

# Physico-chemical and microbiological quality assessment of street foods sold in Jaipur city of Rajasthan

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Street foods are a heterogeneous food category consisting of meals, drinks and snacks. They provide a source of attractive, affordable, convenient and often nutritious food for many section of the society. Street food trade is large and complex. They have been very popular throughout the country since ages. As the street foods are consumed by people of all strata and age groups, so, there is a need to assess the quality of the street foods. The objective of the study was to assess the sensory, nutritional and microbiological quality of 3 commonly vended street foods *i.e.* *Gol gappa*, *Pao bhaji* and *Bhelpuri*. Among various street foods sold in Jaipur city, *Gol gappa*, *Pao bhaji* and *Bhelpuri* were found to be very commonly sold. The samples were procured from street food vendors located at six different areas of Jaipur city. Twelve samples of each were collected aseptically and were assessed for organoleptic characteristics, nutritional quality and microbial quality. All the samples analyzed possessed good sensory quality and were found to be nutritionally adequate but the microbial quality was reported to be very poor, all samples were heavily contaminated by bacteria's. *E.coli* was isolated from all the samples. *Staphylococcus aureus*, *Bacillus cereus* and *Shigella* were reported in majority of samples. *Salmonella* was not present in *Gol gappas* but was reported in 8.33 per cent of *Bhelpuri* samples. Thus, the result revealed that *Gol gappa*, *Pao bhaji* and *Bhelpuri* sold by street food vendors of Jaipur city were not at all safe for consumption.

**Key Words :** *Gol gappa*, *Pao bhaji*, *Bhelpuri*, *Staphylococcus aureus*, *Bacillus cereus*, *Shigella*, *E.coli*

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## INTRODUCTION

“Street foods” describes a wide range of ready-to-eat foods and beverages sold and sometimes prepared in public places, notably streets (Winarno, 1986). Street-vended foods are appreciated for their unique flavours and convenience, as well as for maintaining nutritional status and also assuring food security for low-income

urban population and livelihood for a significant proportion of the population. Street foods are sold mainly on the streets, in crowded public places, outside parks and gardens, in markets and schools, at the railway station or bus stand, in cinema halls and auditoriums as well as in places of tourist interest.

Availability of street foods has offered a lot of advantages like they provide good amount of energy at low cost, are delicious, easily available, provide an easy solution to time starved working women, provide variety and are a source of employment, as they require minimal capital and expertise (Bajaj *et al.*, 2002). In spite of so many advantages, the consumption of such foods create problem related to food safety risks, availability of safe drinking water, waste disposal and traffic disposal (Bajaj

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*et al.*, 2002). Vendors are not aware of hygienic practices; proper storage and handling practices, which in turn leads to contamination of food.

Food is one of the three essentials for maintenance of life and is a major determinant of health, nutritional status and productivity of population. Thus, maintenance of safe and nutritious food supply is of utmost importance. Firstly, food should be of good nutritive value so as to provide the nutrients required for normal body functions; at the same time it should be free from microbial, physical and chemical contaminants which would undermine health and cause disease.

## METHODOLOGY

Quality assessment includes sensory, nutritional and microbial quality. Quality of any food is affected by quality of raw material used, knowledge and practices of food handles, hygiene and sanitation practices followed during storage, preparation and serving. Initially, mapping of entire Jaipur city was done to select the sites where street food vendors stand in cluster. Out of many sites six sites namely Jawahar Circle, Birla Mandir, Raja Park, Bagadia Bhawan, Gaurav Tower and Link road were selected based on their popularity among consumers. It was observed that almost at every site *Gol Gappa*, *Bhelpuri* and *Pao bhaji* were the most commonly sold street food. As the turnover rate of all these three street foods was observed to be very high, so they were selected for analysis. The samples were collected in sterilized zip lock plastic bags and immediately kept in ice bucket. After reaching the laboratory they were transferred to freezer and stored at temperature below 0°C till estimations were performed. A total of 15 samples of each street food were analysed for sensory quality, proximate composition and microbial quality. Sensory quality was assessed on a 5-point rating scale by 10 semi-trained panel members (Srilakshmi, 2002). The nutritional quality of the street foods was assessed

in duplicate by standard methods of proximate composition which comprises of moisture, ash, crude protein, fat, crude fibre and carbohydrate content (AOAC, 2005) Total calories provided per 100g of the street food were also calculated. Microbial quality was analyzed by Standard Plate Count (SPC), Total coliform Count, Total Staphylococcal Count and presence of 5 pathogenic bacterias like *Salmonella*, *Shigella*, *E.coli*, *Staphylococcus aureus* and *Bacillus cereus* (Cappuccino and Sherman, 2004).

