

Original Research Article

## A Cross-Sectional Study on Microbiological Quality of Street Food in Hyderabad, Telangana, India

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### ABSTRACT

**Introduction:** Food-borne illnesses of microbial origin are major health problem associated with street foods. Street food is ready-to-eat food or drink sold by a hawker, or vendor, in a street or other public place, such as at a market or fair. It is often sold from a portable food booth, food cart, or food truck and meant for immediate consumption.

#### Objectives:

- To study the amount of contamination of street foods by various pathogens.
- To associate the education of food vendors with the implementation of hygienic food-handling practices.
- To determine the relations between the contamination of foods and certain parameters of the vending site.

**Materials and methods:** A cross sectional study on 80 samples of street food was conducted during the month of January-August 2015. Simple random sampling was done to choose the street food center. Samples from center were collected in dry, leak proof, wide mouthed sterile bottles, and culture was done.

**Results:** Around 53.5% of street food samples were found to be contaminated. All the juice samples were found to be contaminated. Almost 45% of panipuri samples were found to be contaminated. Chutney samples were around 70% contaminated. Significant associations were found between method of washing utensils, presence of open drains and bin distance with contamination of street food.

**Conclusions:** Lack of hygiene of food handlers and improper waste disposal could be the main risk factors for the contamination of street foods.

**Keywords:** Street food, food borne illnesses, hygiene.

### INTRODUCTION

Street-vended food is one of the most favorite foods for many people across the world. It is 1) Cost effective 2) Easily accessible and 3) the most important of all, incredibly tasty! For the above reasons, street foods are consumed, paying less attention to their nutritional value and the

amount of the contamination that might have occurred. <sup>[1]</sup>

Food-borne illnesses of microbial origin are major health problem associated with street foods. <sup>[2]</sup>

There have been various reports of food borne illnesses associated with consumption of street vended foods in many places in India as well. A study done in

Amaravati by Tamedkar, et al [3] has shown that street foods are contaminated with several bacteria such as E coli (21%), Proteus (12%), Pseudomonas (39%), and Salmonella (12%).

A study by Mensah et al [4] concludes that Food vendors are mostly uninformed of Good Hygiene Practices (GHP) and causes of diarrheal diseases.

New data on the harm caused by food-borne illnesses underscore the global threats posed by unsafe foods, and the need for coordinated, cross-border action across the entire food supply chain. [5] The WHO theme for World Health Day, 2015-“From farm to plate, make food safe” has been the rationale behind study.

#### Objectives:

1. To study the amount of contamination of street foods by various pathogens.
2. To associate the education of food vendors with the implementation of hygienic food-handling practices.
3. To determine the relations between the contamination of foods and certain parameters of the vending site.

## MATERIALS AND METHODS

**Study design:** Cross-sectional study

**Study period:** January-August, 2015

**Study area:** Street food centers of Hyderabad

**Sample size:** A feasible sample of 80 street food samples was taken.

**Sampling technique:** Simple random sample

**Sample collection:** The collection was done in clean, dry, leak-proof, wide-mouthed, sterile, bottles. They were then well labeled with a number and type of sample and were transported to laboratory.

**Study tool:** Semi-structured questionnaire which includes information about site of shop, time of collection of sample, Hygiene status of the vendor and the servants, Hygiene status of the vending site, literacy status of the vendor etc. was used.

**Method:** Visit to randomly selected areas in the city, and collection of street foods such as - PaniPuri, Chutneys, Samosas and Juices

1. The liquid samples were plated directly on Mac Conckey and Chrome agar and incubated for 24-48 hrs. Identification of colonies was done. For Salmonella spp., special media such as XLD and DCA agars were used. Further, biochemical tests- Indole, Methyl Red, Oxidase, and Citrate utilization tests were performed.
2. In case of solid samples, they were first transferred to Peptone water and incubated for 2-4 hours at 37°C. Then they were cultured on Mac Conckey and Chrome agars and the above was followed.

**Data analysis:** Data was analyzed using MS excel and epi info software.

## RESULTS AND DISCUSSION

This study revealed that 53.75% of the street food samples that have been collected from the streets of Hyderabad, were found to be contaminated (have shown growth of one or more micro-organisms on culture). 100% (all 20 samples) of the juices were contaminated. The study findings were concurrent with those of a similar study, [6] that has shown that 96.6% of the street-vended juices in the same city were contaminated.

