

Original Research Article

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Bacteriological Analysis of Street Vended Food Panipuri in Mumbai Metropolitan Region

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ABSTRACT

The present study undertaken to assess the bacterial analysis of masala ware and potato masala sold with panipuri in Mumbai, Maharashtra, India. Total ten samples from different zones of Colaba area of Mumbai were aseptically collected and analysed within one hour of procurement. Isolation, enumeration and identification of the bacteria were carried out following the standard procedure. The CFU counts of the panipuri water samples ranged from 4×10^5 to 6×10^6 cfu/ml. The viable aerobic bacterial load of samples of potato masala on NA ranged from 2×10^7 to 3×10^9 cfu/g, thus indicating a high rate of contamination. All samples of have high bacterial load of pathogenic bacteria such as *Escherichia coli* (50%), *Salmonella typhi* (30%), *Salmonella paratyphi A* (20%). The isolates in potato masala were identified as *Escherichia coli* (50%), *Salmonella typhi* (20%). The bacteriological analysis of the panipuri sold in Mumbai city constitutes an important potential hazard to human health and provision of health education to the vendors improves quality of panipuri.

Keywords

Panipuri, Street food, Bacteria, Masala

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Introduction

India is famous for their unique street food and millions of people consume a wide variety of ready to eat street foods and beverage. In developing countries like India Street food contributes to 40 % of daily diet of urban population (consumer international, 2011; Pma1). People who depends on these types of food are often more interested in its

convenience rather than its safety, quality and hygiene. All types of foods are sold by street food vendors, they also provide variety and choice to customers. Consumption of this type of foods potentially increases the risk of food borne diseases caused by various pathogens. Usually vendors sold these foods by wheels barrows, trays mats, tables and make shift stalls consequently, they increasing the risk of food contamination (Ray and Mishra, 2014).

Food and Agriculture Organization defines street foods as ready to eat foods and beverages prepared and/or sold by vendors especially in streets and similar public places. In developing countries, drinks, meals and snacks sold by street food vendors are widely consumed by millions of people. In present times, people in urban parts of India are dependent on ready to eat street food which is easily available and economical as well (Madhuchhanda *et al.*, 2012). The most popular street foods in India are Panipuri or Gol gappas and Papdi chaat among others (Madhuchhanda *et al.*, 2012). The street vended foods are prepared under unhygienic conditions and displayed openly leading to a high degree of contamination water, common ingredient in panipuri is the critical factor in transmission of pathogen (Sharma and Mazumdar, 2014). The microbiological quality of street vended foods becomes important as food can act as a major source for transmission of food borne infections and intoxications. The most important mode of transmission for pathogenic microbes from food handlers to food is the faecal-oral route (Tomar *et al.*, 2018). Microbial contamination of ready-to-eat foods sold by street vendors and hawkers has become a major health problem. Street food vendors are mostly uninformed of good hygiene practices (GHP) and causes of diarrhoeal diseases (Mensah *et al.*, 2002), which can increase the risk of street food contamination (Bhaskar *et al.*, 2004; Tambekar *et al.*, 2009). 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 the analyzing the hazards due to street foods (Mankee *et al.*, 2003; Dawson and Canet 1991). The vendors can be carriers of pathogens like *E. coli*, *Salmonella*, *Shigella*, *Campylobacter* and *S. aureus* who eventually transfer these food borne hazards to consumers. In most cases, running water is not

available at vending sites; hands and utensils washing are usually done in one or more buckets, and sometimes without soap. Wastewaters and garbage's are discarded nearby, providing nutrients for insects and rodents, which may carry food borne pathogens (Tambekar *et al.*, 2011). This study was carried out to assess the bacteriological quality of a popular street food Panipuri to identify and isolate the risk factors in street food trade in Mumbai metropolitan city and recommended safety intervention, to ensure safe food practices.

Materials and Methods

Study site and samples collection

Total of 10 Panipuri samples were collected from different vendors in and around Colaba, south Mumbai. Samples were collected during visits to the sites. Vending sites hygiene and salubrious status were determined by use of structured interview and through observations. The panipuri water, the liquid part served with panipuri and the potato masala, the solid part were collected separately in different pre-sterilized vials and were maintained in chilled state using coolants (ice pack) and analyzed after procurement.

Determination of pH of the sample

The pH of panipuri water and potato masala were determined using pH paper strip, directly at the vendor and confirmed using pH meter (Systronics-361) in the laboratory.

Bacteriological analysis

For analysis 1 ml Panipuri water sample was inoculated in to Mac-Conkey broth and incubated for 12-16 h at 37⁰ C. The microbial growth was observed as turbidity in broth, and then sub cultured on the Thiosulfate-citrate-bile salts-sucrose agar (TCBS) and incubated

at 37°C for 24 hrs. After incubations, suspected colonies were identified based on their morphological, physiological and biochemical features using microscopic observation, standard biochemical methods and cultural characteristics on TCBS. Characterization and identification of the isolates were made through standard microbiological methods (Cruickshank *et al.*, 1975; Collins and Lyne, 1970; Bhat and Myero, 1962; Holt *et al.*, 2000).

Results and Discussion

In the present study total 10 Panipuri samples were collected from different public places of Colaba, Mumbai. Each sample was fragmented into two different segments (the liquid khatta pani and solid potato masala) and evaluated further. Vendors sell their samples on stands, carts or on improvised structures that are assembled every day on roadsides and share the area with several other street vendors. They cook/prepare these food items fully or partly at their homes and keep at ambient temperature, which stimulates the growth of the mesophilic organisms including food borne pathogenic bacteria. Further, none of the vendors use gloves or head caps during preparation and selling. The pH of the panipuri water samples were observed to be highly acidic ranging from 3 to 4.5 whereas the pH of panipuri mashed potato samples ranged from 5.5 to 6.8 at a temperature of 32°C. The high acidity of the panipuri water could be attributed to the addition of tamarind juice and other acidic ingredients to it.

