

Exposure of Food Safety Knowledge and Inadequate Practices among Food Vendors at Rawalpindi; the Fourth Largest City of Pakistan

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Abstract Street food vending trade has earned a significant place all over the world. Rawalpindi city has huge food industry with large market places dedicated only for food items, often coined with food streets which require investigation of food safety knowledge and handling practices among vendors. For this purpose 223 vendors from six clusters of Rawalpindi were selected. 37% of the vendors were from the age bracket of 26-35 years. Majority of them showed the unprofessional attitude towards food preparation and maintenance – about 61% did not cover their food at all and the remaining had the insufficient covering arrangements. Thereby, more than 80% of the stalls were exposed to flies ($P=0.000$) regardless of the type of cart ($P=0.000$). 75% vendors used the tap water for their food preparation, amongst which majority (60%) was of those vending either on mobile carts or stalls near to footpath ($P = 0.000$). Almost 98% handled the food with bare hands. However, 80% vendors agreed that food could be contaminated with the microbes, insects, dust particles, food coloring, and spices used in the preparation of food. Malpractices during the preparation of food and unhygienic conditions may cause foodborne outbreaks.

Keywords: food safety, contamination, handling practices, knowledge, street vendors

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1. Introduction

The trend of street food vending is mushrooming globally due to fast urbanization, technological advancement and alarmingly increasing hasty lifestyle. People are more inclined to shop ready to eat foods instead of cooking at home. They are inclined towards easier ways of spending life without realizing about safety concerns. On the other side this expansion is thought to be a profitable enterprise due to low capital expense and tax-free earnings [1] which may a) provide benefits to country's economy [2], b) offer low cost and often nutritious foods and, c) be responsible for employment and convenient to people from low socio-economic groups [3]. That is why street vending pays a significant contribution to many local inhabitants, business community and is considered affordable to many sections of the population [3]. It is estimated that 2.5 billion people worldwide consume street foods each day. Only in Latin America, street foods account for up to 30% of urban household purchases (Samapundo et al., 2015). In Southern Asian countries like India, Bangladesh, Bangkok, Thailand, and Indonesia, street foods are an important portion of their diet [4]. The impact of this shift

is very high, so much so that international organizations have carefully devised a universally acceptable terminology and developed various definitions related to the food vending business. For example, World Health Organization (WHO) and Food and Agriculture Organization (FAO) define street foods as “Ready-To-Eat” (RTE) food and beverages prepared and sold by hawkers and vendors especially on the roadways and other public places for instant consumption [5,6]. While, a food handler is the one who handles food irrespective of whether s/he prepares or serves it.

Street food safety is highly dependent on the handling of raw food to the cooking of food till its consumption. The fact that street food vendors possess the underprivileged local infrastructure in general, lack of sanitary facilities, no proper training about food hygiene, poor sanitation and limited knowledge of personal hygiene have posed countless problems [7]. Many studies conducted to assess the quality of street foods in various countries show that most of the times such food is not up to the safety standards, many are responsible for various foodborne diseases [8,9] and known to be the amongst greatest challenges of the 21st century [10].

During the last few decades, street food vending trade in Pakistan has earned a significant place like in any other

developing nation. However, no awareness programs on food safety practices are being initiated that could combat epidemics of Foodborne diseases. Unwanted organisms are commonly found in street foods, for example, reports showed that the prevalence of only campylobacter species in food (raw/undercooked) commodities in big cities of Pakistan including Islamabad adjacent to Rawalpindi, Faisalabad and Lahore is significantly high [11]. Sanitary practices among food handlers in Satellite Town area of Rawalpindi were also not optimal [12]. Rawalpindi city, which has a huge food industry with large market places dedicated only for food items, often coined as food streets. Vending stalls are located almost everywhere, on roadways near to taxi stands, bus and train stations, building construction sites, school premises and hospitals. Therefore, it is very important to learn the dynamics of this exponentially growing business and its potential implications on the society. This study aims to get the current status of food safety knowledge and practices among street food vendors - limited information about safety of street foods is documented in Rawalpindi. Provision of this information will be useful for understanding the food related safety challenges in general and, for the regulatory agencies in order to take appropriate steps to tackle the worsening situation.

2. Materials and Methods

2.1. Description of Study Area

The study was conducted in Rawalpindi, 4th largest city of Pakistan, situated in the Pothohar region of Northern Punjab. The city is growing rapidly: according to census 2006, its population was approximately 2 million, which increased to over 5 million in 2010 [13]. Major areas of concern in this city are Pir Wadhai, Faizabad, Commercial Market, Saddar, Raja Bazaar and Bakra Mandi. Most of the places are accessible via Murree road by intercity public transport or recently developed Metro Bus Service. Pir Wadhai and Faizabad are known to be the principal stations for the interstate transport system. The commercial market is now becoming a new hub for shopping activities, especially for those who want to avoid the busy and packed old city. Saddar bazaar is developed as the cantonment bazaar between the old city and The Mall. Raja Bazaar is located in the old city which offers wholesale and retail shops for almost everything including all kinds of foods. Bakra Mandi, also known as Kalma chowk is also an old commercial place as well as a residential area.

2.2. Sampling Technique and Inclusion Criteria

Cluster sampling was done to collect the required data. The city was divided into six clusters i.e. Pir Wadhai, Faizabad, Commercial Market, Saddar, Raja Bazaar and Bakra Mandi. Firstly, permanent vendors who met the inclusion criteria were identified then five vendors from each cluster were selected randomly. A total of 240 food vendors were nominated out of which 223 were studied with a response rate of 92%. All the street vendors that

were mobile or operating at their sites for last two years' experience or more were included in this study. Ethical considerations were kept in mind by taking the informed consent from each vendor. They were also assured that the information received would be kept confidential. Those vendors who fulfill the inclusion criteria but refused to share the consent were excluded.

2.3. Data Collection and Analysis

A pretested structured questionnaire was used to assess the food safety knowledge and handling practices of the street vendors [14,15,16,17]. It was based on socio-demographic characteristics, food handling and preparation practices, storage facilities and management of leftover food, personal hygiene of food handlers, awareness about FBDs, the importance of medical examination and food safety training. The data was analyzed using Statistical Package for Social Sciences software, version 20.0 (SPSS Incorporated, At- Atlanta, Illinois, USA). Furthermore the results were analyzed by univariate and bivariate analysis and presented in the form of tables and figures. Association between the study variables was assessed through cross-tabulations and chi-square test. The level of significance was set at 95%.

3. Results and Discussion

3.1. Socio - Demographic Profile of the Respondents

Socio-demographic characteristics included the age, education, and income of the study subjects as presented in Figure 1. Out of 223 subjects' majority of the vendors, 37% (83) were in the age bracket of 26-35 years. The mean age was found to be 35.3 ± 11.9 ranged from 15-70 years. Same trend was observed in other countries of subcontinent, like India [18] and Bangladesh [19] where street vending is considered to be the second employment opportunity after the rickshaw pulling and particularly important for young and middle-aged men [19]. Lack of education was the common feature as 35% (78) of the respondents were illiterate and remaining of the subjects had the education up to XII Grades only. In present study and throughout the world this segment of population exhibited the low education level between grades 5 to 10 like reported in neighboring countries of Pakistan, Bangladesh [20] and India [21]. The study also revealed that level of education does not exhibit improvement in food safety practices ($P=0.000$) also shared by [22] that more education may not always lead to positive change in handling behavior. However, education, income and working experience are found to have correlations between them, For example t, Income is highly correlated with age and education level at significance level of 0.01 and age is strongly correlated with vending period or years of experience (see Supporting Information S1 & S2 for the details). 39% of the vendors reported their monthly income equivalent to three times of minimum wages, i.e. 12,000/-PKR for 2013-14 fiscal year and only 10% of the vendors were earning less than their minimum wage as set by the government.

