Original Article

Journal of Food Safety and Hygiene

Journal homepage: http://jfsh.tums.ac.ir

Food safety knowledge and practices of street food handlers for designing training module- a needs assessment study

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ARTICLE INFO

Article history:
Received 07 Jan. 2023
Received in revised form
27 Feb. 2023
Accepted 09 Mar. 2023

Keywords:
Street food vendors;
Food safety;
Knowledge;
Practice

ABSTRACT

A targeted food safety training program for street food handlers is very essential to provide safe food for consumers. An in-depth assessment of knowledge and specific food safety practices of vendors is a prerequisite for incorporating a novel approach in training programs. The present study is a cross-sectional study conducted on 400 street food vendors (Panipuri-150, Bhelpuri-150, Fruit juice vendors-50, Chinese fast food-50) in south Indian city-Hyderabad, by stratified random sampling technique from 5 zones. A validated pre-tested questionnaire was administered by interview mode, and practices were recorded through the observational checklist. Scores have been allotted for a knowledge-based questionnaire with 18 items of which 5 are exclusive on knowledge and 13 questions on knowledge and subsequent practices recorded via observation checklist with different weights. Among all the street vendors, panipuri vendors (20.5±1.94) secured high scores and bhelpuri vendors (14.04±1.20) secured the least scores for knowledge whereas practice scores were relatively the same for all types of vendors. The average percentage for knowledge (17.40±3.56) scores was 68.1% and for practices (8.28±2.54) 38% for all the vendors. Very few vendors know the importance of practices like separating raw from cooked foods (22%), cooking food thoroughly (21.7%), and safe storage of cooked food (8.5%). Only about 13.7% of vendors thought that it is important to use soap for washing hands and only 4 % of the vendors practiced. The present study helps in identifying knowledge and knowledge-practice gaps in street food vendors for developing targeted food safety training programs.

Citation: Sabbithi A, Kumar RN, Gavaravarapu SM, Balakrishna N, Rao VS. **Food safety knowledge and practices of street food handlers for designing training module- a needs assessment study**. J food safe & hyg 2023; 9 (1): 24-37

1. Introduction

Street vending trade is an integral part of urban economies especially in developing counties like India. According to the estimations of the Ministry of Urban Poverty Alleviation, Government of India, there are about 10 million street vendors in the country of which 2 million are street food vendors (1).

Street vendors/hawkers are those who sell a wide range of ready-to-eat foods and beverages in public places (2).

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Despite their tremendous contribution to the economy, the safety of street foods remains uncertain. They are present in wide varieties, which greatly differ from place to place. Perceptions, cultural, and food handling practices of food handlers also greatly vary. The food safety knowledge and practices of street food handlers are highly region-specific. Poor food safety knowledge and handling practices of street food hawkers are perceived to pose a significant public health threat (3). Several outbreaks have been determined to be a result of poor food handling practices (4). In Europe, about 44% of foodborne illnesses were reported due to improper heating, reheating, undercooking, cooling, cross-contamination, unclean processing, poor hygiene, and improper use and management of leftovers accounted for 14% of foodborne diseases (5). CDC reported that cross-contamination from meat or poultry, unclean hands of a food handler, and inadequate cleaning of equipment and utensils were identified as major contamination factors.

Food safety training is the most cost-effective and long-term solution for enhancing the safety of these foods. The National Association of Street Vendors of India (NASVI) has taken an initiative for capacity building and training street food vendors using the guidelines developed by the Food Safety Standards Authority of India (FSSAI). Many mass training programs are being conducted and made food safety training and certification mandatory for all the small-scale food business operators/street food vendors across India.

In most cases, despite food handlers attending the food safety training programs, the conventional method of training was only able to improve knowledge but was not successful in achieving behavioral results among street vendors (6-9). Reviews and meta-analyses indicated the need for the usage of motivational theories in food safety training programs (10, 11). Developing food safety training programs that are customized and targeted for change in behaviors is the need of the hour. But before such training programs are devised it is essential to assess the perception, knowledge, and practices of street food vendors. This helps to target the program better. The present study aimed to assess the knowledge and food-specific practices of street food handlers in the South Indian city, Hyderabad.

