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Microbiological quality of panipuri sold in and around Greater Hyderabad municipal corporation, Telangana

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Abstract

The microbiological quality of panipuri sold at street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants in and around Greater Hyderabad Municipal Corporation, Telangana State was studied. Twenty-five samples from each source were collected and analyzed. The total viable count, Total coliform count, Fecal coliform count, and Yeast and mold counts in the samples collected from street vended panipuri were 3.6×10^9 cfu/gm, 5.2×10^7 cfu/gm, 3.8×10^6 cfu/gm, and 3.2×10^3 cfu/gm respectively, 1.7×10^7cfu/gm, 4.3×10^5 cfu/gm, 1.2×10^5 cfu/gm, 7.2×10^2 cfu/gm respectively in the samples collected from the moderately hygienic food courts and 2.8×10^5cfu/gm, 3.6×10^4cfu/gm, 4.7×10^3 cfu/gm, and 1.2×10^2cfu/gm respectively from hygienically maintained restaurants. The incidence of *staphylococcus aureus* was 100%, 100% and 72%, *Bacillus cereus* of 44%, 28% and 16%, *Salmonella* of 16%, 8% and 0% (Nil), Shigella of 24% 12%, and 4%, Escherichia *coli* of 88%, 72% and 48%, *Streptococcus fecalis* of 64%, 44%, and 24% respectively from the street vended panipuri, moderately hygienic food courts and hygienically maintained restaurants. The counts of *staphylococcus aureus* were 2.6×10^6, 5.2×10^5, and 2.3×10^3, *Bacillus cereus* of (3.8×10^3), (4.9×10^2), 2.5×10^2, *Salmonella* of 3.9×10^2, 9.5×10^1, Nil, Shigella of 8.6×10^3, 3.9×10^2, 5.8×10^1, *Escherichia coli* of 3.6×10^2, 2.9×10^3, 4.2×10^4 and *Streptococcus fecalis* of 8.6×10^1, 8.7×10^2, 2.6×10^3 cfu/gm respectively from the samples collected from street vended panipuri, moderately hygienic food courts and hygienically maintained restaurants.

Keywords GHMC, microbial quality, panipuri, street vended foods, Telangana

Introduction

Panipuri is a type of snack that originated in the Indian subcontinent and is one of the most common street foods. During the past 10 years, the street foods and small restaurants have expanded quickly in urban as well as semi-urban areas providing a diversity of inexpensive foods for low-income groups and offering job opportunities for many local people [1]. With vast changes in the social and cultural milieu, an increase in buying power and long hours spent away from home, eating varieties of foods at cheaper rates. The food-born illness in various industrialized countries shows that up to 60% of cases may be caused by poor food handling and contaminated food. Microbial contamination of foods is an indicator of

poor sanitary practices during the preparation and storage of foods. In developing countries like India, several food products such as Panipuri, Bhelpuri, Chat, etc. are widely consumed by millions of people mostly from street vendors and small restaurants, where the hygienic conditions are very poor affecting public health [2]. Among all the street foods panipuri or golgappa are more popular where it is served without any protection against dust, smoke, etc. and the use of contaminated water, poor handling, and unhygienic conditions put together make the food one of the main sources of foodborne illnesses.

The panipuri comprises three different articles i.e., puri, filling masala, and spicy water. The filling masala and spicy water are the major sources of food pathogens. In most cases, street foods are sold without any running water source wherein the people wash their hands in contaminated water stored in buckets. The pathogens like *staphylococcus aureus, Salmonella, Bacillus cereus*, *Escherichia coli, Streptococcus fecalis, Shigella* are the major pathogens in street foods. The people handling these foods have inadequate knowledge and proper food handling and their role in the transmission of foodborne pathogens [3]. Even though people in India are consuming these foods from a variety of selling points, proper investigation of microbiological quality is scanty. The present study aims to establish the rate of contamination of the pathogens from panipuri sold in three different selling sources i.e., Street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants.

Methodology

A total of 75 panipuri samples (25 each from street vendors, moderately hygienic food courts, and hygienically maintained restaurants) were collected from different areas in and around Greater Hyderabad Municipal Corporation, Telangana State. Samples were collected in the screw-capped bottles, packed in icebox, and transported to the laboratory of Veterinary Public Health and Epidemiology, College of Veterinary Science, Hyderabad.