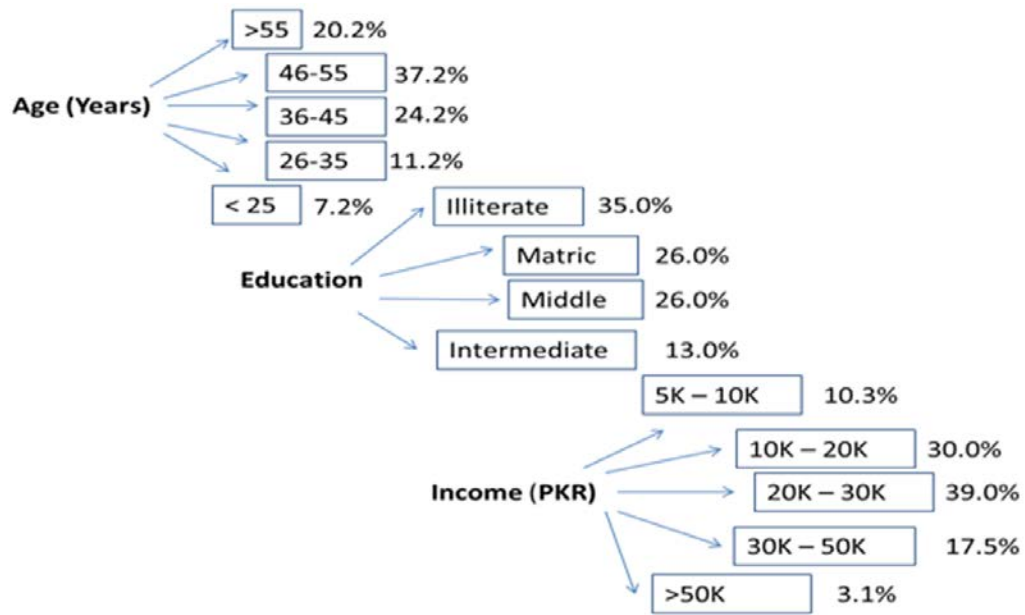


Figure 1. Socio-demographic characteristics of street food vendors of Rawalpindi city

Table 1. Basic Occupational Traits of The Vendors

Characteristics	Categories	n	%
Type of food stuff vended	Burger	27	12.1
	Rice	27	12.1
	Chicken Tikka	26	11.7
	Samosa	27	12.1
	Chana Chaat	26	11.7
	Fruit Chaat	30	13.5
	Sugar Cane Juice	30	13.5
	Tamarind Prune Juice	30	13.5
	2- 5	30	13.5
Length of trading (Years)	6- 10	31	13.9
	11-15	65	29.1
	16-20	74	33.2
	> 20	23	10.3
Type of cart	Mobile	31	13.9
	Dhabas	100	44.8
	Near to foot path	92	41.3
Number of coworkers	None	100	44.8
	1-3	111	49.8
	> 3	12	5.4

3.2. Occupational Traits of the Respondents

Basic occupational information of the vendors is shown in Table 1. Out of the 92% response rate, a percentage range from 11.7 to 13.5 were selling the fruit cup (locally named as Fruit Chaat), fresh Sugarcane juice and Tamarind prune juice (locally named as Imlu Alu-Bukhara sherbet), Burger, Rice, Samosa, Chicken Tikka (Barbequed) and chickpeas (locally called as Chana Chaat). All of these food items are very much popular in sub-continent especially in India and Pakistan [21] and undoubtedly people of Rawalpindi city are very much inclined to dine out these RTE foods as a mid-evening snack. The business community and people who are engaged in jobs usually took these at mid-morning or lunch time. As far as the length of trading or vending period is concerned 62.3% (139) of the vendors had experience of 11-20 years of vending with the mean length of trading 13.5 ± 5.5 years irrespective of the basic

mandatory training on food safety ($P = 0.001$). The length of experience or trading indicates that street vending business is an economical, profitable enterprise due to the low capital expense and tax-free earnings.

44.8% (100) of the vendors were selling their food stuff at Dhabas; known as roadside mini restaurants. These serve 41.3% of the people belonging to low socio economic category (92) had wooden cart fixed near to footpaths, very common in Pakistan while 13.9% (31) had a mobile cart (on a wheelbarrow). Similarly a large number of hawkers in Bangladesh [20] and India [21] sell food stuff on mobile carts. In present study significant association ($P = 0.000$) was also found between the vending period and type of cart. This indicates that vendors who worked at Dhabas had the maximum length of trading, which declares it a profitable enterprise.

3.3. Food Handling and Preparation Practices

In present study food handling and preparation practices were carefully observed, see the details in Table 2. Out of 223 vendors 63.7% (142) prepared their foodstuffs at their own marketplace and around half of the vendors prepared food at morning and during the sale at $P = 0.000$. A similar practice has also been observed in Bangladesh where 82% hawkers prepared food at their vending site [19] and 60% of the West Indians hawkers prepared food in the morning timings [23]. Nevertheless, there were two exceptions – fruit Chaat (76.7%) and the sugar cane juice (100%) are the items which were freshly sold by the vendors; seem to be the good practice among the vendors.

Furthermore results regarding handling practices among vendors from different clusters showed that over 61% did not give due preference to cover their food items and the remaining practiced to cover their food but it was not properly covered therefore more than 80% of the stalls were exposed to flies ($P=0.000$) regardless of the type of cart ($P=0.000$). Comparable practice had been studied in Bangladesh [20], Indonesia [24], and India [25] which shows that contamination can also be occurred mechanically through flies as carrier of micro-organisms [26].

Table 2. Food Handling, Preparation and Water Consumption Practices

Variables	Categories	n	%
Preparation site	At home	27	12.1
	At own market place	142	63.7
	At home + own market place	45	20.2
	Get from another source	9	4.0
Timings of food preparation	In the morning	45	20.2
	During the sale	54	24.2
	Morning + during the sale	48	21.5
	At previous night + morning	76	34.1
Heating of food before selling	No	8	3.6
	Yes	105	47.1
	Not required	110	49.3
Food handled at ground level	No	125	56.1
	Yes	98	43.9
Washing of utensils	Warm water	41	18.4
	Detergent	35	15.7
	Drying with cloth	2	0.9
	Washing in bucket	108	48.4
	Cold water	24	10.8
	Warm water + detergent + drying with cloth	13	5.8
Source of water for preparation of food	Tap water	176	78.9
	Filter water	10	4.5
	Tube well	13	5.8
	Boring	24	10.8
Proper covering of food	No	136	61.0
	Yes	87	39.0
Presence of flies on food	No	25	11.2
	Yes	198	88.8
Proper cooking of food	No	9	4.0
	Yes	124	55.6
	Not required	90	40.4
Washing of food items before cooking food	No	93	41.7
	Yes	130	58.3
Use of clean water for cooking food	No	23	10.3
	Yes	124	55.6

3.4. Water Source and Consumption for Utensil Washing and Preparation of Food

More than 75% vendors used the tap water for food preparation supplied by Water and Sanitation Agency (WASA), Rawalpindi and a small percentage of vendors used the borehole water. Nevertheless, selection of water mainly depends on the readily available source and is not the result of particular choice of vendors themselves. Drinking water of Rawalpindi is reported to be unfit for human consumption due to the presence of heavy microbial load [27]. Studies also indicate that boring water is generally considered safe, gets contaminated during its storage [28]. - Pathogens can be transferred from contaminated water to utensils and causes cross contamination [29]. So whatever the source of water, there is a chance of contamination if not properly taken care of.