2. Materials and methods

2.1. Study area

It was a cross-sectional study conducted in Hyderabad, the capital of the southern Indian state of Telangana, which has the 5th largest metro population of 10 million. It is divided into 5 zones (East, West, North, South, and central zone) with 18 circles and 150 wards. There are about 0.15 million street vendors (including food vendors) in Hyderabad (12).

2.2. Sample selection

In the present study, four high-risk foods have been identified. Based on 40% prevalence of Salmonella spp. and 20% relative precision (13) sample size has been derived. About 400 street food vendors who sell high-risk foods (150- panipuri [round, the hollow ball made of flour, fried crisp and filled with a mixture of flavored water], 150- bhelpuri [puffed rice and sev (a fried snack shaped like thin noodles made from besan flour) mixed with potatoes, onions, Chat masala and chutney and mixture], 50-Chinese fast food [including poultry

foods], 50- fruit juice vendors [vendors who sell multiple fruit juices] have been selected (14) using a stratified random sampling technique. Inclusion criteria-street vendors who sell high-risk foods, who operate mobile vending carts in main road/street corners, who don't have pipeline water supply and prominent roof. Exclusion criteria- street food vendors who don't sell high-risk foods, stationary with basic infrastructure (water connection, ceiling fan, concrete roof, and blocks).

2.3. Questionnaire

A structured pre-tested questionnaire has been developed. Questions included demographic profile (8), general food safety knowledge and perceptions (18), practices of specific foods they sell (Fruit juice-8, Panipuri-19, Bhelpuri-16, Chinese fast food-28), and personal hygiene (5). The questionnaire has been tested on 30 vendors (who sell high-risk foods) and they were excluded from the main study. The reliability test has shown Cronbach's ά 0.72, which was considered significant to carry out the study. Closed-ended and open-ended questions (later grouped after complete data collection) have been included to obtain all types of probable answers. In the quantitative method, questions were asked by interview mode at the vending site. In the qualitative method, observation study notes were used to record practices.

Scores have been allotted for a knowledge-based questionnaire with 18 items of which 5 are exclusive on knowledge/perception and 13 questions on knowledge and subsequent practices recorded via observation checklist with different weights.

The maximum score for knowledge and practices were 28 and 23 respectively.

2.4. Ethical clearance

The study protocol was cleared by Institutional Ethical Committee, National Institute of Nutrition, Hyderabad with Registration (No: ECR/35/Inst/AP/2013). The street food vendors who are willing to participate were enrolled in the study. Anonymity was maintained for the vendors.

2.5. Statistical analysis

SPSS 21 software version was used for analysis. Data was presented in Mean±SD. $P<0.05$ was considered significant.

3. Results

In the present study, four high-risk street foods have been identified. About 550 street vendors who sell high-risk foods have been contacted to arrive at a sample size of 400.

3.1. Demographic profile of street food vendors of Hyderabad

The majority of the vendors were males, had 2-5 years of experience in street vending activities except for Chinese fast-food vendors who were more experienced. About 56% of the Chinese food vendors were running the street vending business for more than 10 years. The general education level among vendors was low with some having high school education. However, panipuri vendors were slightly more educated than the other vendors were. Among all the categories of vendors, the Chinese fast-food vendors have either one or two employees working under them for carrying out vending activities.

Most of the vending units were located in poor hygienic places shown in Table 1. The majority of the vendors had an average of 1-5 working h per day in the

units. Most of the vendors did not undergo any formal food safety training before.

3.2. Food safety knowledge of street vendors

About 62% of fruit juice vendors have given correct responses on contamination of food followed by Panipuri vendors (30%) and Chinese fast-food vendors (26%). Fifty percent of vendors were aware of the causes of diarrhea and vomiting, but only 6%of the Bhelpuri vendors have responded correctly which was shown in Table 2. About 46% and 44% of Panipuri vendors know about the importance of separating raw and cooked foods, the importance of cooking food thoroughly but the rest of the vendors exhibited poor knowledge. The majority of the vendors were not aware of the effects of the storage of cooked foods at ambient temperature for a long duration.

3.3. Comparison of knowledge with practices

All the vendors of four categories have shown good knowledge of washing hands but very few of them have converted it to practice with the lowest percentage being the panipuri vendors. About 95% of them did not use soap for washing hands. The majority of the vendors thought using disposable plates is safe compared to the use of non-disposal plates for serving but all the Chinese fast-food vendors and the majority of the bhelpuri vendors (98.7%) served food on non-disposable plates.