## OBSERVATIONS AND ASSESSMENT

Initially mapping of Jaipur city was done by street walk to identify the locations where the street food vendors stand in cluster and finally six sites were selected. During mapping itself, it was observed that the most commonly sold street foods were *Gappa*, *Bhelpuri* and *Pao bhaji*. Improper handling and storage of all the ingredients and cooked food items was reported. Hygiene and sanitation practices were also observed to be very poor.

### *Bhelpuri* :

It consists of mixture of various ingredients like puffed rice, *Papri* or *Puri*, thick and thin *Sev*, fried items like canapés and frimes, fresh items like boiled and chopped potatoes, tomatoes, onion, green coriander, green chillies and *Chutneys*. Green *Chutney* prepared from coriander leaves and sweet *Chutney* from mango powder/tamarind and jaggery/dates, etc. All the items were mixed thoroughly in required proportion in deep steel container with a spoon having long handle. It was served in a paper plate with disposable plastic spoon. Some of the vendors also used a paper napkin underneath to prevent spill over.

### Sensory characteristics:

The *Bhelpuri* samples collected from street food

**Table 1 : Nutritional composition of *Bhelpuri*, *Gol gappa* and *Pao bhaji* samples collected from street food vendors of Jaipur city**

Sr. No.	Street food	Moisture (g/100g)	Ash (g/100g)	Crude protein (g/100g)	Total fat (g/100g)	Crude fibre (g/100g)	Total carbohydrates (g/100g)	Total calories (Kcal)
1.	<i>Bhelpuri</i>	54.19 ±5.59	1.29 ±0.769	4.10 ±0.883	5.51 ±1.176	0.022 ±0.0102	34.89 ±6.910	205.54 ±22.94
2.	<i>Gol Gappa</i>	80.88 ±0.926	0.84 ±0.349	0.53 ±0.0796	1.87 ±0.470	0.20 ±0.004	15.82 ±1.159	82.69 ±4.067
3.	<i>Pao Bhaji</i>	82.35 ±0.007	1.60 ±0.01	1.63 ±0.007	3.83 ±0.001	0.037 ±0.001	10.55 ±0.013	83.19 ±0.007

vendors were of red or green or reddish green colour depending upon the quantity of *Chutney*. All the samples had acceptable flavour, crispy texture and sweet and sour taste. The average weight of *Bhelpuri* served in a plate approximately 200g ranging from 110-270g/ plate.

#### Nutritional quality:

The average moisture content of *Bhelpuri* was  $54.19 \pm 5.597$ g/100g of sample. The average ash, protein, fat and fibre content of *Bhelpuri* samples was  $1.27 \pm 0.769$ ,  $4.10 \pm 0.883$ ,  $5.51 \pm 1.176$  and  $0.022 \pm 0.0102$ g/100g, respectively. The average carbohydrate content was  $34.89 \pm 6.91$ g/100g ranging from 30.74 - 45.55g. The average calories provided by 100g of *Bhelpuri* were  $205.54 \pm 22.94$  Kcal and per plate varies from 225.87-552.90 Kcal.

#### Microbial quality:

All the samples of *Bhelpuri*, analysed were found to be very heavily loaded with microbes. The total bacterial count as assessed by standard Plate Count (SPC) ranged from  $1.1 \times 10^8$  to  $6.6 \times 10^{10}$  cfu/g. The Total Coliform Count ranged from  $1.1 \times 10^8$  to  $3.8 \times 10^{10}$  cfu/g. The average Total Staphylococcal Count was  $5 \times 10^7$  ranging from  $1 \times 10^7$ -  $2 \times 10^8$  cfu/g. *E.coli* was isolated from all the samples. *E. coli* was also isolated in *bhelpuri* samples of different cities of India (Goyal, 2002; Bajaj *et al.*, 2002; Mukhopadhyaya *et al.*, 2002; Watchel and Charkowshi, 2002 and Sheth *et al.*, 2005). *Staphylococcus aureus* indicating contamination through nasal and throat discharge was found in 83.33 per cent samples. Staphylococci was also reported by Bajaj *et al.* (2002) and Sheth *et al.* (2005) in *Bhelpuri* samples collected from different cities of India. Presence of *Shigella* (indicates contamination through excreta of infected animals and man) was seen in 75 per cent.

*Salmonella* (the source of which is same as *Shigella*) the common causative micro-organism for food poisoning, was reported in only 8.33 *Bhelpuri* samples. The presence of *Shigella* was also reported in *Bhelpuri* samples of different cities in India (Kenny, 2005, Mukhopadhyaya *et al.*, 2002, Watchel and Charkowshi, 2002 and Sheth *et al.*, 2005). *Bacillus cereus* was reported in 75 per cent samples.