Improper washing of utensils stands amongst the biggest issues. Out of 223, 60% washed their utensils in cold water either in a bucket or directly from tap water, significantly seen in vendors with mobile carts and stalls near to footpath ($P = 0.000$). A similar practice was observed in Lungwena, Malawi [14] and Indonesia [24].

The severity of contamination seemed to multiply when same water was reused for multiple times, especially on mobile carts having buckets for cleaning purpose. Such practice provides an excellent environment for cross-contamination [30]. Use of disinfectants for washing purpose was found very rare: vendors used only plain water for washing utensils. ($P = 0.000$) and none of them used detergent for washing. However, vendors or the hawkers belonged to Lome [16] and Brazil [31] used various disinfectants in order to eliminate the contaminants. Such good practices have been reported as commonsense ways to sanitize the food.

3.5. Serving of Food

Food serving practices by the vendors are revealed in Table 3. Around three fourth of the total vendors did not use any serving fork or spoon while 98.2% served with bare hands. Similar research in India revealed that all such food vendors (100%) served the food with bare hands. Since bare hands cause food contamination as enteropathogens can survive on hands for three hours or longer [7]. The serving utensils are equally important. It was found that slightly more than a quarter 28.3% (63) used to sell their food in disposable utensils – mainly, the Fruit Chaat, and Channa Chaat. Stainless metallic utensils were used to serve rice and juices by a quarter of the vendors (25.1%). In contrast, 87% of the vendors reported the use of disposable utensils to serve food in Kampala (Uganda) [32] and 64% in Hyderabad city of India [25]. In the present study, it was observed that 17.5 % (39) vendors sold food also in paper bags, plain and with old and fresh newsprints. Since, these bags use gums / glues that are not recommended by any food control authority, plus papers are scavenged from unknown sources, we believe that the origin of these bags in itself is questionable. Same is also amongst the point of focus in another study [33]. About 5% (12) vendors used the polythene bags to wrap the Samosa, Burger and Channa Chaat, half of that found being used in Uganda [32]. Microbes, cockroaches, rodents and dust may invade into the polythene bags from the environment resulting in food contamination. A study conducted by [34] concluded that high and low-density polythene bags for wrapping of watermelon slices facilitate the growth of bacteria and fungi when kept at ambient temperature. There is a useful study enlisting all these materials mentioned above, used to wrap foods in India which is considered the indirect source of increasing the waste and environmental hazards [18].

Table 3. Serving of Food

Variables	Categories	n	%
Serving with fork and spoon	No	151	67.7
	Yes	72	32.3
Food served with bare hands	No	4	1.8
	Yes	219	98.2
Type of utensils used for serving of food	Paper bags	39	17.5
	Polythene bags	12	5.4
	Stainless steel	56	25.1
	Plastic	18	8.1
	Disposable	63	28.3
	Glass	35	15.7

Table 4. Storage facilities and management of left-over food

Variables	Categories	n	%
Presence of Food Storage Facilities	No	106	47.7
	Yes	116	52.3
Type of Food Storage Facilities	Ice Box	19	16.4
	Deep freezer	94	81.0
	Refrigerator	3	2.6
	Not stored	46	20.6
Duration of food storage	One day	137	61.4
	Two days	37	16.6
	> Two days	3	1.3
	Thrown away	22	9.9
	Used at home	6	2.7
Use of leftover food	Reuse after heating	68	30.5
	Completely used	55	24.7
	Distributed to people	9	4.0
	No answer	63	28.3

3.6. Storage Facilities and Management of Leftover Food

Good food safety practices also include proper food storage facilities and careful management of leftover food. The situation in Rawalpindi is depicted in Table 4. Around half 47.7% (106) of the vendors had no storage / refrigeration facilities required to prevent food contamination. This situation is in agreement with the findings in Bangladesh and Indonesia – developing countries like Pakistan where vendors have no refrigeration facilities due to lack of resources [20,24]. The majority of food handlers (61.4%, 137) stored food stored food for one day only but the storage conditions were poor. Only 1.3 % stored food for more than three days. In RTE foods the potential for growth of toxin-producing bacteria's increases beyond the recommended storage time and / or without storage at recommended low temperatures [14]. Outbreaks, at many instances, are also associated with inadequate storage or refrigeration facilities beyond the safe period of time [33].

The left-over food, if not stored properly, contributes towards outbreaks of FBDs. An alarmingly large percentage i.e.30.5% (68) of vendors reused the leftover food after heating while 28.3% (63) did not give any response. Consumption of leftover foods if not properly reheated at 75°C for 15 seconds can lead to severe health implications [33]. In the present study, 9.9% leftover food was being thrown away either in the municipal waste bin or at their vending vicinity which further contributed in unhealthy environment.

3.7. Personal Hygiene of Food Handlers

Personal hygienic practices of food handlers rank amongst the major concerns that may potentially lead towards foodborne outbreaks. In this work, personal hygiene was assessed in terms of usage of gloves, head coverings, apron and hand washing of the respondents, see Table 5 for details. The study revealed that most of the vendors practiced to sell their food items without wearing gloves 98.2% (219), similar to the study done in Uganda, where the majority did not wear gloves [32]. 79.6% (172) did not cover their head and 76.8% (156) did not wear an apron with a significant relationship with the type of food

and cart ($P = 0.000$). However, most of the cases were attired with casual clothing. A similar situation can be seen among food handlers of Malaysia who had poor food safety practices but 46.6% practiced to wear aprons, uniform and caps [22], in Bangkok 74.5% had an apron [35].

Less than a half of the food handlers washed their hands before food preparation and after using the toilet. Hands are considered as crucial vectors in cross contamination of food [36]. Food handling requires good washing of hands at every step of making food, in particular, before handling of food, after touching any other contaminated material, eating, using toilet and even touching the raw food material [37].

Table 5. Personal Hygienic Profile Of The Food Handlers

Personal Hygiene	Categories	n	%
Use of Gloves	No	219	98.2
	Yes	4	1.7
Type of gloves	Cotton	0	0.0
	Rubber	3	75.0
	Disposable	1	25.0
Use of Head Covering	No	172	79.6
	Yes	44	20.4
Type of head covering	Cotton	40	97.6
	Disposable	1	100
Use of Apron	No	156	76.8
	Yes	47	23.2
Type of Apron	Cotton	26	55.3
	PVC aprons	21	44.7
	Daily	0	0.0
Washing of all coverings	After one day	1	1.6
	After two days	20	31.2
	Weekly	43	67.2
	Before preparation of food	73	32.7
Hand washing	After touching each food item	18	8.1
	After using toilet	20	9.0
	Before preparation food + after using toilet	95	42.6
	No answer	17	7.6

3.8. Awareness about FBDs, Their Symptoms, and Source of Contamination

Results related to awareness about FBDs and their symptoms exhibited by food vendors are reflected in Table 6. Previous research showed that improper handling practices contributed to 97% of FBDs in food service establishments [38]. In a present study over 80% of the study subjects were familiar with the term food borne illness and knew that food could cause illnesses, a similar response has been recorded by [39] but unusually, vendors do not apply the safe handling practices in their routine lives, they just have the urge for more earnings. In this work, around 80% agreed that food could be contaminated with the microbes present in food, insects, dust particles, food coloring and spices used in the preparation of food. Likewise, 70% of the Saudi vendors assumed that food colors, flavors, and spices are the common food contaminants [39]. In present study around 40% respondents knew that diarrhea, vomiting, abdominal pain are the most common symptoms of FBDs. Studies done

by [40] showed that majority of the vendors knew the common symptoms of FBDs but exhibited the poor food safety practices.