Washing utensils once a day was considered safe and the majority of the vendors are following the same practice from all the three categories but panipuri vendors thought washing utensils thrice a day was safer. However, they did not practice the same as shown in Table 3. The majority of the vendors thought using soap for washing utensils is a good practice but very few of them practiced. Most of the vendors used a single bucket for washing utensils though most of them thought using two buckets for cleaning is safe. Most of the vendors thought wiping utensils after washing is not necessary, so most of them did not practice. About 82% of fruit juice vendors did not know the importance of using a clean cloth to maintain food safety. However, vendors from the other three categories have shown good knowledge about mopping cloth, but most of the vendors used unclean cloth for cleaning the vending unit. The majority of the vendors were aware of the importance of covering cooked and raw foods, but very few of them have translated it into practice. About 98.7 % of panipuri vendors thought cleaning the vending unit frequently is good to maintain safety and the same percentage of the vendors practiced it. Among 98% of Chinese fast-food vendors who thought cleaning the cooking area frequently was necessary to maintain safety, only 24% of them have put them into practice.

The majority of the vendors thought cleaning the vending unit twice a day is important but most of them reported cleaning only once a day. Most of the vendors cleaned the vending unit with only water though they thought cleaning with soap was better. About 90% of fruit juice vendors thought proper waste disposal is essential to maintain food safety but only 16 % of them have put them into practice by maintaining closed dustbins. All the vendors of the remaining category used dustbins without lids though they reported waste disposal is important.

Table 1. Demographic profile of street food vendors of Hyderabad with % in parenthesis

Variable	Fruit juice vendors (n=50)	*Panipuri* vendors (n=150)	*Bhelpuri* vendors (n=150)	Chinese fast-food vendors (n=50)
Gender				
a.Male	50(100)	148(98.7)	150(100)	47(90.4)
b.Female	0(0)	2(1.3)	0(0)	3(5.8)
Duration of business				
a.0-1yr	8(16)	2(1.3)	37(24.7)	0(0)
b.2-5yr	15(30)	111(74)	62(41.3)	12(24)
c.6-10yr	24(48)	0(0)	51(34)	10(20)
d.>10yr	3(6)	37(24.7)	0(0)	28(56)
Education				
a. Illiterate	7(14)	22(14.7)	0(0)	22(44)
b. Read and write	23(46)	4(2.7)	48(32)	24(48)
c.1-4thstd	15(30)	86(57.3)	39(26)	4(8)
d.5-8thstd	3(6)	0(0)	63(42)	0(0)
e.9-12thstd	2(4)	38(25.3)	0(0)	0(0)
f. College	0(0)	0(0)	0(0)	0(0)
Number of workers				
a.No workers	36(72)	66(54)	90(60)	0(0)
b.1	13(26)	0(0)	60(40)	32(64)
c.2	1(2)	84(56)	0(0)	18(36)
Vending location				
a. Adjacent to the road	47(94)	22(14.7)	37(24.7)	27(54)
b. Near open place	0(0)	38(25.3)	58(38.7)	15(30)
c. Near to drainage	2(4)	59(39.3)	11(7.3)	3(6)
d. Near to municipal garbage	1(2)	31(20.7)	44(29.3)	1(2)
e. Near to toilets				
	0(0)	0(0)	0(0)	4(8)
Hygiene of the surrounding area				
a. Garbage around				
b. Animals	46(92)	4(2.7)	0(0)	19(38)
c. Houseflies/Fruit lies	1(2)	0(0)	0(0)	10(20)
d. Open sewage	50(100)	38(58.3)	101(67.3)	3(6)
e. All the above	3(6)	86(57.3)	0(0)	3(6)
f. None of the above	4(8)	22(14.7)	49(32.7)	7(14)
	0(0)	0(0)	0(0)	8(16)
Duration of business in a day				
a.1-5h				
b.5-10h	33(67)	123(82)	101(67.4)	39(78)
	17(34)	27(18)	49(32.6)	11(22)
Food safety training				
a. Yes	0(0)	3(2)	3(2)	5(10)
b. No	50(100)	147(98)	147(98)	45(90)

