

## RESEARCH ARTICLE

# Microbiological and Nutritional Quality Assessment of Street Vended *Pao bhaji* Sold in Jaipur City, India

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## Abstract

The *Pao Bhaji* samples analysed were procured from street food vendors located at different areas in Jaipur city. Mapping of entire Jaipur city was done to locate street food vendors. The sites were observed and vendors were interviewed by a structured questionnaire. A total of 15 samples of *pao bhaji* were analysed. Quality assessment was done through sensory quality, nutritional quality and microbial quality. Sensory quality was assessed by a semi-trained panel of experts, nutritional quality by proximate composition analysis and microbiological quality by SPC, total Coliform Count, total Staphylococcal Count, identification of 5 pathogenic bacteria's and analysis of Critical Control Points. The sensory and nutritional quality was found to be good but the microbial quality was very poor. All the samples were found positive for *E.coli* contamination.

## Keywords

Critical Control Points, *E.coli*, *Pao Bhaji*, *Salmonella*, *Shigella*, *Staphylococcus aureus*

## Introduction

Urban population growth has stimulated a rise in the number of street food vendor's in many cities throughout the world. Migration from rural areas to urban centres has created a daily need among many working people to eat outside the home. Street food vendors may be located outdoors, which is easily accessible from the street. These vendors are also known as 'hawkers' or 'sellers'.

"Street foods" describe a wide range of ready-to-eat foods and beverages sold and sometimes prepared in public places. These 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 the significant portion of the population. In spite of so many advantages, the consumption of such foods create problem related to food safety risks, availability of safe drinking water, waste and garbage disposal (Bajaj *et al.*, 2002).

Looking into the popularity of street foods, quality assurance of the food items becomes a major concern. The overall quality of the food depends on the nutritional, microbiological, sensory qualities and other hidden attributes. So, it is a measure of excellence and refers to the degree to which a commodity satisfies the

want of the consumer. The objective of the present investigation was to determine the sensory, nutritional and microbiological quality of street foods sold in Jaipur city.

*Pao bhaji* is comprised of two basic preparations namely *bhaji* and *pao*. *Bhaji* is a type of mixed vegetable (cabbage, capsicum, tomato, onion and potatoes seasonally peas, carrot, beans are also added) cooked in butter with *pao bhaji masala* added to it. *Pao* is a type of bakery preparation like bread but thicker than bread.

Guisti *et al.* (1993) examined the bacteriological quality of street foods in Benin Republic and found that over 75 percent of the foods were contaminated by Pathogenic micro-organism. Burt *et al.* (2003) observed a high incidence of *Pseudomonas species* (69%) in street food samples. *E. coli*, *Salmonella* and *Shigella* were reported in *bhulpuri* samples in many studies (Beuchat and Ru, 1997; Mukhopadhyay *et al.*, 2002; Wachtel and Charkowski, 2002 and Sheth *et al.*, 2005). Mensah *et al.* (2002) conducted a study in Accra, Ghana and found poor environmental hygiene surrounding the street food vending sites. Jeyasekaran *et al.* (2002) studied prevalence of *Listeria species* in floors, drains, tables, containers and equipments of a catering establishment in Mangalore, India and found that 5.1 percent of the samples were positive for *L.monocytogenes*. Tessi *et al.*

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(2002) found high contamination on the surfaces of knives, plastic bags, and employees' plastic gloves after they were used in a centralized school kitchen in Argentina. They also reported heavy contamination on the surfaces of wood and plastic cutting boards before they were used. *E.coli* was detected on the surfaces of knives and plastic bags. Nicolas *et al.* (2006) identified knives as a source of contamination by *Coliforms* and *S.aureus* in street food processing sites in Ouagadougou, Burkina Faso. *Salmonella* and *Shigella* counts were high in butcher knives. Apart from knives, pathogenic bacteria also generally invaded utensils used at vending sites.

## Material and Methods

Initially mapping of Jaipur city was done by street walk to identify the locations where the 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. As the turnover rate of *pao bhaji* was observed to be high, it was selected for analysis. The knowledge and practices related to food hygiene and personal hygiene of street food vendors was assessed using structured interview schedule.