Table 6. Awareness about FBDs, Their Symptoms and Source of Contamination

Variables	Categories	n	%
Awareness about FBDs	No	42	18.8
	Yes	181	81.2
Symptoms of FBDs	Don't know	31	13.9
	Fever	9	4.0
	Diarrhea	46	20.6
	Soreness of eyes	0	0.0
	Vomiting	18	8.1
	Headache	0	0.0
	Abdominal pain and cramps	31	13.9
	Combination of 2-3 symptoms	88	39.5
Sources of food contamination	Don't Know	44	19.7
	Insects	48	21.5
	Microbes present in food	54	24.2
	Dust particles	23	10.3
	Food colors and spices	13	5.8
	Combination of 2-3 sources	41	18.4

3.9. Disposal of Solid and Water Waste

In our study, it was found that half of the vendors disposed off solid waste in municipal waste bin however over 80% threw the waste water along the road side regardless of the type of cart ($P = 0.000$). The municipal waste bins are usually made of metallic and plastic material and rarely seen empty thus raising a public health concern. Same observations were made in a study conducted in Uganda [32] and the sanitation at vending environment was rated to be poor (48%) by [23].

3.10. Importance of Medical Examination and Food Safety Training

None of the respondents had any sort of medical examination prior to come into this business. They failed to present their health certificates, although, more than 80% of food handlers agreed to have a medical examination to prevent the spread of foodborne diseases. In a research carried out in the Philippines, 80% of the vendors exhibited the medical health certificate imposed by the Authorized University Health Service which might be a safer practice to minimize the outbreaks [41]. The absence of proper food safety training and lazy implementation of existing protocols are the main cause for this shortcoming as over 80% vendors were willing to get the food safety training. It is believed that by proper facilitation from the local authorities would greatly reduce the prevalence of foodborne diseases in the region. Similar sort of interest was exhibited by Malaysian people [22], and 73% in West Indies [23].

Although implementation of food safety training and personal fitness criterion could be a huge task for authorities, studies conducted globally conclude that following such protocols imposed to food handlers would serve the purpose to a greater extent [22,42]. There are

some reports that such training and awareness education programs could not produce positive change [43]. We believe it was not only awareness programs that were needed but also, implementation need to be carried out by law enforcement bodies.

3.11. Relationship between Socio-demographic Keys and Occupational Traits on Food Safety Practices

The relationship between some important socio-demographic keys and occupational traits on food safety practices has been established in Table 7, Table 8 and Table 9 to check the strength of some fundamental results. Keeping in view the utmost important indicators it was found that education, length of vending and type of cart are highly significant with the preparation site ($P=0.000$), timings of food preparation ($P=0.000$), washing of utensils ($P=0.000$), source of water for preparation of food ($P=0.000$), proper cooking of food ($P=0.000$), type of utensils used for serving food ($P=0.000$) and hand washing ($P=0.001$) respectively. Although non-significant results were revealed in the case of washing of food before cooking ($P=0.214$), heating of food before selling ($P=0.086$) with education and length of vending with the washing of food before cooking ($P=0.307$). In addition type of cart also showed the non-significant result with food handling at ground level ($P=0.182$) and proper covering of food ($P=0.212$). Association between the variables indicates that food safety concerns are highly correlated with each other. It cannot be claimed that lack of implementation of one or the other food safety practices is responsible for street food contamination. There should be the mutual responsibility of the vendors, food authority officials and the consumers as well to play a role in their own domains.

4. Conclusion and Recommendations

This is the first study done in Rawalpindi city covered at large that dignifies the food safety knowledge and practices among food vendors. The study concluded that vendors are not selling the safe food to consumers. Their main objective is money making without considering the health of community. Positive aspect of the study was that, vendors were willing to have food safety training and learn about the key traits of food safety. So there is an immense need to impose education on the food safety knowledge and practices before vendors are allowed to trade. The local and provincial government should legalize the standards of food safety in the light of recommendations of WHO and monitor the sanitary and hygienic conditions on a regular basis. Provision of potable water to all citizens is the responsibility of the local government, which may help to overcome the spread of food and waterborne diseases. Food safety training programs should be initiated on ground level to mass level. The principal of Hazard Analysis and Critical Point (HACCP) system should be included in the curriculum as a part of food and health education. Media can also play the role of raising awareness on hand washing and proper

food safety handling practices necessary for food handling and preparation. At last but not the least National Food Sanitation Code should ensure the sanitary permit and health /medical certificate to food handlers.

Table 7. Relationship between education and food safety practices (N=223)