Table I: Over all contamination

Samples	Uncontaminated	Contaminated
JUICES	0 (0%)	20 (25.0%)
CHUTNEYS	6 (7.5%)	14 (17.5%)
PANIPURI	11 (13.75%)	9 (11.25%)
SAMOSAS	20 (25.0%)	0 (0%)
<b>Total</b>	<b>37 (46.25%)</b>	<b>43 (53.75%)</b>

Juices, which are believed to be fresh and healthy, and commonly consumed by everyone with the impression that these are better than fast foods, were actually the most contaminated ones. This could be because freshly squeezed fruit and vegetable juices have little or no process steps that reduce pathogen levels, if contaminated. [7] Panipuri on the other hand, is well known

for its contamination. In this study around 45% (9 out of 20) of the Panipuri samples were contaminated. The chutney (known as Meetha chutney), that is used as part of the filling of Panipuri was also tested. Results show that 70% of the chutney samples (14 out of the 20) were contaminated. No pathogen was found in Samosa samples. This may be because the pathogens (if present), might have been killed in the process of its making. However, it is important to realize the fact that if there is a long gap between preparation and consumption, there is a possible chance of contamination of the samosas from the external environment.

On culture, the bacteria that were found to grow were Escherichia coli 40%, Salmonella spp. 17.5%, Klebsiella spp. 12.5%, Pseudomonas spp. 1.25%,

Staphylococcus spp. 1.25% and Enterococci 1.25%. It is noteworthy that fungal growth was found in 11.25% of the samples, the fungal organisms being Candida species.

**Table II: Organisms cultured**

Micro-Organisms	Samples (Out Of Total 80)	Percent
Escherichia coli	32	40%
Salmonella spp.	14	17.5%
Klebsiella spp.	10	12.5%
Candida spp.	9	11.25%
Pseudomonas	1	1.25%
Staphylococcus spp.	1	1.25%
Enterococci	1	1.25%

The percentages of E coli and Salmonella 40% and 17.5% respectively, were very high when compared to the study done by Tamedkar et al, [3] in the city of Amaravati, where the percentages of the same were 21% and 12% respectively.

**Table III: Sample type and organism cultured (There have been samples that were positive for more than one organism)**

MICRO-ORGANISMS	JUICES	CHUTNEYS	PANIPURI	SAMOSAS	TOTAL (%)
Escherichia coli	16	11	5	0	32(40)
Salmonella spp.	8	6	0	0	14(17.5)
Klebsiella spp.	4	4	2	0	10 (12.5)
Candida spp.	3	4	2	0	9(11.25)
Pseudomonas	0	0	1	0	1(1.25)
Staphylococcus spp.	0	0	1	0	1(1.25)
Enterococci	1	0	0	0	1(1.25)

Of the 20 samples of juices collected, 16 (80%) of them were positive for E coli; 8 (40%) samples for Salmonella spp.; 4 (20%) samples for Klebsiella; 3 (15%) for Candida spp. and 1 (5%) was positive for Enterococci.

Of the 20 samples of chutneys collected, 11(55%) of them were positive for E coli, 6 (30%) samples for Salmonella spp., 4 (20%) samples for Klebsiella and, 4 (20%) samples positive for Candida spp.

Total of 9 samples of Panipuri were contaminated-mostly with E coli. None of them was positive for Salmonella. Pseudomonas and Staph spp. were found in 1 sample of Panipuri each.

No organisms were cultured from the Samosa samples which were collected.

The type of utensils used for service, were disposable utensils by almost 45% of the vendors. Around 68.75% of the food serving staff was educated and the relation

between education status of the vendor and use of disposable utensils during service was found to be statistically significant.

**Table IV: Education status of the vendor and use of disposable utensils**

Educated	Disposable Utensils	Non-Disposable Utensils	Total
YES	36 (65.5%)	19 (34.5%)	55(100%)
NO	9 (36%)	16 (64%)	25(100%)
Total	45(56.25%)	35 (43.75%)	80(100%)

Chi square statistic= 5.1931; p statistically significant at <0.05

**Table V: Education status of the vendor and use of gloves while preparation**

Educated	Disposable Utensils	Non-Disposable Utensils	Total
YES	14 (25.5%)	41 (74.5%)	55 (100%)
NO	1 (4%)	24 (96%)	25(100%)
Total	15 (18.75%)	65 (81.25%)	80(100%)

P statistically significant at <0.05 using fisher exact test

On analysis, it was found that most of the educated people, who are aware of using gloves, did not use gloves. This may be due to negligence or due to reasons unknown.