Table 2. Knowledge of street food vendors with the percentage in parenthesis of Hyderabad

Variable	Fruit juices (50)	*Panipuri* (150)	*Bhelpuri* (150)	Chinese fast foods (50)	Total (400)
Do you know anything about contamination?					
a. Correct answer	31(62)	45(30)	9(6)	13(26)	98(24.5)
b. Wrong answer/did not respond	19(38)	105(70)	141(94)	37(74)	302(75.5)
Do you know what causes diarrhea/vomiting?					
a. Correct answer	29(58)	74(49.3)	10(6.7)	26(52)	139(34.7)
b. Wrong answer/did not respond	21(42)	76(50.7)	140(93.3)	24(48)	261(65.2)
Is it important to separate raw food from cooked foods?					
a. Correct answer	2(4.0)	70(46.7)	10(6.7)	6(12)	88(22)
b. Wrong answer/did not respond	48(96)	80(53.3)	140(93.3)	44(88)	312(78)
Is it important to cook food thoroughly?					
a. Correct answer	5(10)	67(44.7)	10(6.7)	5(10)	87(21.7)
b. Wrong answer/did not respond	45(90)	83(55.3)	140(93.3)	45(90)	313(78.2)
Is it safe to store cooked food for a long time at ambient temperature?					
a. Correct answer	5(10)	16(10.7)	10(6.7)	3(6)	34(8.5)
b. Wrong answer/did not respond	45(90)	134(89.3)	140(93.3)	47(94)	366(91.5)

3.4. Knowledge and practice scores of street vendors

Based on the list of questions on knowledge and practices, scores were allotted for correct answers. The maximum score for knowledge and practices were 28 and 23 respectively. Among the four food groups, knowledge scores of *panipuri* vendors were high, followed by Chinese fast-food vendors.

However, the practice scores were low in all the four categories of street vendors as shown in table 4. Comparing knowledge and practices of each food category, there is a significant difference between knowledge and practices. The maximum score for knowledge and practices obtained were 24 and 11 respectively.

3.5. Food specific practices of street food vendors

Fruit juices: About 76% of the vendors use separate blenders for each type of fruit juice and only 12% of them wash the blenders frequently. Around 78% of the vendors stored milk in the ambient temperature and 56% of them used pasteurized milk for dilution. Around 98% of the stored ice is in an unclean container. About 74% of the vendors used unclean water for cleaning the utensils and 84% of the vendors maintained unclean knives and cutting boards.

Panipuri: The majority of the panipuri vendors sold yellow peas stuffing (97.3%) which was prepared at home (100%) and stored at ambient temperature (97.3%) before the sale. Mint flavored water (75.3%) was used with all the vendors preparing it manually and 99.3% of vendors used municipal water for dilution. About 25.3% of vendors prepared chutneys on daily basis and the dry puri was prepared by themselves by 64% of the vendors. About 3.3% of the vendors use non-disposal plates for serving which were mostly steel and porcelain but the majority (96.7%) of the vendors used disposal plates for serving.

Table 3. Comparison of Knowledge with practices of street food handlers with the percentage in parenthesis

