For Typhimurium serotype, a 401 bp *Spy* gene fragment was selected, which encodes a

specific periplasmic protein (TyphF and TyphR primers). All these primers were compiled from Alvarez et al. (2004). Concerning serotype Typhi, a fragment of 738 bp *ViaB* gene coding for bacterial capsule protein synthesis (Vi antigen) was selected (ViaBF and ViaBR primers). This pair of primers was described in Kumar et al. (2006). DNA of suspected culture was extracted by boiling lysis method. In brief, the optimized PCR reaction mixture consisted of 2.5 µl of 10× PCR buffer, 6 mM MgCl₂, 0.3 mM dNTP mix, 1 U of Taq polymerase, 10 pmol of each set of forward and reverse primer, 5 µl of DNA template and nuclease free water to make reaction volume of 25 µl. The PCR cycling conditions were programmed with an initial denaturation of 5 min at 94 °C; followed by 35 cycles each with denaturation at 94 °C for 30 s, annealing at 57 °C for 1 min, extension at 72 °C for 1 min 30 s followed by final extension at 72 °C for 7 min. Agarose gel electrophoresis and documentation of amplified PCR products was carried out as described earlier.

Antibiotic resistance profile of the *Salmonella* isolates

The antibiotic resistance profile of the recovered and selected 23 *Salmonella* isolates were carried out as per the guidelines provided by Clinical Laboratory Standards Institute (CLSI 2014). In brief, *Salmonella* isolates were subjected to disc diffusion assay on Mueller–Hinton agar (Bauer et al. 1966). The commercially available antibiotic discs viz., Cefotaxime (30 µg), Ceftriaxone (30 µg), Cefotaxime (30 µg), Sulfamethoxazol and Trimethoprim (23.75/1.25 µg), Ampicillin (10 µg), Amoxicillin and Clavulanic Acid (30 µg), Ciprofloxacin (5 µg) Cefepime (30 µg), Cefoxitin (30 µg), Oxacillin (1 µg), Kanamycin (30 µg), Cefpodoxime (10 µg), Ceftazidime (30 µg) were used for testing. A loopful of pure culture of each isolate was transferred into a tube containing 5 ml of nutrient broth medium. The inoculated broth was incubated at 37 °C for 2 h in a shaker water bath. After incubation, each

Table 1 Sequence of the primers used in PCR assay of *Salmonella* spp. with the product size

Sr. no.	Bacteria	Primer sequence (5'-3')	Corresponding gene	Expected product size (bp)	References
1	<i>Salmonella</i> spp.	F: 5' GTGAAATTATCGCCACGTTCTGGGCAA -3' R: 5'TCATCGCACCGTCAAAGG AACC-3'	<i>invA</i>	284	Rahn et al. (1992)
2	<i>S. Enteritidis</i>	F: 5' TGT GTT TTA TCT GAT GCA AGA GG-3' R: 5' TGA ACT ACG TTC GTT CTT CTG G- 3'	<i>Sdf I</i>	304	De Freitas et al. (2010)
3	<i>S. Typhi</i>	F: 5' CAC GCA CCA TCA TTT CAC CG-3' R: 5' AAC AGG CTG TAG CGA TTT AGG-3'	<i>Via B</i>	738	De Freitas et al. (2010)
4	<i>S. Typhimurium</i>	F: 5' TTG TTC ACT TTT TAC CCC TGA A-3' R:5' CCC TGA CAG CCG TTA GAT ATT-3'	<i>Spy</i>	401	De Freitas et al. (2010)

test isolate culture was centrifuged at 5000 rpm for 5 min, the pellet thus obtained was dissolved using appropriate volume of sterile normal saline solution to match the turbidity to 0.5 McFarland standard tubes. This culture was then evenly spread on Mueller- Hinton (MH) agar plate. Antibiotic discs were then placed on inoculated agar surface at about 2–3 cm apart. Each disc was pressed down to ensure complete contact with the agar surface. The plates were inverted and kept in inverted position for incubation at 37 °C overnight. The zone of inhibition (diameter in mm) for each antibiotic was measured and noted for each test isolate. The obtained data was compared with CLSI interpretative chart to grade the test isolates as sensitive, intermediate and resistant for respective antibiotics.