The total aerobic bacterial load was determined separately for liquid and solid parts of the samples collected, through spread plate method. The CFU counts of the panipuri water samples ranged from 4×10^5 to 6×10^6 . The viable aerobic bacterial load of samples of potato masala on NA ranged from 2×10^7 to 3×10^9 cfu/g, thus indicating a high rate of

contamination. The isolates were subjected to a series of biochemical tests that is carbohydrate fermentation, indole, methyl red, Voges Proskauer, citrate, triple sugar iron, and lysine decarboxylase. The isolates were identified using Bergey's manual of determinative bacteriology, 9th edition.

The isolates in the panipuri water samples were identified as *Escherichia coli* (50%), *Salmonella typhi* (30%), *Salmonella paratyphi* A (20%) respectively. The isolates in potato masala were identified as *Escherichia coli* (50%), *Salmonella typhi* (20%).

The panipuri water showed high load of *Escherichia coli* followed by *Salmonella typhi* and *Salmonella paratyphi* A. The panipuri potato masala showed high load of *Escherichia coli* followed by *Salmonella typhi*.

The contamination in panipuri is high because of the conditions under which it is prepared and sold. In most cases running water is not available at vending sites and thus hand and dish washing are usually done in stagnant waters in buckets and sometimes without soap which results in contamination from hands and utensils.

Vendors usually prepare and serve the food with bare and unwashed hands which is one of the most potable sources of contamination (Das *et al.*, 2010). Waste water and garbage are discarded nearby in addition to unhygienic food handling increase the contamination.

The street food is not very much protected from flies, which may possibly get contaminated with food borne pathogens. Street foods are frequently associated with diarrheal diseases due to improper handling and serving practices. Cross contamination of street foods is also increased by unsanitary processing and preservation (Table 1 and 2).

Table.1 Cultural and biochemical characterisation isolates from Panipuri water

Sample No.	Cultural characteristics (cfu/ml)			Biochemical Tests								Probable microorganism
	NA	McA	TCBS	Xylose	Maltose	Indole	Methyl Red	Voges Prouskauer	Citrate	TSI	MDB	
1	5x10 ⁶	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, no H ₂ S	+	<i>Escherichia coli</i>
2	4x10 ⁵	LNF	NG	A	A	-	+	-	-	Alk slant/ Acid butt, No Gas, H ₂ S	+	<i>Salmonella typhi</i>
3	3x10 ⁶	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
4	2x10 ⁶	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
5	6x10 ⁶	LNF	NG	-	AG	-	+	-	-	Alk slant/ Acid butt, Gas, No H ₂ S	-	<i>Salmonella paratyphi A</i>
6	2x10 ⁶	LNF	NG	A	A	-	+	-	-	Alk slant/ Acid butt, No Gas, H ₂ S	+	<i>Salmonella typhi</i>
7	6x10 ⁶	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
8	5x10 ⁶	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
9	3x10 ⁶	LNF	NG	A	A	-	+	-	-	Alk slant/ Acid butt, No Gas, H ₂ S	+	<i>Salmonella typhi</i>
10	4x10 ⁶	LNF	NG	-	AG	-	+	-	-	Alk slant/ Acid butt, Gas, No H ₂ S	-	

Table.2 Cultural and biochemical characterisation isolates from Panipuri potato masala

Sample No.	Cultural characteristics			Biochemical Tests								Probable microorganism
	NA (cfu/ml)	MA	TCBS	Xylose	Maltose	Indole	Methyl Red	Voges-Proskauer	Citrate	TSI	MDB	
1	5x10 ⁸	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, no H ₂ S	+	<i>Escherichia coli</i>
2	4x10 ⁷	NG	NG	-	-	-	-	-	-	-	-	<i>Salmonella typhi</i>
3	3x10 ⁸	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
4	2x10 ⁹	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
5	2x10 ⁷	NG	NG	-	-	-	-	-	-	-	-	<i>Salmonella typhi</i>
6	5x10 ⁸	LNF	NG	A	A	-	+	-	-	Alk slant/ Acid butt, No Gas, H ₂ S	+	<i>Salmonella paratyphi A</i>
7	4x10 ⁸	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
8	3x10 ⁹ Cfu/g	LF	NG	AG	AG	+	+	-	-	Acid slant/ Acid butt, Gas, No H ₂ S	+	<i>Escherichia coli</i>
9	3x10 ⁷ Cfu/g	NG	NG	-	-	-	-	-	-	-	-	<i>Salmonella paratyphi A</i>
10	2x10 ⁸ Cfu/g	LNF	NG	A	A	-	+	-	-	Alk slant/ Acid butt, No Gas, H ₂ S	-	<i>Salmonella typhi</i>

The results of this study clearly show that the street-vended food is contaminated with different pathogenic bacteria and this is because proper hygienic practices are not followed while handling the food material or utensils used for food preparation or serving. The presence of these bacteria in food can pose potential risk to human health. Poor personal hygiene, improper handling, and storage practices of foods are the factors which are associated with contamination of street-vended foods in Mumbai. Provision of health education to the vendors and enforcing implementation of appropriate hygienic practices would improve bacteriological quality of street vended foods. Regular monitoring of the street food is suggested as this will help improve their quality.

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