sn	Variable		Fruit juices (50)		*Panipuri* (150)		*Bhelpuri* (150)		Chinese fast foods (50)	
			K (%)	P (%)	K (%)	P (%)	K (%)	P (%)	K (%)	P (%)
1.	When do you wash your hands?	Before food preparation	31(62)	5(10)	33(22)	43(28.7)	123(82)	123(82)	0(0)	32(64)
		Before serving food	19(38)	36(72)	41(27.3)	49(32.7)	27(18)	27(18)	19(38)	18(36)
		Neither	0(0)	9(18)	1(0.7)	58(38.6)	0(0)	0(0)	1(2)	0(0)
		Both	0(0)	0(0)	75(50)	0(0)	0(0)	0(0)	30(60)	0(0)
2.	How do you wash your hands?	With only water	25(50)	48(96)	135(90)	143(95.3)	140(93.3)	143(95.3)	45(90)	50(100)
		With water and soap	25(50)	2(4)	15(10)	7(4.7)	10(6.7)	7(4.7)	5(10)	0(0)
3.	Type of plate/ glasses used for serving	Disposal	39(78)	32(64)	140(93.3)	138(92)	140(93.3)	2(1.3)	50(100)	0(0)
		Non disposal	11(22)	18(36)	10(6.7)	12(8)	10(6.7)	140(98.7)	0(0)	50(100)
4.	When do you wash utensils	Once in a day	29(58)	48(96)	7(4.7)	145(96.7)	145(96.7)	145(96.7)	19(38)	49(98)
		Twice a day	21(42)	2(4)	5(3.3)	5(3.3)	5(3.3)	5(3.3)	31(62)	1(2)
		Thrice a day or more	0(0)	0(0)	138(92)	0(0)	0(0)	0(0)	0(0)	0(0)
5.	How do you wash	With only water	7(14)	43(86)	9(6)	148(98.7)	150(100)	148(98.7)	19(38)	47(94)
		With water and soap	43(86)	7(14)	141(94)	2(1.3)	0(0)	2(1.3)	31(62)	3(6)
6.	Number of buckets used for washing utensils	One	29(58)	49(98)	0(0)	95(63.3)	83(55.3)	95(63.3)	42(84)	29(58)
		Two	21(42)	0(0)	67(44.7)	55(36.7)	67(44.7)	55(36.7)	8(16)	21(42)
		Three	0(0)	1(2)	83(55.3)	0(0)	0(0)	0(0)	0(0)	0(0)
7.	Is it necessary to wipe utensils after washing	Yes	11(22)	5(10)	16(10.7)	13(8.7)	16(10.7)	10(6.7)	2(16)	0(0)
		No	39(78)	45(90)	134(89.3)	137(91.3)	134(89.3)	140(93.3)	48(84)	50(100)
8.	Is Cloth used for cleaning important for food safety	Yes	9(18)	5(10)	110(73.3)	6(4)	110(73.3)	5(3.3)	45(90)	1(2)
		No	41(82)	45(90)	40(26.7)	144(96)	40(26.7)	145(96.7)	5(10)	49(98)
9.	Do you think cooked food and cut vegetables kept uncovered for a long time are prone to contamination?	Yes	46(92)	21(42)	135(90)	5(3.3)	135(90)	2(2.6)	44(88)	1(2)
		No	4(8)	29(58)	15(10)	145(96.7)	15(10)	148(97.4)	6(12)	49(98)
10.	Do you think frequent mopping of the preparation area is important?	Yes	34(62.9)	25(50)	148(98.7)	148(98.7)	148(98.7)	49(32.7)	49(98)	12(24)
		No	16(32)	25(50)	2(1.3)	2(1.3)	2(1.3)	101(67.3)	1(2)	38(86)
11.	When do you clean the vending unit?	Once in a day	15(30)	47(94)	2(1.3)	49(32.7)	49(32.7)	128(85.3)	1(2)	23(46)
		Twice a day	35(70)	3(6)	101(67.3)	101(67.3)	101(67.3)	20(13)	33(66)	27(54)
		Thrice a day or more	0(0)	0(0)	47(31.3)	0(0)	0(0)	2(1.3)	16(32)	0(0)
12.	How do you clean the vending unit?	With only water	38(72)	46(92)	2(1.3)	144(96)	2(1.3)	141(94)	0(0)	32(64)
		With water and Detergent	12(24)	4(8)	148(98.7)	6(4)	148(98.7)	9(6)	50(100)	18(36)
13.	Do you think waste disposal is necessary to maintain food safety?	Yes	45(90)	8(16)	128(85.3)	0(0)	128(85.3)	0(0)	38(76)	0(0)
		No	5(10)	42(84)	22(14.7)	150(100)	22(14.7)	150(100)	12(24)	50(100)

Table 4. Mean scores of knowledge and practices of street vendors

Street food	Knowledge score (Mean±SD)	Knowledge score (Min-Max)	Practice score (Mean±SD)	Practice score (Min-Max)
Panipuri (n=150)	20.5±1.94	(17-24)	8.9±1.15	(7-11)
Bhelpuri (n=150)	14.04±1.20	(6-11)	8.68±1.21	(7-11)
Fruitjuices (n=50)	16.3±2.58	(13-21)	8.36±0.89	(7-10)
Chinese fast foods (n=50)	19.0±3.42	(14-23)	9.92±0.65	(9-11)
Total (400)	17.40±3.56		8.28±2.54	