#### HACCP:

The HACCP was carried out for *Bhelpuri* sold by street food vendors of Jaipur City and the contamination was found at each and every step, raw materials used, utensils used and in final product. The Standard Plate Count was highest for chopped coriander ( $7.8 \times 10^{14}$ ) followed by chopped tomatoes ( $3.7 \times 10^{12}$ ). It was also observed that chopping board, knives, duster, working surface (*Thela*), lemon squeezer also contributed to a great extent to microbial load in *Bhelpuri* samples. Tessi *et al.* (2002) has reported high contamination on the surfaces of knives and plastic bags. *E.coli* was detected on the surfaces of knives (Bansal and Kaul, 2004).

#### Gol gappa :

It comprises of *Puri/Papri*, potato filling (boiled and mashed potatoes with spices) and spicy water. Different varieties of *Puri's* were available in the market like whole wheat flour/ refined wheat flour/ semolina/ semolina and refined wheat flour/ black gram flour.

#### Sensory characteristics:

The *Puri/ Papri's* were crispy, they had sweet and sour taste and acceptable flavour. The average weight of *Gol gappa* (including filling and water) served in a plate was 93.125g. 5-7 pieces of *Papri* were served in a plate throughout the city.

**Table 2 : Microbiological quality of selected street foods**

Sr. No.	Street food	Standard plate count	Total coliform count	Total staphylococcal count
1.	<i>Bhelpuri</i>	$1.1 \times 10^8$ - $6.6 \times 10^{10}$	$1.1 \times 10^8$ - $3.8 \times 10^{10}$	$5.8 \times 10^7$
2.	<i>Gol gappa</i>	$2.8 \times 10^7$ - $2.5 \times 10^8$	$2.2 \times 10^7$	$3.5 \times 10^7$
3.	<i>Pao bhaji</i>	$7.9 \times 10^{12}$	$3.8 \times 10^{10}$	$1.1 \times 10^9$

**Table 3 : Per cent street food samples found positive for specific pathogenic bacteria's**

Sr. No.	Street food	<i>Salmonella</i>	<i>Shigella</i>	<i>Staphylococcus aureus</i>	<i>E.Coli</i>	<i>Bacillus cereus</i>
1.	<i>Bhelpuri</i>	8.33	75	83.33	100	75
2.	<i>Gol gappa</i>	0	75	83.33	100	91.67
3.	<i>Pao bhaji</i>	16.67	66.67	100	100	50

**Nutritional quality :**

The average moisture content was  $80.88 \pm 0.926$ g/100g ranging from 78.97-82.27g. The average proximate composition of 100g of *Gol gappa* was ash ( $0.84 \pm 0.349$ g), protein ( $0.53 \pm 0.0796$ g), fat ( $1.87 \pm 0.470$ g), carbohydrate ( $15.82 \pm 1.159$ g) and crude fibre ( $0.020 \pm 0.0043$ g). The total calories provided per 100g of *Gol gappa* were  $82.69 \pm 4.06$  Kcal.

**Microbial quality:**

The microbial quality of *Gol gappa* revealed that they were heavily loaded with microbes. The SPC ranged from  $2.8 \times 10^7$  to  $2.5 \times 10^8$  cfu/g. The average total Coliform Count was  $2.2 \times 10^7$ . The average total Staphylococcal count was  $3.5 \times 10^7$  ranging from  $0.5 \times 10^3$ - $1.5 \times 10^8$  cfu/g. The presence of pathogenic bacteria's was seen as *E. Coli* (100%), *Bacillus cereus* (91.67%), *Staphylococcus aureus* (83.33%) and *Shigella* (75%). *Salmonella* was not reported in any of the sample collected for the study. *E.coli* was also reported in *Gol gappa* by Goyal (2000) and the masala or filling used in *Gol gappa* by Sathisbabu and Rati (2003). The *Gol gappa* containing *Chutney* had higher total viable count than *Gol gappa* without *Chutney* (Goyal, 2000). Other pathogens isolated from *Gol gappa* were Staphylococci, Klebsiella and Pseudomonas. Most probable Number Count of Coliform was reported by Mohapatra *et al.* (2002).

**HACCP:**

The HACCP approach revealed that potato filling and spicy water were the major contributor of microbes. The duster or the napkin used for cleaning surface and wiping hands were also loaded with microbes. All the samples (boiled potatoes, *Gol gappa*, spicy water, filling and complete *Gol gappa* sample) and the swabs (duster, working surface and the container in which filling was prepared) were found to be contaminated by *Shigella*, *Salmonella*, *S. aureus*, *E.coli* and *B.cereus*.

***Pao bhaji* :**

It is comprised of two basic preparations – *Pao* and *bhaji*.