**Table VI: Relationship between important parameters and microbial contamination**

Parameters	Microbial contamination		Total (%)	Chi square value
	Present (%)	Absent (%)		
Bin distance <2 M	27 (48.2)	29 (51.8)	56 (100)	5.2*
Bin distance ≥2 M	5 (20.8)	19 (79.2)	24 (100)	
<b>Total</b>	<b>32 (40)</b>	<b>48 (60)</b>	<b>80 (100)</b>	
Open drains	22 (78.6)	6 (21.4)	28 (100)	26.7**
No open drains	10 (19.2)	42 (80.8)	52 (100)	
<b>Total</b>	<b>32 (40)</b>	<b>48 (60)</b>	<b>80 (100)</b>	
Wash utensils with running water	5 (12.8)	34 (87.2)	39 (100)	19.7**
Wash utensils by dipping in tub	25 (61)	16 (39)	41 (100)	
<b>Total</b>	<b>30 (37.5)</b>	<b>50 (62.5)</b>	<b>80 (100)</b>	

\*p statistically significant at <0.05; \*\* p statistically highly significant at <0.001

### 1. “Bin distance”:

This refers to the distance between the vending site and the dustbin used for disposal of waste produced at the site.

It was found that almost 48.2% of samples of food were contaminated when bin was placed at a distance less than 2 meters and only 20.8% samples of food were contaminated when the bin distance was > 2 meters. The association between contamination of food samples with E coli and the bin distance was found to be statistically significant.

This may be because, the waste disposed at the vending site, would attract houseflies which will contaminate the food at the site. This finding concurred with a study where houseflies have been known to play a role in the contamination of food items and transmission of food-borne pathogens like E coli & Staph aureus. [8]

The present study findings were similar to a study that has shown that houseflies are not merely mechanical vectors for certain pathogens like E coli O157:H7, but also that the bacteria ingested by them were harbored in the intestine and continued to be excreted at least for 3 days after feeding. [9]

### 2. Open drainages near the vending site and E coli contamination:

A total of 78.6 % of samples collected from areas near presence of open drains have shown positive culture for E coli, when compared to 19.2% of the total samples collected from areas not near open drains showed E coli positivity in culture. A strong association between the contamination of street food with E coli and the presence of open drainages near the

vending site was found.

### 3. Method of washing of utensils and microbial contamination:

In this study, improper methods of cleaning the utensils used for cooking and plates used for serving, seem to be closely associated with fungal contamination (61%). Samples collected from sites where the utensils were washed by simply dipping them in a tub, tested positive for Candida species.

This could be because of the fact that the food vendors could have harbored the fungus in their inter-digital spaces and frequent dipping of their hands into the same tub might have increased the chances for re-contamination of the utensils washed in the tub, directly with the fungal organisms. Only 12.8% of samples tested positive for Candida when running water was used for cleaning the vessels and this difference was found to be significantly associated.

## CONCLUSIONS

- Street food tested from the selected outlets in the city of Hyderabad was contaminated with pathogenic organisms, and hence posed a great risk to people who consume street food on regular basis.
- The overall contamination was 53.75%, and major contaminants were E coli (40%) and Salmonella (17.5%).
- Lack of hygiene of food handlers and improper waste disposal could be the main risk factors for the contamination of street foods.
- Lesser Bin distance was found to be

significantly associated with contamination of food.

- Open drains nearer to the food consumption area was also found to be significantly associated with contamination of food samples.
- Though almost all the vendors were literate, they still did not use gloves to ensure safety of the consumers.
- Juices were the most contaminated food items and samosas were the least contaminated.

### Recommendations

1. There is a need to focus on educating food vendors about the importance of using gloves while preparing and serving to ensure in view of the safety of the consumers.
2. The high percentage of E coli, which is an indicator organism, signifies the need for proper drainage systems, sanitary waste disposal, covering of food items and prevention of vector breeding at/near food stalls.
3. It is of utmost importance to curb the precarious, unhygienic practices of the food handlers and re-emphasize the need for abiding by the rules that ought to be followed, while handling food.

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