Table 5. Food specific practices of street food vendors in Hyderabad with the percentage in parenthesis

Fruit juices	*Panipuri*	*Bhelpuri*	Chicken items
Obtain fruits from: Fruit market (wholesale) 50 (100)	Obtain Vegetables from: market 119 (79.3)	Obtain vegetables from: Vendors 101(67.3)	Purchase of chicken: Meat shop 33(66)
Check for the quality: Yes 42(84)	Check for the quality: No 81(54)	Check for the quality of vegetables: Yes: 137(91.3)	Check for the quality of chicken: Yes 47(94)
Frequency of purchase of fruits: • Daily: 20(40) • Once in every three days: 21(42)	Frequency of purchase of fruits: • Once in a week 107(71.3) • Daily 38(25.3)	Frequency of purchase of vegetables: • Purchase daily 73(48.7) • Twice a week 39(26)	Store before cooking: Room temperature 24(48)
Types of fruit juices in different seasons: Summer and winter – All seasonal fruits 32(64)	Wash vegetables: No 104(69.3)	Storage: House 99(66)	Duration of marinating: 1-2 h 19(38)
Water used for dilution: Municipal water 39(78)	Type of stuffing*:* Yellow peas stuffing 146(97.3) Potato 4(2.7)	Water is used for washing: Municipal water 89(59.3)	The doneness of chicken: Yes 29(58)
Specific blenders for each type of fruit: Yes 38(76)	Preparation of stuffing: House 150(100%)	Cut vegetables: • Before preparation38(25.3) • Cut and keep 112(74.7)	Storage of fried chicken: Fridge 23(46)
Blenders washed frequently: No:44(88)	Storage of stuffing: At Ambient temperature 146(97.3)	Type of *Bhelpuri*: Wet variety 110(73.3)	Boil noodles/rice: Morning 32(64)
Milk stored at ambient temperature: Yes 39(78)	Type of flavored water: Mint 113(75.3)	Frequency of purchase puffed rice and sev: Purchase daily 73(48.7)	Wash vegetables before cooking: No 26(52)
Type of milk used: Pasteurized milk 28(56)	Flavored water prepared: Manually 150(100)	Types of chutneys used in *Bhelpuri:* Three73(48.7)	Separate cutting board for vegetables and chicken: No 34(68)
Ice stored in: Unclean box 48(96)	Frequency of chutney preparation: Twice a week 59(39.3)	Frequency of chutney/sauce preparation: Daily 73(48.7)	Store cut vegetables for: 1-2h 27(54)
Utensils washed in: Unclean water 37(74)	Puri preparation: At home 96(64)	Store chutneys: Ambient temperature 112(74.7)	Use of separate utensils for raw and cooked foods: No 34(72)
Maintenance of Cutting board and knife: unclean 42(84)	Types of plates used for serving: disposal 145(96.7)	Type of plates for serving: Porcelain 80(53.4)	-

Table 6. Habits of street food handlers with percentage in parenthesis

S.no	Variable	Fruit juices (n=50)	*Panipuri* (n=150)	*Bhelpuri (n=150)*	Chinese fast foods (n=50)
1.	Long finger nails	30(60)	112(74.7)	77(51.3)	17(32.7)
2.	Hand jewelry	32(64)	112(74.7)	139(92.7)	30(57.5)
3.	Smoking	1(2)	0(0)	0(0)	8(15.4)
4.	Pan chewing	1(2)	26(17.3)	100(66.7)	17(32.7)
5.	Frequent spitting	1(2)	22(14.7)	64(42.7)	10(19.2)

Bhelpuri: About 66.7% of the vendors reported washing vegetables before use with the majority (95.3%) of the vendors using municipal water for washing.

About 74.7% of the vendors cut and keep the vegetables much before their use. A majority (73.3%) of the vendors prepare a wet variety of *bhelpuri.* Purchase of puffed rice was done daily and 3 varieties of chutneys are used for mixing by 48.7% of the vendors. About 74.7 % of the vendors' store chutneys at room temperature and about 98.7% of them used non-disposal plates for serving which were mainly steel and porcelain.