Results

As *Salmonella* is one of the major food borne pathogen causing various illnesses in humans, a total of 1075 street vended foods and associated environmental samples were collected from Delhi and Bareilly cities and processed for isolation, identification, typing and antibiotic resistant profile. Out of all, 52 presumptive *Salmonella* were recovered and processed further for biochemical characterization including TSI and LIA test revealed 36 suspected isolates. However, while analyzing by PCR targeting genus specific *invA* gene, it was observed that only 31 (2.88%) isolates could be amplified the gene (product size 284 bp) suggesting confirmed *Salmonella* isolates (Fig. 1). The details of the isolates recovered from various foods and associated environmental samples are given in Table 2. However, all the remaining samples excluding the samples depicted in Table 2 were found to be negative for *Salmonella*.

Out of the 31 (11.27%) confirmed *Salmonella* isolates, 19 (15.96%) isolates could be recovered from raw chicken, chicken gravy, raw chicken masala, plate swab, table swab, chutney and raw kabab samples collected from meat vendors; 8 (7.84%) isolates from masala, table swab, plate swabs, raw egg and boiled egg samples from egg vendors, while remaining 4 (7.40%) isolates from table swab, ras-malai and paneer samples of milk vendors. Interestingly, majority of the recovered isolates were from Bareilly (3.05%) than Delhi (1.91%) where majority of raw food samples (like raw chicken, raw egg, raw paneer and raw chicken masala) showed presence of *Salmonella* isolates than cooked or processed food samples. Some of the swab samples collected from these vendors also showed presence of heavy load of *Salmonella*.

All the confirmed *Salmonella* isolates were further subjected to multiplex PCR for *Salmonella* typing targeting serovar specific genes for *S. Typhimurium*, *S. Typhi* and *S. Enteritidis* giving an expected product size of 401, 738 and

Fig. 1 PCR amplified product of *invA* gene (284 bp) of *Salmonella* spp. isolated on 1.5% agarose gel. Lanes 1: positive control; Lanes 2–11: positive samples; Lane M: 100 bp plus DNA ladder

304 bp, respectively (Fig. 2). Overall, 19, 6 and 1 isolates of *S. Typhimurium*, *S. Enteritidis* and *S. Typhi* could be detected by PCR while remaining 5 isolates could not be amplified by these three serovar specific genes suggesting untypable or other type of *Salmonella* (Table 2). Raw chicken, raw chicken masala and raw kabab samples showed presence of maximum number of *Salmonella* Typhimurium isolates than other food samples. Overall, *S. Typhimurium* found to be frequently contaminated these street foods and associated environmental samples than *S. Enteritidis* and *S. Typhi*. However, 5 isolates which were positive by *invA* gene could not be typed in the present study needs to be investigated further.

In vitro antibiotic susceptibility assay showed that all the tested isolates were completely resistant to Oxacillin (100%) followed by Cefoxitin (30.43%) and Ampicillin (26.10%). However, Ceftazidime was found to be highly effective antibiotic followed by Cefepime, Ciprofloxacin, Ceftriaxone and Cefotaxime as all the tested isolates were highly sensitive and completely inhibited by these antibiotics (Table 3). Susceptibility to other antibiotics was variable as given in Table 3.

Discussion

Salmonellosis is known for major food borne zoonotic disease transmitted through foods of animal origin. Millions of people suffered from Salmonellosis all over the world and many of these cases acquired infection after consumption of foods of animal origin (Majowicz et al. 2010). However, reports are very scanty particularly about the *Salmonella* infection acquired through consumption of street vended foods, though millions of people are consuming street food every day. Further, majority of children and young age group have hobbies of taking foods from street where they visited to these street vendors at least once in a week. WHO estimated that food borne and waterborne diarrhoeal diseases taken together kill about 2.2

Table 2 Details of *Salmonella* types isolated from different street vended foods and associated environmental samples

