ISSN 0101-2061 (Print)
ISSN 1678-457X (Online)
Food Science and Technology

DOI: https://doi.org/10.1590/fst.13320

Food safety knowledge, attitudes and practices of street food vendors in Jashore region, Bangladesh

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Abstract

Most people now have their meals outside their homes and are vulnerable to illness caused by food. Unsafe food preparation and supply by vendors have made food safety a concern for public health. Jashore is a densely populated city, this study was designed to evaluate food safety knowledge, attitude and practice (KAP) of food vendors in Jashore region, Bangladesh. A randomized descriptive cross-sectional study on food safety KAP was conducted among 200 food vendors. Where 96% were male food vendors, 72.5% were smokers, and 63% were found to be overweight or obese. While 72.5% vendors had good knowledge of food safety, only 33% and 0.5% had good food safety attitude and practice, respectively. Among the socio-demographic factors investigated, only the level of education showed significant influence ($p = 0.005$ and 0.015) on the food safety knowledge and practice of the vendors. While handling food, over 90% vendors did not use any personal protective equipment, 4.5% had diarrhoea, 8.5% did not wash their hands after going to the toilet and 28.5% reused previous leftover oils. The data suggest that the overall food safety knowledge of suppliers in the Jashore region is good but their attitudes and practices need to be improved.

Keywords: street food; food safety; hygiene; food control; food borne illness.

Practical Application: Increasing the food safety knowledge, attitudes and practices of street food vendors to reduce the foodborne diseases.

1 Introduction

Street food (SF) and beverages are ready-to-eat food items prepared and sold by vendors in different public places especially in streets and crowded bus or train stations in Bangladesh as well as other countries around the world (Food and Agriculture Organization of the United Nations, 2013; Winarno & Alain, 1991). SF is an age-old practice and earning source of income in several countries (Cortese et al., 2016). Worldwide increase of unemployment and poverty are the key factors behind people tend to run street food businesses, because it requires minimal experience and capital to set up (Addo-Tham et al., 2020; King et al., 2000). It plays a vital socio-economic role by providing food and nutritional supports to the lower and middle-income people at a reasonably low price and is valued for the unique taste of its food items (Khairuzzaman et al., 2014). It is a typical food culture; due to the pricing of street food it is easily accessible to everyone (Lucca & Torres, 2006). At the same time, due to their current hectic lifestyle, people have to depend on street foods as they are too busy to spend at home (Temeche et al., 2016). At the same time, street foods offer a pleasant diet for many consumers and help low-income people's livelihoods with contributions to the economy. (Al Mamun et al., 2013; Anandhi et al., 2015; König et al., 2010). Around 2.5 billion people worldwide consume street foods per day (Fellows & Hilmi, 2011).

Street food safety is a critical public health issue in the third world and developing countries, including Bangladesh. (Khairuzzaman et al., 2014; Muinde & Kuria, 2005; Samapundo et al., 2016). In those countries, street food is an important source of food for the urban dwellers and the concerns about street food are the safety, nutritional value, vendor's knowledge of food hygiene and the ineffectiveness of safety legislations (Hiamey & Hiamey, 2018). In Bangladesh, street vendors are typically clustered in overcrowded areas including residential areas, near the workplaces, taxi ranks, railway stations and busy street pavements due to the hope of mass sales (Gamieldien & van Niekerk, 2017). People of all ages from different backgrounds consume these food items as these are inexpensive, convenient and comparatively nutritious (Lues et al., 2006).

Foodborne diseases are a significant and growing public health problem in both developing and developed countries (Bhattacharjya & Reang, 2014). Food items are contaminated with microorganisms, can result in a foodborne disease outbreak (Webb & Morancie, 2015). Several previous studies have indicated that a large proportion of street foods are contaminated with microorganisms and can cause diseases such as diarrhoea, cholera, typhoid fever and food poisoning (Al Mamun et al., 2013; Oguttu et al., 2014). Consumption of contaminated

Received 11 Apr., 2020
Accepted 19 May, 2020
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food and water causes the death of about 2 million people per year, most of whom are children (World Health Organization, 2014). In general, food items from the street food vendors are processed and distributed in unsafe conditions, with less access to safe water, sanitation or waste disposal facilities. There is widespread recognition in developing countries that street food vendors frequently cook and sell food under unhygienic conditions (Sharma & Mazumdar, 2014). Additionally, they are often uneducated and have little knowledge about the safe handling of foods (Lues et al., 2006). Several studies have reported that the street food items are an appropriate medium for coliforms and antimicrobial-resistant pathogens despite their diversity and temporary nature (Ghosh et al., 2007; Guven et al., 2010; Hanashiro et al., 2005; Harakeh et al., 2005). Consequently, foodborne infections and intoxications can occur from the intake of food products from the street, rendering the safety of street food a significant public health concern (Bryan, 1988; Ekanem, 1998; Rheinländer et al., 2008; Sharma & Mazumdar, 2014).