Chinese fast-food vendors: About 38% marinated the chicken for 1-2 h at room temperature. Ensuring the cooking adequacy of chicken was done by 58% of the vendors and 46% of them stored the cooked chicken in the fridge. About 68% of the vendors used a common cutting board for cutting vegetables and chicken and 54 % of the vendors left cut vegetables uncovered for 1-2 h before preparation. The use of separate utensils for storing raw and cooked foods was done by 32% of the vendors as shown in Table 5.

3.6. Habits of street food vendors

About 74.7% of the panipuri vendors had, long fingernails followed by fruit juice vendors (60%), bhelpuri vendors (51.3%) with the least being Chinese fast-food vendors (32.7). About 92.7 % of bhelpuri vendors wore hand jewelry followed by panipuri vendors. About 15.4% of Chinese fast-food vendors were observed smoking while preparing the food. The majority of the bhelpuri vendors were chewing pan and frequently spitting while preparing the food compared to other food categories as shown in Table 6.

4. Discussion

In the present study knowledge and practices of street food vendors from Hyderabad who sell high-risk food have been evaluated. The majority of the vendors were males compared to females which are inconsistent with the data reported, where the majority of the vendors were females (9, 15-18) but some of the studies reported more number of males compared to females (19-22).

Studies from most of the Asian countries have shown male vendors due to the cultural norms where females were restricted but in African countries majority of the vendors were females and acted as a major income source for their families.

Most of the vendors in the present study had primary education, which was contrary to the study conducted by Cortese et al. (20), where most of the vendors had

completed elementary school education and same as the study conducted by Murat bas et al. (21). In the present study, two categories of vendors had 1 or 2 workers employed under them which was contradictory to the study conducted by Roever (23); who operated their enterprises and hired no employees. In the present study, Chinese fast-food vendors had more experience compared to other categories of vendors, which was similar to the study conducted by Murat bas et al. (21), the majority of the participants had been employed 10 or more years in some segment of the food businesses.

In the present study, the hygiene of surrounding areas was poor which was contradicting with results from the study conducted by Okojie et al. (24), where a high proportion of 259 (90.5%) of the vending sites appeared clean. But the data on other studies reported unhealthy surroundings (eg. Proximity of drains and public discharge sites) Tinker et al. (25), insufficient facilities for waste disposal (26, 27), and inappropriate accumulation of garbage, dirty plates or utensils attracting flies, insects, rodents, and birds (28, 29) which were as per the present study.

Very less percentage of street food vendors have undergone formal food safety training in the present study which was similar to the study conducted by Okojie et al. (24); where only 28% of them had food safety training and 4.76% of the vendors surveyed admitted to formal training in food handling (30). But 55% of 444 vendors reported formal food safety training by a study conducted by Walker et al. (31).

Most of the fruit juice vendors exhibited good knowledge about contamination compared to other vendors. Similarly, some studies on street vendors have shown good knowledge about contamination of food (31-33). In the present study, about fifty percent of vendors were aware of the causes of diarrhea and vomiting. Similar results have been shown by the study conducted by Osaili et al. (32), about 84%, 52%, and 38% of the correspondents knew that diarrhea, sore throat, and vomiting would affect food safety, respectively. Another study reported diarrhea and stomach pain were the most prevalent symptoms of foodborne illness identified, followed by vomiting, nausea, and headache. Many of the vendors are aware of some common food-borne diseases and modes of contracting those (33). About 46% of Panipuri vendors knew about the importance of separating raw and cooked foods but about 97% (444) food handlers knew that raw and cooked foods should be separated to prevent bacterial transfer (31), and 59.3% (764) food handlers (21). About 47 % of street vendors were aware of the importance of cooking food thoroughly but the rest of the vendors did not give correct answers. There is a marked difference in knowledge of thorough cooking and storage of cooked foods among food handlers in a restaurant setup and street setup. Food handlers in restaurants used thermometers to check the internal temperature of the cooked food and are aware of the danger zone of storage temperature (31-35). The majority of the street vendors from the present study do not know the importance of reheating the stored cooked food. But the food handlers in restaurants had good knowledge about the danger zone of storage temperature and the

importance of reheating the cooked foods (31, 32, 34, 36).