Vendors	Type of sample	No. of samples tested	No. of isolates	Type of <i>Salmonella</i>			
				<i>S. Typhimurium</i>	<i>S. Typhi</i>	<i>S. Enteritidis</i>	Not able to detect
Meat vendor	Raw chicken	47	12	10	Nil	1	1
	Chicken gravy	6	1	1	Nil	Nil	Nil
	Plate swab	18	1	Nil	Nil	Nil	1
	Table swab	18	2	1	Nil	1	Nil
	Raw chicken masala	6	1	1	Nil	Nil	Nil
	Chutney	18	1	Nil	Nil	1	Nil
	Raw kabab	6	1	1	Nil	Nil	Nil
Egg vendor	Boiled egg	18	1	Nil	Nil	Nil	1
	Masala	30	2	Nil	Nil	Nil	2
	Table swab	18	2	Nil	1	1	Nil
	Plate swab	18	2	2	Nil	Nil	Nil
	Raw egg	18	1	1	Nil	Nil	Nil
Milk vendors	Table swab	18	1	1	Nil	Nil	Nil
	Paneer	18	2	Nil	Nil	2	Nil
	Rasmalai	18	1	1	Nil	Nil	Nil
	Total	275	31	19	1	6	5

Fig. 2 PCR amplified product of *Sdf I* (304 bp), *Via B* (738 bp) and *Spy* (401 bp) genes of *S. Enteritidis*, *S. Typhi* and *S. Typhimurium* isolated on 1.5% agarose gel. Lanes 2–3: *S. Typhimurium*. Lane 6: *S. Typhi*. Lanes 5, 7: *S. Enteritidis*. Lane M: 100 bp plus DNA ladder

million people annually, 1.9 million of them are children (WHO 2011b). In India, majority of the food borne illnesses are under reported due to several reasons where no treatment or self treatment is one of the major reasons which may further burden on antibiotic resistance among these food borne pathogens. Therefore, continuous monitoring of these foods for control of food borne infection is very important. In the present study also, we could isolated 31 (2.88%) *Salmonella* from 1075 samples collected from street vendors which is similar to the finding of Tunung et al. who reported the isolation rate of 9.3% from street foods (Tunung et al. 2007). However, higher isolation rate of 27.5 and 49.58% was also observed in street foods (Khan et al. 2013; Kawser 1997). Surprisingly, out of 36 presumptive *Salmonella* isolates, only 31 could amplify

invA gene. As discussed earlier the *invA* gene is recognized as an international standard for detection of *Salmonella* genus (Jamshidi et al. 2008).

Out of the 31 (11.27%) confirmed *Salmonella* isolates, 19 (15.96%), 8 (7.84%) and 4 (7.40%) isolates could be recovered from raw foods and environmental samples from meat, egg and milk vendors, respectively. From the initial contamination of raw foods with pathogenic bacteria to subsequent contamination by vendors during preparation; there are many factors that should be considered for analyzing the hazards due to street foods (Mankee et al. 2003; Dawson and Canet 1991). From the present finding also, it is indicative that, the raw foods and associated environment play an important role in transmission of food borne pathogens including *Salmonella*. Several *Salmonella* spp. have been isolated from various raw foods including raw milk, meat, eggs and their products (Van et al. 2007; Mare et al. 2001; Lim et al. 2005). Further, hygienic and sanitary practices followed by uneducated or poorly educated vendors were not appropriate which leads to contribution of additional contamination in these street vended foods. Some of the swab samples collected from these vendors also showed presence of heavy load of *Salmonella* organisms. The results suggested for requirement of good quality raw food, proper cleanliness of vending operations and appropriate cooking of these foods before human consumption.

Interestingly, majority of the recovered isolates were from Bareilly (3.05%) than Delhi (1.91%) where majority of raw food samples like raw chicken, raw egg, raw paneer and raw chicken masala showed presence of *Salmonella*