All the media used in the study are obtained from Himedia laboratory Pvt Ltd. One gram of panipuri was taken and homogenized using a sterile mortar and pestle. One millimeter of the restaurant homogenate was added to 9ml of sterilized distilled water in a test tube and diluted serially to obtain dilutions up to 10^8. For isolation and enumeration of microbes, 0.1ml of appropriate dilution from each tube was aseptically pipetted and plated onto different selective media like Nutrient Agar for Total viable count, MacConkey Agar for coliforms and fecal coliforms, Potato Dextrose Agar for Yeast and Mold count, Baird-parker medium for *Staphylococcus aureus, Mannitol Yolk polymixin B* agar for *Bacillus cereus,* Xylose-lysin Deoxycholate Agar(XLD) for *salmonella,* Salmonella-shigella Agar for Shigella, Eosin methylene blue agar (EMB) for *Escherichia coli* and Blood Agar for *streptococcus fecalis*. All the plates were incubated at 37°C +0.5°C for 24 -48 hours except for Potato Dextrose Agar which is stored at 27°C for 3 to 5 days. The number of colony-forming units (CFU) is counted.

Results and Discussion

The Total viable count (TVC), Total coliform count (TCC), Fecal coliform count (FCC), and Yeast and mold counts of panipuri collected from three sources were presented in Table 1. The total viable count per gram was 3.6×10^9, 1.7×10^7, 2.8×10^5 cfu/gm in the samples collected from street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants respectively. The Total Viable count (TVC) was highest in the samples collected from street vendors, least in hygienically maintained restaurants, and in between in Moderately hygienic food courts. These are due to a number of factors such as improper handling and processing, use of contaminated water or the use of dirty processing utensils [4]. Rinsing water is a major possible source of contamination of panipuri sold by street vendors [5]. The total viable count in the panipuri samples collected from the street vendors (3.6×10^9 cfu/gm) in the present study was higher than the counts of 2.5×10^8cfu/gm, 8.6×10^8 cfu/gm and 3.0×10^4 cfu/gm as reported in available literature [6-8]

respectively in the panipuri samples collected from street vendors from various localities. Teegala et al., [9] reported total viable count of 0.3-2.9×10^5 cfu/gm in the panipuri samples collected from Jagitial district of Telangana state which was similar to the counts obtained in the samples collected from the hygienically maintained restaurants in the present study. The Total coliform count in the panipuri samples was 5.2×10^7, 4.3×10^5, 3.6×10^4 cfu/gm in the street vended panipuri, moderately hygienic food courts and hygienically maintained restaurants respectively. The Total coliform count (TCC) of the panipuri in the present study was almost similar to the counts (2.8×10^7cfu/gm) reported by Saxena and Agarwal [6]. The incidence of coliform in the present study was 100%, whereas Garode and Waghode [10] reported an incidence of 80%. The Total fecal coliform count (TFCC) values in the samples collected from the street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants in the present study were 3.8×10^6 cfu/gm, 1.2 ×10^5 cfu/gm, and 4.7×10^3 cfu/gm respectively. The total fecal coliform count (TFCC) was highest in the samples collected from street vended panipuri, least in the samples collected from hygienically maintained restaurants, and in between in the samples collected from moderately hygienic food courts. Teegala et al., [9] reported, 0.06-0.21 ×10^4cfu/gm of feacal coliform count in the panipuri samples collected from Jagtial district of Telangana state, was almost similar to the counts observed in the present study from the samples of hygienically maintained restaurants. The Total fecal coliform count (TFCC) reflects the level of contamination with human and/animal fecal matter that reflects directly the personal hygiene maintained by the people involved in different stages of food preparation [11]. The Yeast and Mold count was 3.2×10^3 cfu/gm, 7.2×10^2 cfu/gm, and 1.2×10^2 cfu/gm in street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants respectively. Yeast and Mold count of 4.2×10^4 cfu/gm was reported by Kharel et al., [7] in the panipuri collected from Nainital and Gangtok, which was higher than the counts observed from all the three sources in the present study.