Variables	Categories	Illiterate n (%)	Middle n (%)	Matric n (%)	Intermediate n (%)	Total n (%)	Test Statistics
Preparation site	At home	6 (22.2)	11 (40.7)	2 (7.4)	8 (29.6)	27 (12.1)	$\chi^2=27.4$ df =9 P=0.001
	At own market place	56 (39.4)	27 (19.0)	46 (32.4)	13 (9.2)	142 (63.7)	
	At home + own market place	13 (28.9)	15 (33.3)	10 (22.2)	7 (15.6)	45 (20.2)	
	Get from another source	3 (33.3)	5 (55.6)	0 (0.0)	1 (11.1)	9 (4.0)	
Timings of food preparation	In the morning	6 (13.3)	22 (48.9)	16 (35.6)	1 (2.2)	45 (20.2)	$\chi^2=47.3$ df =9 P=0.000
	During the sale	18 (33.3)	14 (25.9)	21 (38.9)	1 (1.9)	54 (24.2)	
	Morning + during the sale	20 (41.7)	9 (18.8)	7 (14.6)	12 (25.0)	48 (21.5)	
	At previous night + morning	34 (44.7)	13 (17.1)	14 (18.4)	15 (19.7)	76 (34.1)	
Heating of food before selling	No	5 (62.5)	1 (12.5)	1 (12.5)	1 (12.5)	8 (3.6)	$\chi^2=11.09$ df =6 P=0.086
	Yes	40 (38.1)	27 (25.7)	20 (19.0)	18 (17.1)	105 (47.1)	
	Not required	33 (30.3)	30 (27.3)	37 (33.6)	10 (9.1)	110 (49.3)	
Food handled at ground level	No	35 (28.0)	37 (29.6)	40 (32.0)	13 (10.4)	125 (56.1)	$\chi^2=10.7$ df =3. P=0.013
	Yes	43 (43.9)	21 (21.4)	18 (18.4)	16 (16.3)	98 (43.9)	
Washing of utensils	Warm water	15 (36.6)	7 (17.1)	14 (34.1)	5 (12.2)	41 (18.4)	$\chi^2=40.2$ df =15 P=0.000
	Detergent	2 (5.7)	14 (40.0)	15 (42.9)	4 (11.4)	35 (15.7)	
	Drying with cloth	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)	2 (0.9)	
	Washing in bucket	45 (41.7)	34 (31.5)	17 (15.7)	12 (11.1)	108 (48.4)	
	Cold water	9 (37.5)	2 (8.3)	6 (25.0)	7 (29.2)	24 (10.8)	
	Warm water + detergent + cloth	6 (46.2)	0 (0.0)	6 (46.2)	1 (7.7)	13 (5.8)	
Source of water for preparation of food	Tap water	69 (39.2)	54 (30.7)	37 (21.0)	16 (9.1)	176 (78.9)	$\chi^2=76.2$ df =9 P=0.000
	Filter water	7 (70.0)	0 (0.0)	1 (10.0)	2 (20.0)	10 (4.5)	
	Tube well	0 (0.0)	0 (0.0)	13 (100.0)	0 (0.0)	13 (5.8)	
	Boring	2 (8.3)	4 (16.7)	7 (29.2)	11 (45.8)	24 (10.8)	
Proper covering of food	No	61 (44.9)	40 (29.4)	24 (17.6)	11 (8.1)	136 (61.0)	$\chi^2=27.12$ df =3 P=0.000
	Yes	17 (19.5)	18 (20.7)	34 (39.1)	18 (20.7)	87 (39.0)	
Presence of flies on food	No	4 (16.0)	1 (4.0)	14 (56.0)	6 (24.0)	25 (11.2)	$\chi^2=24.49$ df =3, P=0.000
	Yes	74 (37.4)	57 (28.8)	44 (22.2)	23 (11.6)	198 (88.8)	
Proper cooking of food	No	1 (11.1)	0 (0.0)	1 (11.1)	7 (77.8)	9 (4.0)	$\chi^2=36.95$ df =6 P=0.000
	Yes	47 (37.9)	32 (25.8)	30 (24.2)	15 (12.1)	124 (55.6)	
	Not required	30 (33.3)	26 (28.9)	27 (30.0)	7 (7.8)	90 (40.4)	
Washing of food before cooking	No	33 (35.5)	19 (20.4)	30 (32.3)	11 (11.8)	93 (41.7)	$\chi^2=4.48$ df =3, P=0.214
	Yes	45 (34.6)	39 (30.0)	28 (21.5)	18 (13.8)	130 (58.3)	
Food served with bare hands	No	0 (0.0)	4 (100.0)	0 (0.0)	0 (0.0)	4 (1.8)	$\chi^2=11.58$ df =3. P=0.009
	Yes	78 (35.6)	54 (24.7)	58 (26.9)	29 (13.2)	219 (98.2)	
Type of utensils used for serving of food	Paper Bags	20 (51.3)	2 (5.1)	7 (17.9)	10 (25.6)	39 (17.5)	$\chi^2=58.03$ df =15 P=0.000
	Polythene Bags	0 (0.0)	5 (41.7)	3 (25.0)	4 (33.3)	12 (5.4)	
	Stainless steel	28 (50.0)	5 (8.9)	21 (37.5)	2 (3.6)	56 (25.1)	
	Plastic	7 (38.9)	8 (44.4)	1 (5.6)	2 (3.6)	18 (8.1)	
	Disposable	17 (27.0)	25 (39.7)	15 (23.8)	6 (9.5)	63 (28.3)	
	Glass	6 (17.1)	13 (37.1)	11 (31.4)	5 (14.3)	35 (15.7)	
Hand washing	Before preparation of food	34 (46.6)	10 (13.7)	24 (32.9)	5 (6.8)	73 (32.7)	$\chi^2=34.68$ df =12 P=0.001
	After touching each food item	7 (38.9)	6 (33.3)	3 (16.7)	2 (11.1)	18 (8.1)	
	After using toilet	5 (25.0)	7 (35.0)	8 (40.0)	0 (0.0)	20 (9.0)	
	Before preparation food + after using toilet	31 (32.6)	30 (31.6)	19 (20.0)	15 (15.8)	95 (42.6)	
	No answer	1 (5.9)	5 (29.4)	4 (23.5)	7 (41.2)	17 (7.6)	