Table 3 Antimicrobial resistance/sensitivity pattern of *Salmonella* isolates

Antimicrobials	Resistant	Intermediate	Susceptible
Ciprofloxacin (CIP)	1 (4.35)	1 (4.35)	21 (91.30)
Cefepime (FEP)	0 (0.00)	1 (4.35)	22 (95.65)
Amoxicillin/clavulanic acid (AMC)	4 (17.40)	1 (4.35)	18 (78.26)
Cefoxitin (FOX)	7 (30.43)	1 (4.35)	15 (65.22)
Oxacillin (OX)	23 (100.00)	0 (0.00)	0 (0.00)
Ceftriaxone (CRO)	0 (0.00)	2 (8.70)	21 (91.30)
Cefotaxime (CTX)	0 (0.00)	3 (13.04)	20 (86.96)
Ampicillin (AM)	6 (26.10)	2 (8.70)	15 (65.22)
Kanamycin (K)	5 (21.74)	0 (0.00)	18 (78.76)
Cefpodoxime (CPD)	2 (8.70)	2 (8.70)	19 (82.61)
Ceftazidime (CAZ)	0 (0.00)	0 (0.00)	23 (100.00)
Trimethoprim/sulfamethoxazole (SXT)	2 (8.70)	0 (0.00)	21 (9.30)

isolates than cooked or processed food samples. Overall, due to good or appropriate cooking practices followed by most of the vendors, cooked food samples found to be free from *Salmonella*, however post cooking contamination may appeared in such samples as noted in one chicken gravy sample in the present study. However, *Salmonella* spp. was regularly isolated from ready-to-eat poultry dishes of the street foods examined by Cardinale et al. (2005).

Various serotype-specific PCR have also been developed for some common serovars to reduce time and cost in processing isolates by conventional serotyping which is very much labor intensive and time-consuming (Withee and Dearfield 2007). In the present study also, all the confirmed *Salmonella* isolates were further subjected to multiplex PCR where 19, 6 and 1 isolates of *S. Typhimurium*, *S. Enteritidis* and *S. Typhi* could be detected while remaining 5 isolates could not be amplified by these three species specific genes suggesting untypable or other type of *Salmonella*. Raw chicken, raw chicken masala and raw kabab samples showed presence of maximum number of *Salmonella* Typhimurium isolates than other food samples. Overall, *S. Typhimurium* found to be frequently contaminated these street foods and associated environmental samples than *S. Enteritidis* and *S. Typhi*. However, 5 isolates which were positive by *invA* gene could not be typed in the present study needs to be investigated further for their typing. On the other hand, *S. Weltevreden*, *S. Braenderup*, *S. Typhimurium* and *S. Weltevreden* were among the various serotypes detected in poultry, raw milk and clinical sources in Malaysia (Rusul et al. 1996; Yassin et al. 1997; Noorzaleha et al. 2003; Chye et al. 2004).

Resistance to commonly prescribed antibiotics has emerged and spread very rapidly in the recent times. This imposes serious constraint over treatment option available against common bacterial infection in animals and humans. Present finding were comparable to Rasheed et al. (2015) where isolates of *Salmonella* obtained from different types

of food samples of bovine origin were 100 per cent sensitive to five antibiotics viz., chloramphenicol, co-trimoxazole, doxycycline hydrochloride, netillin and ofloxacin and 100 per cent resistant to Oxacillin. Out of 23 isolates of the present study, 5 (21.73%) isolates showed combined resistance to Amoxicillin/clavulanic acid (AMC), Cefoxitin (FOX), Oxacillin (OX), Ampicillin (AM), Kanamycin (K) and Trimethoprim/sulfamethoxazole (SXT). This result is comparable with the findings of Singh et al. (2012) who identified 24 different resistance patterns among their *Salmonella* isolates (Singh et al. 2012). Despite moderate frequency, the resistance to these antibiotics in food borne pathogens poses a serious public health hazard. Food borne pathogen can acquire resistance due to indiscriminate use of antibiotics in food animals, contaminate various food products at the time of slaughter, storage and possibly transmit the resistance gene to humans via food chain and vice versa (Threlfall et al. 2000; White et al. 2001).

Conclusion

Raw foods and associated environment during street vending operations play an important role in transmission of food borne pathogens including *Salmonella* where majority of the isolates belongs to *S. Typhimurium* and *S. Enteritidis*. Many of these *Salmonella* isolates were resistance in varying degree to Oxacillin, Cefoxitin and Ampicillin. However, due to appropriate cooking practices followed by most of the vendors, cooked food samples were found to be free from *Salmonella*, however post cooking/manufacturing contamination may appeared in such samples as noted in one each of chicken gravy, ras-malai and boiled egg sample in the present study. Therefore, proper hygienic practices with good quality food and adequate cooking practices needs to be followed while street vending operations in India.

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