A total of 15 samples of *pao bhaji* were procured in sterilized ziplock plastic bags from the selected site. The sensory quality of all the samples was assessed using a semi-trained panel of experts. The attributes analyzed were color, flavour, texture, taste overall appearance and portion size. The nutritional quality was assessed in triplicate by estimating - crude protein, moisture, total ash, total carbohydrate, fat, crude fibre and total calories (A.O.A.C.,1995). The microbiological quality was assessed by Standard Plate Count, Total Coliform Count, Total Staphylococcal Count, HACCP and presence of 5 pathogenic bacteria (*Salmonella*, *Shigella*, *Staphylococcus aureus*, *E.coli* and *Bacillus cereus*) was identified using selective media and biochemical tests - carbohydrate fermentation, catalase test and Methyl Red Voges Proskauer (MRVP) test were also performed for confirmation of bacteria. Selective media used were Mannitol Salt Agar Base for *S.aureus*, Nitrate broth for *B.cereus* and Triple sugar iron agar for *Salmonella*, *Shigella* and *E.coli* (Cappuccino and Sherman, 2004).

## Results and Discussion

Mapping of entire Jaipur city was conducted and six sites where the street food vendors congregate in cluster were selected for the study. The results of the present

study revealed that majority of the vendors were male of middle age group, having low educational status. Monthly income was not disclosed by any of the vendor. None of the vendor was found to wear apron and cover hair during cooking and serving food.

Majority of the vendors had seating arrangement for service. Improper storage and handling of raw vegetables are known to harbour large number of harmful organisms. In the study, it was observed that potatoes were not washed before boiling and once they were boiled, were used throughout the day irrespective of season. The vegetables used in for *bhaji* were chopped on a wooden chopping board before starting work, and were displayed on the edge of the griddle the entire day. It was served in a steel partitioned plate with either steel or disposable spoon. Majority of the vendors used personal dustbins. The stalls were cleaned only once a day at the end of the day without using soap/detergent. The dusts used throughout the day were washed only once at the end of the day. Hand washing before starting work was not practiced. The use of soap and water for cleaning hands was also not practiced, no matter what they do i.e. whether they sneeze, cough smoke go to toilet, etc.

## Sensory Quality

As the acceptability of street foods and its sale, depends upon the sensory quality, therefore, the vendors do all efforts to maintain it. All the collected samples had acceptable color, texture, taste, tempting flavour and good appearance.

## Nutritive Value

The average total weight of *pao bhaji* was 426.149g. The total calories provided per 100g of sample were 83.19±0.007 Kcal and per plate was 354.5 Kcal. The *pao bhaji* samples collected from the street food vendors of Jaipur city had 82.35±0.007 (moisture), 1.60±0.01 (total ash), 1.63±0.007 (crude protein), 3.83±0.001 (fat), 0.037±0.001 (crude fibre) and 10.55±0.013 (total carbohydrate) per 100g of sample. The cost per plate of *pao bhaji* varied from Rs 25-35 depending upon the site of location of the vendors (Table 1).

## Microbiological Quality

The microbiological quality of all the samples under the study was found to be poor. The average Standard Plate Count was 1.3x10<sup>12</sup> cfu/g; Total Coliform count was 3.8x10<sup>10</sup>cfu/g and Total Staphylococcal count was

$1.1 \times 10^9$  cfu/g. All the samples studied were contaminated by *E.coli* (faecal contamination) and *Staphylococcus aureus* (nasal and throat discharge). *Shigella* was found in 66.67%; *Bacillus cereus* in 50% and *Salmonella* in 16.67% samples. The hazard analysis revealed that at each and every step of processing, microbes were invaded. The major contributor was chopped onion followed by napkin or duster and chopping board. *S.aureus* was present in all the samples and swabs collected for the study. *E.coli* was reported in all the samples (Table 2).

The sensory quality was good as it was mouth watering and tempting. The nutritive value of *pao bhaji* was found good as it is calorie dense, a plate of *pao bhaji* provided approximately 350 Kcal which is quite a good amount. The major contributor of calories is fat and carbohydrates. But the microbial quality showed alarming results. Although the *bhaji* was cooked well but the *pao* and chopped onion, the utensils in which it was served can lead to contamination of final product. Generally, the vendors don't heat *pao* at high temperature, which may allow the bacteria present in it to grow. The vendors store chopped onion in bulk as it was used as salad also. It lies open through out the day. The chopping board and the knife used for chopping were also washed ones a day. The use of wooden chopping board also leads to contamination as wood

absorbs moisture which enhances the growth of micro-organisms.

The steel partitioned plates were also a source of contamination as the vendors wash them just by dipping and taking them out from soap water and plain water simultaneously. This method followed by them removes all the leftover from the plate. It was also observed that the water used for washing was very dirty. Many vendors simply re-use the water, especially for cleaning utensils, equipments and food preparation area. Joshi, (1995) reported the presence of *E.coli*, *S.aureus* and *Salmonella* due to unhygienic food handling practices and presence of dropping of rats, mice or other animals which further contaminated food equipments. Same results were observed by Francina and Alexander, 2000 and Sheth *et al*, 2005). The dishwashing area was also found to be dirty and moist. Bajaj *et al*, (2002) and Sheth *et al*, (2005) have also reported the same in street food vending of New Delhi and Baroda respectively.