Table 8. Relationship Between Length Of Trading And Food Safety Practices

Variables	Categories	Length of trading (years) (n=223)					Total n (%)	Test Statistics
		2-5 n (%)	5-10 n (%)	11-15 n (%)	16-20 n (%)	>20 n (%)		
Preparation site	At home	9 (33.3)	1 (3.7)	12 (44.4)	3 (11.1)	2 (7.4)	27 (12.1)	$\chi^2=45.12$ df =12 P=0.000
	At own market place	14 (9.9)	18 (12.7)	38 (26.8)	62 (43.7)	10 (7.0)	142 (63.7)	
	At home + own market place	5 (11.1)	8 (17.8)	15 (33.3)	7 (15.6)	10 (22.2)	45 (20.2)	
	Get from another source	2 (22.2)	4 (44.4)	0 (0.0)	2 (22.2)	1 (11.1)	9 (4.0)	
Timings of food preparation	In the morning	14 (31.1)	2 (4.4)	4 (8.9)	17 (37.8)	8 (17.8)	45 (20.2)	$\chi^2=45.81$ df =12 P=0.000
	During the sale	6 (11.1)	6 (11.1)	15 (27.8)	22 (40.7)	5 (9.3)	54 (24.2)	
	Morning + during the sale	0 (0.0)	10 (20.8)	17 (35.4)	12 (25.0)	9 (18.8)	48 (21.5)	
	At previous night + morning	10 (13.2)	13 (17.1)	29 (38.2)	23 (30.3)	1 (1.3)	76 (34.1)	
Heating of food before selling	No	1 (12.5)	1 (12.5)	4 (50.0)	2 (25.0)	0 (0.0)	8 (3.6)	$\chi^2=19.27$ df =8 P=0.013
	Yes	9 (8.6)	24 (22.9)	30 (28.6)	30 (28.6)	12 (11.4)	105 (47.1)	
	Not required	20 (18.2)	6 (5.5)	31 (28.2)	42 (38.2)	11 (10.0)	110 (49.3)	
Food handled at ground level	No	24 (19.2)	6 (4.8)	27 (21.6)	49 (39.2)	19 (15.2)	125 (56.1)	$\chi^2=39.17$ df =4, P=0.000
	Yes	6 (6.1)	25 (25.5)	38 (38.8)	25 (25.5)	4 (4.1)	98 (43.9)	
Washing of utensils	Warm water	0 (0.0)	6 (14.6)	15 (36.6)	18 (43.9)	2 (4.9)	41 (18.4)	$\chi^2=74.70$ df =20 P=0.000
	Detergent	5 (14.3)	5 (14.3)	2 (5.7)	17 (48.6)	6 (17.1)	35 (15.7)	
	Drying with cloth	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)	
	Washing in bucket	25 (23.1)	15 (13.9)	23 (21.3)	31 (28.7)	14 (13.0)	108 (48.4)	
	Cold water	0 (0.0)	3 (12.5)	14 (58.3)	6 (25.0)	1 (4.2)	24 (10.8)	
	Warm water + detergent + cloth	0 (0.0)	0 (0.0)	11 (84.6)	2 (15.2)	0 (0.0)	13 (5.8)	
Source of water for preparation of food	Tap water	21 (11.9)	22 (12.5)	52 (29.5)	59 (33.5)	22 (12.5)	176 (78.9)	$\chi^2=50.23$ df =12 P=0.000
	Filter water	0 (0.0)	2 (20.0)	7 (70.0)	1 (10.0)	0 (0.0)	10 (4.5)	
	Tube well	0 (0.0)	1 (7.7)	0 (0.0)	12 (92.3)	0 (0.0)	13 (5.8)	
	Boring	9 (37.5)	6 (25.0)	6 (25.0)	2 (8.3)	1 (4.2)	24 (10.8)	
Proper covering of food	No	26 (19.1)	21 (15.4)	30 (22.1)	49 (36.0)	10 (7.4)	136 (61.0)	$\chi^2=18.73$ df =4, P=0.001
	Yes	4 (4.6)	10 (11.5)	35 (40.2)	25 (28.7)	13 (14.9)	87 (39.0)	
Proper cooking of food	No	3 (33.3)	0 (0.0)	3 (33.3)	1 (11.1)	2 (22.2)	9 (4.0)	$\chi^2=18.82$ df =8, P=0.016
	Yes	14 (11.3)	25 (20.2)	29 (23.4)	46 (37.1)	10 (8.1)	124 (55.6)	
	Not required	13 (14.4)	6 (6.7)	33 (36.7)	27 (30.0)	11 (12.2)	90 (40.0)	
Washing of food before cooking	No	11 (11.8)	10 (10.8)	26 (28.0)	38 (40.9)	8 (8.6)	93 (41.7)	$\chi^2=4.81$ df =4, P=0.307
	Yes	19 (14.6)	21 (16.2)	39 (30.0)	36 (27.7)	15 (11.5)	130 (58.3)	
Food served with bare hands	No	4 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.8)	$\chi^2=26.20$ df =4, P=0.000
	Yes	26 (11.9)	31 (14.2)	65 (29.7)	74 (33.8)	23 (10.5)	219 (98.2)	
Type of utensils used for serving of food	Paper Bags	0 (0.0)	9 (23.1)	13 (33.3)	15 (38.5)	2 (51.2)	39 (17.5)	$\chi^2=1.39$ df =20 P=0.000
	Polythene Bags	4 (33.3)	6 (50.0)	1 (8.3)	0 (0.0)	1 (8.3)	12 (5.4)	
	Stainless steel	4 (7.1)	1 (1.8)	18 (32.1)	32 (57.1)	1 (1.8)	56 (25.1)	
	Plastic	0 (0.0)	12 (66.7)	2 (11.1)	4 (22.2)	0 (0.0)	18 (8.1)	
	Disposable	10 (15.9)	3 (4.8)	20 (31.7)	22 (34.9)	8 (12.7)	63 (28.3)	
	Glass	12 (34.3)	0 (0.0)	11 (31.4)	1 (2.9)	11 (31.4)	35 (15.7)	
Hand washing	Before preparation of food	1 (1.4)	10 (13.7)	22 (30.1)	33 (45.2)	7 (9.6)	73 (32.7)	$\chi^2=63.23$ df =16 P=0.000
	After touching each food item	0 (0.0)	8 (44.4)	2 (11.1)	7 (38.9)	1 (5.6)	18 (8.1)	
	After using toilet	6 (30.0)	3 (15.0)	5 (25.0)	6 (30.0)	0 (0.0)	20 (9.0)	
	Before preparation food + after using toilet	15 (15.8)	10 (10.5)	28 (29.5)	27 (28.4)	15 (15.8)	95 (42.6)	
	No answer	8 (7.1)	0 (0.0)	8 (47.1)	1 (5.9)	0 (0.0)	17 (7.6)	

Table 9. Relationship Between Type Of Cart And Food Safety Practices

Categories	Type of cart (n=223)				Test Statistics	
	Mobile n (%)	Dhabas n (%)	Near to foot path n (%)	Total n (%)		
Preparation site	At home	22 (81.5)	1 (3.7)	4 (14.8)	27 (12.1)	$\chi^2=1.34$ df=6 P=0.000
	At own market place	4 (2.8)	83 (58.5)	55 (38.7)	142 (63.7)	
	At home + own market place	3 (6.7)	12 (26.7)	30 (66.7)	45 (20.2)	
	Get from another source	2 (22.2)	4 (44.4)	3 (33.3)	9 (4.0)	
Timings of food preparation	In the morning	2 (4.4)	18 (40.0)	25 (55.6)	45 (20.2)	$\chi^2=30.26$ df=6 P=0.000
	During the sale	7 (13.0)	22 (40.7)	25 (46.3)	54 (24.2)	
	Morning + during the sale	0 (0.0)	26 (54.2)	22 (45.8)	48 (21.5)	
	At previous night + morning	22 (28.9)	34 (44.7)	20 (26.3)	76 (34.1)	
Heating of food before selling	No	0 (0.0)	5 (62.5)	3 (37.5)	8 (3.6)	$\chi^2=40.59$ df=4 P=0.000
	Yes	2 (1.9)	65 (61.9)	38 (36.2)	105 (47.1)	
	Not required	29 (26.4)	30 (27.3)	51 (46.4)	110 (49.3)	
Food handled at ground level	No	22 (17.6)	55 (44.0)	48 (38.4)	125 (56.1)	$\chi^2=3.40$ df=2, P=0.182
	Yes	9 (9.2)	45 (45.9)	44 (44.9)	98 (43.9)	
Washing of utensils	Warm water	3 (7.3)	29 (70.7)	9 (22.9)	41 (18.4)	$\chi^2=53.88$ df=10 P=0.000
	Detergent	0 (0.0)	15 (42.9)	20 (57.1)	35 (15.7)	
	Drying with cloth	0 (0.0)	0 (0.0)	2 (100.0)	2 (0.9)	
	Washing in bucket	28 (25.9)	32 (29.6)	48 (44.4)	108 (48.4)	
	Cold water	0 (0.0)	12 (50.0)	12 (50.0)	24 (10.8)	
	Warm water + detergent + cloth	0 (0.0)	12 (92.3)	1 (7.7)	13 (5.8)	
Source of water for preparation of food	Tap water	29 (16.5)	85 (48.3)	62 (35.2)	176 (78.9)	$\chi^2=24.46$ df=6 P=0.000
	Filter water	0 (0.0)	7 (70.0)	3 (30.0)	10 (4.5)	
	Tube well	0 (0.0)	1 (7.7)	12 (92.3)	13 (5.8)	
	Boring	2 (8.3)	7 (29.2)	15 (62.5)	24 (10.8)	
Proper covering of food	No	16 (11.8)	67 (49.3)	53 (39.0)	136 (61.0)	$\chi^2=3.10$ df=2, P=0.212
	Yes	15 (17.2)	33 (37.9)	39 (44.8)	87 (39.0)	
Proper cooking of food	No	3 (33.3)	3 (33.3)	3 (33.3)	9 (4.0)	$\chi^2=41.60$ df=4 P=0.000
	Yes	3 (9.7)	74 (59.7)	47 (37.9)	124 (55.6)	
	Not required	25 (80.6)	23 (23.0)	42 (46.7)	90 (40.4)	
Washing of food before cooking	No	6 (6.5)	33 (35.5)	54 (58.1)	93 (41.7)	$\chi^2=20.41$ df=2, P=0.000
	Yes	25 (19.2)	67 (51.5)	38 (29.2)	130 (58.3)	
Food served with bare hands	No	4 (100.0)	0 (0.0)	0 (0.0)	4 (1.8)	$\chi^2=25.22$ df=2, P=0.000
	Yes	27 (12.3)	100 (45.7)	92 (42.0)	219 (98.2)	
Type of utensils used for serving of food	Paper bags	0 (0.0)	22 (56.4)	17 (43.6)	39 (17.5)	$\chi^2=92.42$ df=10 P=0.000
	Polythene bags	3 (25)	6 (50.0)	3 (25.0)	12 (5.4)	
	Stainless steel	1 (1.8)	16 (28.6)	39 (69.6)	56 (25.1)	
	Plastic	6 (33.3)	9 (50.0)	3 (16.7)	18 (8.1)	
	Disposable	3 (4.8)	42 (66.7)	18 (28.6)	63 (28.3)	
	Glass	18 (51.4)	5 (14.3)	12 (34.3)	35 (15.7)	
Hand washing	Before preparation of food	7 (9.6)	44 (60.3)	22 (30.1)	73 (32.7)	$\chi^2=38.43$ df=8 P=0.000
	After touching each food item	0 (0.0)	9 (50.0)	9 (50.0)	18 (8.1)	
	After using toilet	1 (5.0)	17 (85.0)	2 (10.0)	20 (9.0)	
	Before preparation food + after using toilet	20 (21.1)	25 (26.3)	50 (52.6)	95 (42.6)	
	No answer	3 (17.6)	5 (29.4)	9 (52.9)	17 (7.6)	