In south-east Asia, especially Bangladesh is particular for its cheap and diversified street food items, vendors prepare their food items manually and sell to the consumers at various crowded places (Al Mamun et al., 2013; Samapundo et al., 2016). Due to rapid urbanization and its related social and systemic changes, demands for street food in Bangladesh are growing day by day, despite the health problems associated with the selling of various types of street food items. It has been shown that there are approximately 130 forms of street food items are available in Bangladesh and about 2.5 million people eat street food every day (Food and Agriculture Organization of the United Nations, 2007). None of these food items have any guarantee for their safe consumption. Also, interestingly, people do not consume these food items to satisfy their appetite, instead consider them as nutritious and appealing (Islam et al., 2017). Children who go to school eat these unhealthy foods and get sick (Al Mamun et al., 2013). The low level of awareness and vulnerability of current food laws and regulations also lead to the adverse food safety situation in the country (Atahar Ali, 2013). Only a few developing countries have their national laws to regulate their food safety, where developed world like EU (European Union) applies HACCP principles or good safety practices through the skilled food safety authority (Food and Agriculture Organization of the United Nations, 2003; Trafialek et al., 2018).

In Bangladesh, relatively few studies have been performed on the awareness, attitudes and experience of vendors in food safety (Khairuzzaman et al., 2014). Besides, some of the most popular ready-to-eat food products sold on the streets in Jashore are highly contaminated and do not meet the necessary standards quality and safety levels (Hossain & Dey, 2019). The current research focusing exclusively on the street food vendors' KAP was conducted in the Jashore region which is one of the socioeconomically significant regions of Bangladesh (Bangladesh Bureau of Statistics, 2017) with numerous and wide variety of street foods sold there as well. So, undertaking this study will determine the present scenario of street food safety in the studied region and may help the food safety authorities to improve their food safety programs. Furthermore, from a related sociodemographic viewpoint, the current study could help other similar studies to evaluate food safety challenges at the national and global levels.

This study was therefore investigated into the knowledge, attitude and practice of food safety and hygiene among local street vendors in the Jashore area and thus suggest appropriate steps to reduce the threats of related foodborne diseases to improve public health at local and national levels.

2 Materials and methods

This randomized cross-sectional study was conducted to investigate the awareness, behaviours and activities of street food vendors (SFVs) and evaluate sociodemographic factors that are associated with these food safety parameters in the Jashore region of Bangladesh. Data were randomly collected from the vendors (n = 200) through a structured questionnaire from April 2019 to September 2019. Due to its overpopulation and a large number of street food vendors, the district was chosen as a study area. The research was conducted in three zones; rural, urban, and slum. The protocols adopted for carrying out each analysis are listed in more detail below. Figure 1 shows the location of the studied area.

2.1 Food safety knowledge, attitudes and practices questionnaire

During the field survey, data from the 200 street vendors were obtained via face-to-face questioning, which facilitated to understand the realistic scenario of the current study. The questionnaires were divided into two sections, one was the food safety KAP and another was the demographic information as previously described (Ngoc et al., 2011). The KAP's part of

Figure 1. The study area. Source: Maps of Bangladesh (2012).

the questionnaire used to assess the food safety knowledge, attitudes and practices of the street food vendors was according to the previously published procedure (Ansari-Lari et al., 2010). The questions were asked in the mother tongue "Bengali" and the responses were translated into the English language. Subsequently, data were triangulated to present an overall impression of the food vendor's healthy practice, as shown previously (Cortese et al., 2016). The socio-demographic part of the questionnaire was designed to collect data on food handlers' age, gender, civil status, smoking status, education level, monthly income, residence area and so on. The questionnaire on food safety knowledge was intended to obtain information on the experience of food handlers' awareness of food handling, personal hygiene, cross contamination, cleaning equipment and, packaging materials etc. It included 21 questions, each with two possible answers. To reduce the response bias, the multiple-choice answers included "yes & no" options (yes = 1 & no = 0). The score range was 0 to 21. Part II included 21 questions related to food handlers' attitudes toward food safety. Food handlers were asked to indicate their level of agreement to the statements using a three-point rating scale (2 = strongly agree, 1 = agree and, 0 = disagree). The score range was 0 to 42. The scores were converted to 100 points. Part III of the questionnaire consisted of a list of 23 practices that would indicate food handlers' practice. A five points rating scale (2 = always, 1= sometimes, 0 = never) was used for respondents to rate the level of impact of each practice. The score range was between 0 to 46. Subsequently, the KAP scores were converted to 100 points. The score <50 was considered as indicating a poor, scores 50 to 75 as a median (adequate), and scores >75 as a good food safety knowledge, attitude, and practice level, respectively.