Table 1. TVC, TCC, FCC, and Yeast and mould counts of panipuri collected from the three sources in units (cfu/gm)

Sample Type	TVC	TCC	TFCC	Yeast and Mould
Street vended panipuri	3.6×10^9	5.2×10^7	3.8×10^6	3.2×10^3
Moderately hygienic food courts	1.7×10^7	4.3×10^5	1. 2×10^5	7.2×10^2
Hygienically maintained restaurants	2.8×10^5	3.6×10^4	4.7×10^3	1.2×10^2

Incidence

The incidence of Staphylococcus aureus, Bacillus cereus, Salmonella, Shigella, Escherichia coli, and Streptococcus fecalis was presented in Table 2. The incidence of *Staphylococcus aureus* in the present study was 100% in the panipuri samples collected from the street vended panipuri and moderately hygienic food courts and 72% in the hygienically maintained restaurants. Less incidence of *S. aureus* was 29%, in samples collected from Amaravathi city of Maharashtra state and 41.25% in the samples collected from Jagitial district of Telangana state was reported by Tambekar et al., [12] and Teegala et al., [9] respectively. Chavan et al., [13] reported an incidence of 47% (Range from 20% to 80%) in the samples collected from Gulbarga. Tambekar et al., [12] and Chavan et al. [13] observed the highest incidence of *S. aureus* (80%) in the samples collected from hospital areas, which might be due to cross-infection from the hospital skin infection patients. The contamination of panipuri is high where unhygienic conditions like dirty hands and clothing, poor personal hygiene of the food handlers, and open vessels without lids during display and sales are prevailing as opined by Madhuchhanda et al., [14]. An incidence of 80% *staphylococcus aureus* was also reported by Tomar et al., [15] which was slightly more than the incidence in the panipuri samples collected from hygienically maintained restaurants in the present study. The incidence of *Bacillus cereus* was 44% in

the street vended panipuri, 28% in moderately hygienic food courts, and 16% in hygienically maintained restaurants. The *salmonella* showed an incidence rate of 16% and 8% in the street vended panipuri and moderately hygienic food courts respectively, whereas no incidence rate was in the samples collected from hygienically maintained restaurants. Garode and Waghode [10] reported an incidence of 40% *salmonella* in the panipuri samples Collected from Buldana district of Maharashtra state, India which was higher than the incidence in the present study from the street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants. The absence of *salmonella* in the panipuri samples collected from hygienically maintained restaurants might be due to strict hygienic conditions and the personal hygiene of the food handlers maintained in the big restaurants [16-17]. The incidence (24%) of *shigella* was higher in the street vended panipuri whereas 12% and 4% in the moderately hygienic food courts and hygienically maintained restaurants respectively. The incidence of *Escherichia coli* was 88% in the street vended panipuri, 72% in the moderately hygienic food courts, and 48% in the hygienically maintained restaurants. An incidence of 80% *Escherichia coli* in the panipuri samples was reported by Garode and Waghode [10] collected from the Buldana district of Maharashtra state was slightly less than the incidence (88%) in the samples collected from the street vended panipuri and slightly more than the incidence (72%) in the samples from moderately hygienic food courts in the present study. They also reported that all types of food samples sold by street vendors were highly contaminated with *Escherichia coli, salmonella,* and other Gastrointestinal pathogens. The incidence (46%) of *Escherichia coli* in the panipuri samples collected from the hygienically maintained restaurants in the present study was less than the incidence (66%) reported by Tambekar et al., [12] collected from Amaravathi city of Maharashtra state and slightly higher than the incidence (41.25%) reported by Teegala et al., [9] from Jagtial district of Telangana state. The incidence of *Streptococcus faecalis* is 64%, 42%, and 24% in the samples collected from street vended panipuri, moderately hygienic food courts, and hygienically maintained restaurants respectively. An incidence of (80%) of *Streptococcus faecalis* in the panipuri samples was reported by Tomar et al., [15] collected from the Gwalior city, Madhya Pradesh, which was higher than the incidence observed in the present study in the samples collected from all the three sources. There is a potential health risk associated with initial contamination of foods by pathogenic bacteria as well as subsequent contamination by vendors during preparation, handling, and cross-contamination, as assumed by Mosupye and Vanholy [18].

Table 2. The incidence of pathogens in panipuri samples from different sources

Name of the organism	Street vended panipuri (%)	Moderately hygienic food courts (%)	Hygienically maintained restaurants (%)
Staphylococcus aureus	100%	100%	72%
Bacillus cereus	44%	28%	16%
Salmonella	16%	8%	0 %
Shigella	24%	12%	4%
Escherichia coli	88%	72%	48%
Streptococcus faecalis	64%	44%	24%