*Bhaji* is a type of mix vegetable prepared out of finely chopped vegetables like cabbage, capsicum, tomato, onion, potato, etc. in butter with spices and served with extra butter on it. *Pao* is a bakery preparation, it is shallow fried and then served. Chopped onion and a small piece

of lemon were served as salad with *Pao bhaji*.

**Sensory quality:**

It possessed good sensory quality. The *Pao*'s were crispy to soft and *Bhaji* was soft. The taste of *Bhaji* was spicy and the flavour was acceptable and very tempting. The total weight of *Pao bhaji* served in a plate was 426.149g. Two pieces of *Pao*'s were served in a plate.

**Nutritional quality:**

The average proximate composition of *Pao bhaji* sample was  $82.35 \pm 0.007$ g (moisture),  $1.6 \pm 0.01$  (ash),  $1.63 \pm 0.007$  (protein),  $3.83 \pm 0.37$  (fat),  $0.037 \pm .001$  (fibre) and  $10.55 \pm 0.013$  (carbohydrate). The total calories provided by 100g of *Pao bhaji* were reported to be  $83.19 \pm 0.007$  Kcal.

**Microbial quality:**

All the studied samples were found to be heavily contaminated. The Standard Plate Count, Total Coliform Count and Total Staphylococcal Count of *Pao bhaji* samples ranged from  $1.7 \times 10^8$  to  $4 \times 10^{12}$ ,  $2 \times 10^5$  to  $4.3 \times 10^{11}$  and  $1.9 \times 10^3$  to  $7.5 \times 10^9$ , respectively. The samples were found to be heavily contaminated with pathogenic bacteria such as *E.coli* (100%), *S.aureus* (100%), *Shigella* (66.67%), *B.cereus* (50%) and *Salmonella* (16.67%).

**HACCP:**

The HACCP results revealed that at each step of processing, microbes are invaded making the food unsafe for consumption. The major contributor of microbes in *Pao bhaji* samples was chopped onion which was used as salad, followed by it were napkin or duster used for wiping surface and hands, utensils, personnel hands and chopping board. Wiping cloth showed highest *E.coli* contamination (100%) (Bansal and Kaul, 2004). The duster was very dirty and was repeatedly used during cooking throughout the day, this increases the risk of cross-contamination from the duster to the food (Bajaj *et al.*, 2002 and Sheth *et al.*, 2005). *S.aureus* were reported in all the samples and swabs collected for the study. *E.coli* was also reported in all the samples and swabs except *Pao* and *Bhaji* separately. *E. coli* was isolated from food handlers nails (Bansal and Kaul, 2004). Total bacterial Count was very high in the hands and nails of personnel (Sheth and Gurudasani, 2005). *B.cereus*

was also present in all the samples and swabs except for duster and chopping board. In HACCP analysis, high microbial count was observed in food handler's hand, indicating that food handling is a risk factor in transmitting pathogenic micro-organisms to the foods, especially under the conditions where hand washing is not practiced routinely (Sheth and Gurudasani, 2005).

### Conclusion :

The present study concluded that the sensory and the nutritional quality of all the selected street foods were found to be good. The microbial quality was observed to be very poor. The SPC, total Coliform count and total staphylococcal count was found to be very high. The HACCP also reported that each and every step of processing was contributing a lot to microbes making it unsafe for human consumption. The presence of pathogenic bacteria's like *E.coli*, *Shigella*, *S.aureus*, *B.cereus* indicated very poor microbial quality. A study carried out by Central Food Laboratories (CFL) (s) of Kolkata and Pune with the support of FAO have indicated considerable microbial health hazards from street and dhaba food (Ramaswamy, 2008). Street foods are not systematically monitored and inspected by the regulatory authorities.

The street food industry plays an important role in meeting the food requirement of urban dwellers in many cities and towns of developing countries. The industry feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible. However, food borne illnesses of microbial origin are a major health problem associated with them (WHO, 2002). Removing the Street food vendors is impossible and also unjustifiable because they offer a variety and has become a part of the Indian lifestyle. Instead, we should try to improve the hygienic quality of the food supplied by them (BIS (2004) [www.google.com](http://www.google.com), 2009).

### Recommendations for policy makers

- Rehabilitation of street food vendors providing them facilities of safe drinking water, running water facility for washing hands and soiled utensils, proper electricity supply, hygienic space, lavatories, facility for garbage and trash disposal

- Inspection of street foods should be done randomly to check the quality of street foods sold by the vendors

- Regular health check-up of the street food vendors to ensure safe food for the consumers
- Licensing of street food vendors should be made mandatory and license should be the joint responsibility of local municipal authority and health department.

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