2.2 Statistical analysis method

The results of the survey were collected in excel sheets and analysed using statistical package for the social sciences (SPSS version 22.0) to identify the key factors and major impediments of ensuring food safety by the street vendors. Descriptive statistics to summarize the variables of interest and determine correlations between were applied. Statistical significance at 95% confidence level was considered ($P \leq 0.05$). The age, experience, BMI (Body Mass Index) and score results were divided into different categories as follows. For descriptive analysis, cut-off points of age were <25, 25 to 50 *and* >50 years. For respondents' experience of vending the cut of points were <5, 5 to 9, 10 to 15 and >15 years. The cut off points of BMI of the food vendors were <17.5 Kg/m^2 (Underweight), 17.5-22.99 Kg/m^2 (Normal weight), 23-27.99 Kg/m^2 (Overweight) and >28 Kg/m^2 (Obese) (World Health Organization, 2004). Descriptive analyses were conducted to calculate the means, standard deviations, maximum and minimum values, and KAP scores based on different socio-demographic variables of the respondents. The following performed a comparison of the level of scores according to the socio-demographic characteristics by chi-square test. Independent samples t-testing conducted a comparison of two community variables such as gender and smoking with awareness, attitude or practice. Comparison of more than two groups such as age, area of residence and level of education were conducted by employing one-way ANOVA. The normality of the data was first tested by using the explorer test. Instead, through the use of square root transformation of data, the negatively skewed scores were converted to the form of normal distribution. Figure 2 represents the flowchart of the methodology.

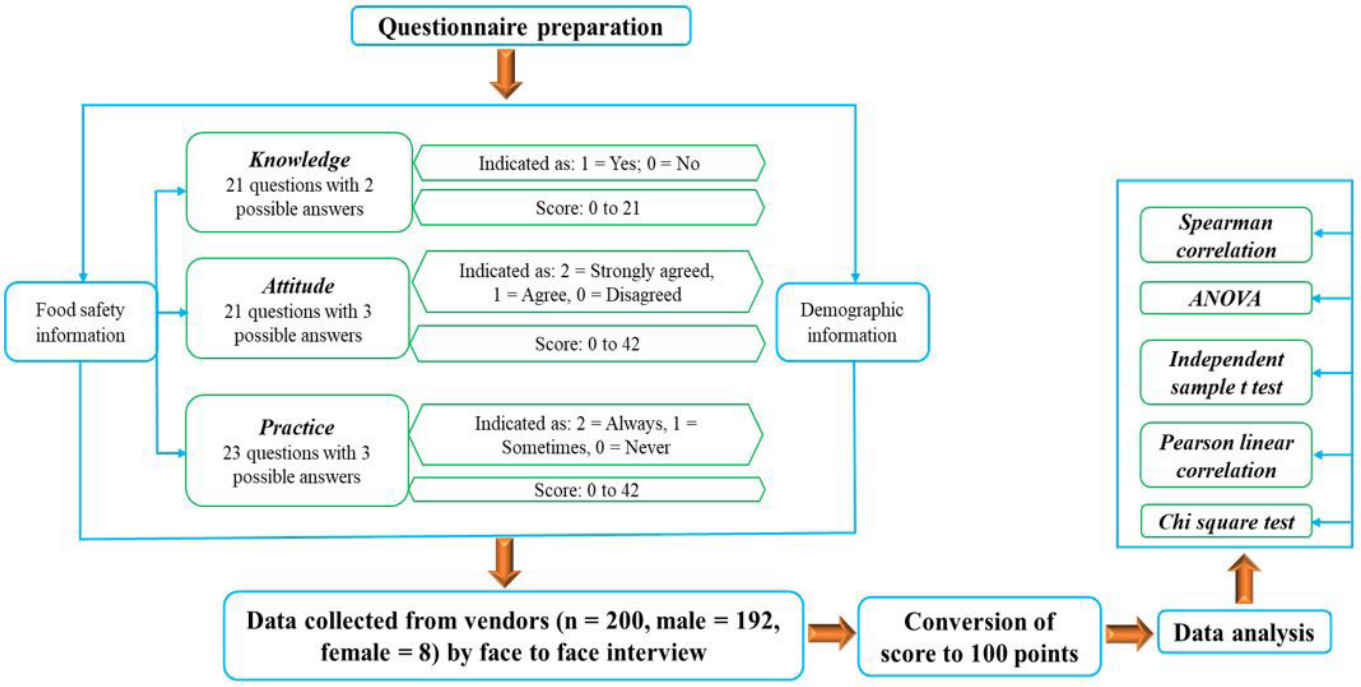

Figure 2. Methodological overview of the study.