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References

- [1] O. Dipeolu, O. Akinbode, and A. Okuneye, "Income generating potentials of street food vending businesses in Ogun State, Nigeria," *ASSET: An International Journal (Series C)*, vol. 2, pp. 180-189, 2007.
- [2] S. K. Bhowmik, "Street vendors in Asia: a review," *Economic and Political Weekly*, pp. 2256-2264, 2005.
- [3] S. Samapundo, R. Climat, R. Khaferi, and F. Devlieghere, "Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti," *Food Control*, vol. 50, pp. 457-466, 4// 2015.
- [4] I. Proietti, C. Frazzoli, and A. Mantovani, "Identification and management of toxicological hazards of street foods in developing countries," *Food and chemical toxicology*, vol. 63, pp. 143-152, 2014.
- [5] World Health Organization, "Food safety Issues: Essential safety requirements for street vended food," W. H. Organization., Ed., Revised edition ed. 1996.
- [6] WHO/FAO, "Basic steps to improve safety of street-vended food," ed: International Food Safety Authorities Network (INFOSAN). 2010.
- [7] A. Atter, H. Ofori, G. A. Anyebuno, M. Amoo-Gyasi, and W. K. Amoa-Awua, "Safety of a street vended traditional maize beverage, ice-kenkey, in Ghana," *Food Control*, vol. 55, pp. 200-205, 2015.
- [8] O. O. Aluko, T. T. Ojeremi, D. A. Olaleke, and E. B. Ajidagba, "Evaluation of food safety and sanitary practices among food vendors at car parks in Ile Ife, southwestern Nigeria," *Food Control*, vol. 40, pp. 165-171, 2014.
- [9] S. A. Da Silva, R. d. C. V. Cardoso, J. Â. W. Góes, J. N. Santos, F. P. Ramos, R. B. De Jesus, *et al.*, "Street food on the coast of Salvador, Bahia, Brazil: A study from the socioeconomic and food safety perspectives," *Food Control*, vol. 40, pp. 78-84, 2014.
- [10] F. Amponsah-Doku, K. Obiri-Danso, R. Abaidoo, P. Drechsel, and F. Kondrasen, "Bacterial contamination of lettuce and associated risk factors at production sites, markets and street food restaurants in urban and peri-urban Kumasi, Ghana," *Scientific Research and Essays*, vol. 5, pp. 217-223, 2010.
- [11] I. Hussain, M. S. Mahmood, M. Akhtar, and A. Khan, "Prevalence of Campylobacter species in meat, milk and other food commodities in Pakistan," *Food microbiology*, vol. 24, pp. 219-222, 2007.
- [12] A. Sultana, A. Awan, and I. Tehseen, "Sanitation practices among food handlers working in street restaurants in Rawalpindi, Pakistan," *Rawal Medical Journal*, vol. 38, 2013.
- [13] Government of Pakistan, "Population census," S. Division, Ed., ed. Pakistan Bureau of Statistics, Islamabad, 2010.
- [14] S. Taulo, A. Wetlesen, R. Abrahamsen, G. Kululanga, R. Mkakosya, and A. Grimason, "Microbiological hazard identification and exposure assessment of food prepared and served in rural households of Lungwena, Malawi," *International journal of food microbiology*, vol. 125, pp. 111-116, 2008.
- [15] A. Omemu and S. Aderoju, "Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria," *Food control*, vol. 19, pp. 396-402, 2008.
- [16] Y. Adjrah, K. Soncy, K. Anani, K. Blewussi, D. Karou, Y. Ameyapoh, *et al.*, "Socio-economic profile of street food vendors and microbiological quality of ready-to-eat salads in Lomé," *International Food Research Journal*, vol. 20, pp. 65-70, 2013.
- [17] P. Mensah, D. Yeboah-Manu, K. Owusu-Darko, and A. Ablordey, "Street foods in Accra, Ghana: how safe are they?," *Bulletin of the World Health Organization*, vol. 80, pp. 546-554, 2002.
- [18] M. Amrutha and T. Udayashankara, "Evaluation of Food Safety and Knowledge of Finger Food Vendors Along with their Socio-economic Conditions in Mysore City, India," *Age*, vol. 1, p. 3, 2014.
- [19] M. Khairuzzaman, F. M. Chowdhury, S. Zaman, A. Al Mamun, and M. L. Bari, "Food Safety Challenges towards Safe, Healthy, and Nutritious Street Foods in Bangladesh," *International Journal of Food Science*, vol. 2014, 2014.
- [20] M. M. Rahman, M. H. Rahman, and N. P. Ansary, "Safety issues of street foods in Bangladesh," *Journal of Biological Sciences and Technology*, vol. 2, pp. 21-32, 2014.
- [21] M. Choudhury, L. Mahanta, J. Goswami, M. Mazumder, and B. Pegoo, "Socio-economic profile and food safety knowledge and practice of street food vendors in the city of Guwahati, Assam, India," *Food Control*, vol. 22, pp. 196-203, 2011.
- [22] N. A. Sani and O. N. Siow, "Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia," *Food Control*, vol. 37, pp. 210-217, 2014.
- [23] C. Benny-Olliviera and N. Badrie, "Hygienic practices by vendors of the street food "doubles" and public perception of vending practices in Trinidad, West Indies," *Journal of Food Safety*, vol. 27, pp. 66-81, 2007.
- [24] A. Vollaard, S. Ali, H. Van Asten, I. Suhariah Ismid, S. Widjaja, L. Visser, *et al.*, "Risk factors for transmission of foodborne illness in restaurants and street vendors in Jakarta, Indonesia," *Epidemiology and Infection*, vol. 132, pp. 863-872, 2004.
- [25] S. L. Reddi, R. N. Kumar, N. Balakrishna, and V. S. Rao, "Microbiological quality of street vended fruit juices in Hyderabad, India and their association between food safety knowledge and practices of fruit juice vendors," *International Journal of Current Microbiology and Applied Sciences*, vol. 4, pp. 970-982, 2015.
- [26] R. Gurudasani and M. Sheth, "Food safety knowledge and attitude of consumers of various food service establishments," *Journal of Food Safety*, vol. 29, pp. 364-380, 2009.
- [27] S. Mehmood, A. Ahmad, A. Ahmed, N. Khalid, and T. Javed, "Drinking Water Quality in Capital City of Pakistan," *Swarm Research*, 2013.
- [28] S. Apanga, J. Addah, and D. R. Sey, "Food Safety Knowledge and Practice of Street Food Vendors in Rural Northern Ghana," *Food and Public Health*, vol. 4, pp. 99-103, 2014.
- [29] C. P. De Sousa, "The impact of food manufacturing practices on food borne diseases," *Brazilian Archives of Biology and Technology*, vol. 51, pp. 815-823, 2008.
- [30] F. Asogwa, P. U. Okechukwu, U. A. Esther, O. E. Chinedu, and E. Nzubechukwu, "Hygienic and Sanitary Assessment of Street Food Vendors in Selected Towns of Enugu North District of Nigeria," *American-Eurasian Journal of Scientific Research*, vol. 10, pp. 22-26, 2015.
- [31] J. H. Behrens, M. N. Barcellos, L. J. Frewer, T. Nunes, B. D. Franco, M. T. Destro, *et al.*, "Consumer purchase habits and views on food safety: A Brazilian study," *Food control*, vol. 21, pp. 963-969, 2010.
- [32] C. Muyanja, L. Nayiga, N. Brenda, and G. Nasinyama, "Practices, knowledge and risk factors of street food vendors in Uganda," *Food Control*, vol. 22, pp. 1551-1558, 10// 2011.
- [33] B. Nicolas, B. A. Razack, I. Yollande, S. Aly, O. C. A. Tidiane, N. A. Philippe, *et al.*, "Street-vended foods improvement: Contamination mechanisms and application of Food Safety Objective Strategy: Critical review," *Pakistan Journal of Nutrition*, vol. 6, pp. 1-10, 2007.
- [34] E. Nwachukwu, C. Ezeama, and B. Ezeanya, "Microbiology of polyethylene-packaged sliced watermelon (*Citrullus lanatus*) sold by street vendors in Nigeria," *African Journal of Microbiology Research*, vol. 2, pp. 192-195, 2008.
- [35] T. Cuprasitru, S. Srisorrachatr, and D. Malai, "Food safety knowledge, attitude and practice of food handlers and microbiological and chemical food quality assessment of food for making merit for monks in Ratchathewi district, Bangkok," *Asia Journal of Public Health*, vol. 2, pp. 27-34, 2011.
- [36] T. Cogan, J. Slader, S. Bloomfield, and T. Humphrey, "Achieving hygiene in the domestic kitchen: the effectiveness of commonly used cleaning procedures," *Journal of Applied Microbiology*, vol. 92, pp. 885-892, 2002.
- [37] J. F. W. C. A. Commission, J. F. W. F. S. Programme, and W. H. Organization, *Codex Alimentarius: Fresh Fruits and Vegetables*: Food & Agriculture Org., 2007.
- [38] M. Baş, A. Ş. Ersun, and G. Kıvanç, "The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in