Dirty utensils were used at majority of the vending sites. This finding was also supported by findings of Jeyasekaran *et al*, (2002), Bajaj *et al*, (2002), Nascimento *et al*, (2005), Bramoski *et al*, (2005), Sheth and Gurudasan, (2005). *E.coli* was isolated from all the samples and serving utensils. Bansal and Kaul (2004) have also reported the presence of *E.coli* in serving utensils. Mosupe and Holy (1999) isolated *E.coli* in 78% of dishwater samples.

**Table 1. Proximate composition of *pao bhaji* sold by street food vendors of Jaipur city**

S. No.	Sample code	Area	Moisture (g/100g)	Total Ash (g/100g)	Crude Protein (g/100g)	Fat (g/100g)	Crude Fibre (g/100g)	Total Carbohydrate (g/100g)	Total Calories (Kcal)
1	PB-1	Birla Mandir	82.05	1.92	1.57	3.79	0.051	10.62	82.87
2	PB-2	Birla Mandir	83.40	1.94	1.68	3.32	0.051	9.61	75.04
3	PB-3	Raja Park	82.73	1.26	1.72	3.82	0.020	10.45	83.06
4	PB-4	Raja Park	82.54	1.26	1.61	4.16	0.016	10.41	85.52
5	PB-5	Bagadia Bhawan	82.09	1.57	1.64	3.86	0.041	10.80	84.5
6	PB-6	Jawahar Circle	81.23	1.68	1.70	4.04	0.039	11.31	88.40
7	PB-7	Jawahar Circle	83.27	1.42	1.68	4.12	0.027	9.48	81.73
8	PB-8	Gaurav Tower	82.68	1.77	1.56	3.82	0.040	10.13	81.14
9	PB-9	Link RoadS	81.84	1.84	1.60	3.64	0.037	11.04	83.32
10	PB-10	Bagadia Bhawan	81.69	1.38	1.52	3.76	0.045	11.61	86.36
Mean			82.35	1.60	1.63	3.83	0.037	10.55	83.19
Standard Deviation			± 0.007	± 0.01	± 0.007	± 0.001	± 0.001	± 0.013	± 0.007

Table 2. CCP's of *pao bhaji* samples collected from street food vendors of Jaipur city

S. No.	Samples	Standard Plate Count	Total Coliform Count	Total <i>Staphylococcus</i> Count	<i>Salmonella</i>	<i>Shigella</i>	<i>Staphylococcus aureus</i>	<i>E.coli</i>	<i>Bacillus cereus</i>
1.	<i>Pao bhaji</i>	4x10 <sup>12</sup>	4.3x10 <sup>11</sup>	5.1x10 <sup>9</sup>	-	-	+	+	+
2.	<i>Pao</i>	1.4x10 <sup>10</sup>	1.1x10 <sup>9</sup>	6.2x10 <sup>4</sup>	-	-	+	+	+
3.	<i>Bhaji</i>	7.1x10 <sup>10</sup>	1.4x10 <sup>9</sup>	7.2x10 <sup>6</sup>	-	-	+	+	+
4.	Chopped onion used as salad	4x10 <sup>10</sup>	4.8x10 <sup>10</sup>	1.8x10 <sup>7</sup>	+	-	+	+	+
5.	Duster swab	3.2x10 <sup>9</sup>	3x10 <sup>7</sup>	2.3x10 <sup>6</sup>	-	-	+	+	-
6.	Working surface swab	2x10 <sup>9</sup>	4.2x10 <sup>8</sup>	2.3x10 <sup>6</sup>	-	-	+	+	+
7.	Chopping board swab	8.1x10 <sup>8</sup>	4.3x10 <sup>8</sup>	2.2x10 <sup>8</sup>	-	+	+	+	-

The adherence by food handlers to good personal hygiene and to hygienic food, handling practices is essential if microbiological contamination of food is to be prevented. It has also been reported that higher the educational level of the food handler or vendor, the better was their personal hygiene (Masud and Kausar, 1993 and Goyal and Kaul, 1998). Though street foods provide sufficient calories but the consumer is at a risk of developing food poisoning. Thus, the Policy makers are recommended to do

- Licensing mandatory for street food vendors.
- Rehabilitate the Street food vendors with the provision of safe drinking water, running water for washing hands and soiled utensils, electricity, hygienic space, lavatories, facility for garbage and trash disposal.
- Training should be organized at regular intervals on issues related to hygiene, sanitation and good food handling practices
- Inspect the street foods randomly to check the quality sold by the vendors
- Regular health check-up of street food vendors to ensure safe food for the consumers.

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