Counts

The counts of staphylococcus aureus, *Bacillus cereus*, Salmonella, Shigella, Escherichia coli, and *Streptococcus faecalisare* presented in Table 3. The counts of *Staphylococcus aureus* were the highest (2.6×10^6 cfu/gm) in the samples collected from the street vended panipuri, the lowest (2.3×10^3cfu/gm) in the samples collected from hygienically maintained restaurants and in between (5.2×10^5 cfu/gm) in the samples collected from moderately hygienic food courts. A count of 1.2×10^5 cfu/gm in the panipuri samples was reported by Kharel et al., [7] from the samples in Nainital and

which was almost similar to the counts observed in the samples collected from moderately hygienic food courts in the present study, whereas they reported very low counts of 7.9×10^1 cfu/gm in the samples collected from the Gangtok. Almost similar counts in the samples collected from hygienically maintained restaurants were reported by Das et al., [8] from the samples sold in Bangalore city. Higher counts of 3.5×10^7 cfu/gm were reported by Saxena and Agarwal [6] in the samples collected from Jaipur city. The rate of contamination of *staphylococcus aureus* in the street vended panipuri might be due to skin lesions of workers or sneezing, coughing in public places, and also due to location of shops in highly Polluted areas as opined by Chavan et al., [13]. The counts of *Bacillus cereus* were 3.8×10^3 cfu/gm in the street vended panipuri, 4.9×10^2 cfu/gm in moderately hygienic food courts, and 2.5×10^2 cfu/gm in hygienically maintained restaurants respectively. A count of 6.3×10^6 was reported by Kharel et al., [7] from the samples collected in Nainital and Gangtok, which are higher than the values observed from different sources in the present study. A count of 2.025×10^3 cfu/gm was reported by Das et al., [8] from the samples sold in the city of Bangalore, which was almost similar to the counts in the sample collected from hygienically maintained restaurants in the present study.

Table 3. Counts of pathogenic bacteria in panipuri from different sources

Name of the organism	Street vended panipuri	Moderately hygienic food courts	Hygienically maintained restaurants
Staphylococcus aureus	2.6×10^6	5.2×10^5	2.3×10^3
Bacillus cereus	3.8×10^3	4.9×10^3	2.5×10^2
Salmonella	3.9×10^2	9.5×10^1	Nil
Shigella	8.6×10^3	3.9×10^2	5.8×10^1
Escherichia coli	3.6×10^2	2.9×10^3	4.2×10^4
Streptococcus fecalis	8.6×10^1	8.7×10^2	2.6×10^3

The count of *Salmonella* was 3.9×10^2 and 9.5×10^1 from the samples collected from the street vended panipuri and moderately hygienic food courts respectively and no counts were observed in the samples of hygienically maintained restaurants Kharel et al., [7] reported that all the panipuri samples collected from the Nainital and Gangtok tested less than the detection limit (10 cfu/gm). As per FSSAI, 2006 food samples should be negative for *salmonella.* The counts of *Shigella* (8.6×10^3 cfu/gm) were high in the street vended panipuri 3.9×10^2 and 5.8×10^1 in the moderately hygienic food courts and hygienically maintained restaurants respectively. Kharel et al., [7] observed that all the panipuri samples collected on Nainital and Gangtok were negative for *Shigella.* The counts of *Escherichia coli* were 3.6×10^2 cfu/gm, 2.9×10^3 cfu/gm, 4.2×10^4 cfu/gm from the samples collected from the street vended panipuri, moderately hygienic food courts and hygienically maintained restaurants respectively. A count of 2.2×10^5 cfu/gm was reported by Saxena and Agarwal [6] in the samples collected from Jaipur city, which was higher than the counts obtained in the present study from all the three sources. A count of 1.08×10^3 cfu/gm was reported by Das et al., [8] in the panipuri samples collected from Bangalore city, which was almost similar to the counts observed in the present study from moderately hygienic food courts. *Streptococcus fecalis* counts were 8.6×10^1 cfu/gm, 8.7×10^2 cfu/gm and 2.6×10^3 cfu/gm from the samples collected from the street vended panipuri, moderately hygienic food courts and hygienically maintained restaurants respectively. A count of 8.37×10^4 cfu/gm of *Streptococcus fecalis* was reported by Das et al., [8] from the samples sold in the streets of Bangalore which was higher than the counts observed in the present study from all the three sources.

Conclusion

The microbiological quality of panipuri sold in and around Greater Hyderabad Municipal Corporation, in and around Hyderabad are of bad quality in the street vended panipuri and fair in the hygienically maintained restaurants and in between in moderately hygienic food courts. Due to the incidence of varieties of pathogens, consumers should be careful while consuming panipuri and other street foods from shops and places where proper hygienic conditions of the environment and personal hygiene are not followed.

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