Among the four groups of street vendors, panipuri vendors had good knowledge of some food safety aspects but the rest of the vendors showed poor knowledge especially bhelpuri vendors. Most of the vendors washed their hands either before food preparation or while serving the food but about 38.6% of panipuri vendors didn't do both. About 60% of Chinese fast-food vendors thought that hands should be washed before food preparation and while serving food but none of them practiced both. A study conducted by Elvis et al., (37); showed that about 44% of the vendors washed their hands every 20-30 min. In the present study, about 90-100% of vendors did not use soap to wash their hands.

Most of the vendors thought using disposal plates is good to maintain food safety but bhelpuri vendors and Chinese fast-food vendors used non-disposal plates for serving. This might be due to the extra financial burden or the quantity of food served and incase of Chinese fast foods the food will be served hot, so the disposal plates cannot withstand the temperature of the food. A review by Alimi et al. (38) on practices of street vendors has shown the majority of the street vendors using non-disposal plates for serving.

In the present study cleaning utensils was done only once a day with the majority of them using only water to wash the utensils. The number of buckets used for cleaning utensils was only one by most of the vendors. A review by Rane et al.(39); has shown that street vendors due to a shortage of potable water, tend to re-use the water for cleaning the utensils.

Studies have shown that vendors used either soap solution or cold water for washing utensils (38).

In the present study majority of the vendors knew that utensils should be cleaned using soap but only bhelpuri vendors have practiced. Generally, bhelpuri vendors do not have to use water for the preparation of the recipe. Hence, the water carried to the vending unit was extensively used for cleaning the utensils, unlike other vendors who use water even for the preparation of the recipe.

The majority of the vendors thought wiping the utensils after washing is not necessary and mopping cloth does not have any role to play in food safety. The mopping cloth used in the vending unit was very unclean and it was used for wiping both hands and cleaning the surrounding areas of cooking. A study conducted by Samapundo et al. (18); has shown that vendors were well aware of the importance of clean mopping cloth to maintain food safety.

In the present study, most of the vendors knew about the importance of covering the food, cleaning the vending units, maintaining the dustbins clean but these were not translated into practices. A study conducted by Cortese et al. (20); has also shown vendors with good knowledge over these aspects.

In the present study, the overall knowledge scores were higher than the practice scores of street food vendors. But a study conducted by MojganTalaei et al. (40); had shown scores of practices were more compared to knowledge. Another study which was conducted by Abdul-Mutalib et al. (41); showed a significant correlation between knowledge and practices with $p=0.007$.

There are four practices observed among the majority of the fruit juice vendors that are using specific blenders for each type of fruit, utensils washed in unclean water, ice maintained in the unclean box, knife and cutting board maintained unclean. Most of the vendors tend to believe that using specifically dedicated blenders for each type of fruit juice excuses them for not washing blenders frequently. Though the vendors are aware of the other three practices, water scarcity and cost were the two major issues reported. Panipuri vendors have shown poor practices of the two most critical issues i.e., not washing vegetables used for stuffing and serving, and storing the cooked yellow peas for more than 2 h at ambient temperature. The majority of the bhelpuri vendors did not wash the vegetables and most of the vendors sold wet variety compared to dry variety. Chinese fast-food vendors used the same cutting board for cutting vegetables and chicken.

Maintaining long fingernails and wearing hand jewelry was most prevalent among street vendors in the present study. Similar to the studies which have shown street vendors with long fingernails (42-44). Wearing hand jewelry especially religious threads was most common among vendors in the present study. Practices such as pan chewing, frequent spitting, and smoking were less prevalent among street vendors in the present study, unlike other studies.

5. Conclusion

This study helped in understanding the knowledge and practices of street food vendors of popular foods in Hyderabad. Results clearly showed the gap between knowledge and practices of street vendors.

Different types of vendors had a different scale of knowledge on food safety. The study clearly shows the importance of developing a customized training program for street vendors. The study identifies some of the key problems that will enable trainers to target specific food safety behaviors.

Conflict of Interest

The authors declare no conflict of interest to the present study.

Acknowledgment

The authors acknowledge the encouragement given to them during the study by the Director, National Institute of Nutrition, Indian Council of Medical Research (ICMR), Hyderabad, India, and University Grants Commission (UGC) for providing fellowship. Indian Council of Medical Research-National Institute of Nutrition: 13-FD04.

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