food businesses in Turkey," *Food control*, vol. 17, pp. 317-322, 2006.

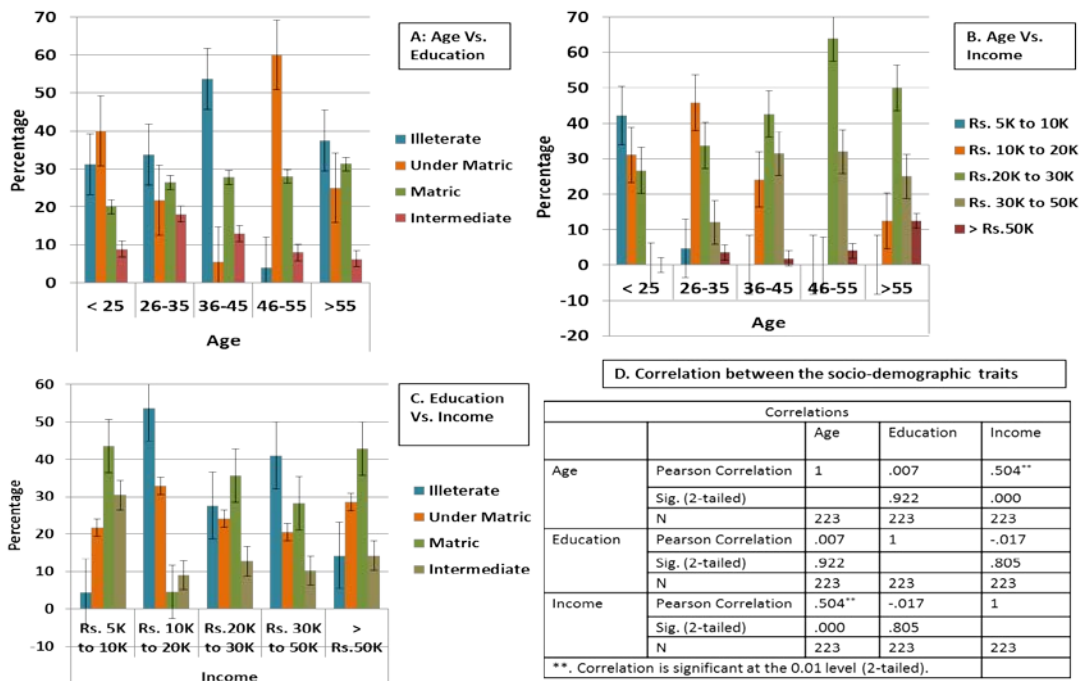
[39] M. S. A. Alhaj, "Food safety knowledge and practices of street vendors in the city of Gizan, Saudi Arabia," 2012.
 [40] T. M. Osaili, D. O. A. Jamous, B. A. Obeidat, H. A. Bawadi, R. F. Tayyem, and H. S. Subih, "Food safety knowledge among food workers in restaurants in Jordan," *Food Control*, vol. 31, pp. 145-150, 2013.
 [41] C. F. G. Patricia V. Azanza, Melba P. Ortega, Ma, "Food safety knowledge and practices of streetfood vendors in a Philippines

university campus," *International journal of Food Sciences and Nutrition*, vol. 51, pp. 235-246, 2000.

[42] T. Afolaranmi, Z. Hassan, D. Bello, Y. Tagurum, C. Miner, A. Zoakah, *et al.*, "Training: A vital tool for improving the knowledge and practice of food safety and hygiene among food handlers in boarding secondary schools in Plateau State," *Journal of Medicine in the Tropics*, vol. 16, p. 87, 2014.
 [43] W.-H. Ko, "The relationship among food safety knowledge, attitudes and self-reported HACCP practices in restaurant employees," *Food Control*, vol. 29, pp. 192-197, 2013.

Supporting Information

S1: Association between the basic socio-demographic profile of the vendors



S2: Association between the basic socio - demographic profile and vending period of the vendors