3. Results

3.1 Socio-demographic characteristics of food vendors in Jashore.

In Table 1 are shown the socio-demographic characteristics of street food vendors, which shows that most (96%) of the 200 respondents were male vendors and 91.5% married. Where we found 70.5% (n=141) vendor's age between 25 and 50 years. About 37.5% vendors had 5 to 9 years of vending experience, while 8.5% had more than 20 years' experience. Most of the vendors (43%) monthly income were between 5,000 and 10,000 BDT ($58.98 to $117.97) while 7% vendors earned as low as 5,000 BDT only (>$58.98). Disturbingly, more than two-thirds (72.5%) of the respondents were smoker. Approximately, an equal proportion of vendors were from rural (48%) and urban (46%) regions respectively, whereas 6% vendors lived in the slum areas. Based on the BMI assessment of health, we also observed 52.5% and 10.5% respondents were overweight and obese, respectively.

Table 1. Socio-demographic characteristics of food vendors.

Characteristics	Frequency	Percentage (%)
Gender		
Male	192	96
Female	8	4
Age (year)		
<25	38	19
25 to 50	141	70.5
>50	21	10.5
Vending experience (year)		
<5	54	27
5-9	75	37.5
10-20	54	27
>20	17	8.5
Education level		
Illiterate	55	27.5
Primary (class 1-5)	94	47
Secondary (class 6-10)	44	22
Higher (over 10)	7	3.5
Monthly income (BDT)		
<5000	14	7
5000-10000	86	43
10001-15000	77	38.5
>15000	23	11.5
Marital status		
Single	16	8
Married	183	91.5
Widow	1	0.5
Residence area		
Rural	96	48
Urban	92	46
Slum	12	6
Smoking status		
Yes	145	72.5
No	55	27.5
BMI (Kg/m²)		
Underweight (<17.5)	4	2
Normal weight (17.5 -22.99)	70	35
Overweight (23-27.99)	105	52.5
Obese (>28)	21	10.5
Total	200	

Note: BMI = Body Mass Index, BDT = Bangladeshi Taka (1 USD = 84.83 BDT).

3.2 Food safety knowledge of food vendors in Jashore

The knowledge about the food safety in street food vendors is presented in Table 2. In order to preserve personal hygiene, 100% of the surveyed vendors strongly believed in hand washing before work, while 96% believed in hand washing after work. 91.55% (n = 183) had the awareness that washing hands could adequately reduce the risk of contamination, while 8.5% (n = 17) felt that washing hands could not effectively reduce the risk of contamination with food handling. 94% (n = 188) knew that only water could not clean hand properly. Surprisingly, about one-fourth of the vendors did not know that personal protective equipment such as apron, mask, gloves, and caps are the parts of personal hygiene. A good number of vendors (73%) were aware of not touching their hair after washing hands. According to our study findings, 94.5% of vendors knew that proper cleaning and handling of instruments reduce the risk of food contamination, whereas 91.5% (n = 183) were informed about cleaning equipment after work can reduce cross-contamination. Besides, 80.5% (n=161) were aware that their long nails could contaminate food. Moreover, 79.5% (n = 159) of vendors knew that reusing of oil is dangerous to health and less than half (48.5%) of the vendors had knowledge about paper/polythene packs are unsafe for food packaging.

The scores of food safety knowledge of vendors as an act of their demographic characteristics are summarized in Table 3. Most of the food vendors (72.5%, 145/200) had enough knowledge about food safety as they scored ≥75 and only 7% (14/200) had insufficient knowledge scored <50. According to this study, only street food vendors' education had a significant ($p \leq 0.01$) influence on their knowledge of food safety and no significant differences were observed with respect to gender, age, year of experience, monthly income, civil status, residence area, smoking and BMI. 87.5% of the female and about 72% of male vendors belonged to a good category of food safety knowledge. The highest 81.5% of the vendors experienced 10 to 20 years of vending had a good food safety knowledge, followed by 76.5% of the vendors vending for >20 years were within the good category of food safety knowledge.

3.3 Food safety attitudes of street food vendors in Jashore city

The food safety attitudes of the suppliers studied are shown in Table 4. All food vendors agreed to food safety knowledge would benefit their personal lives, of which 60.5% (n = 121) strongly agreed. Where 1% (2/200) did not agree with safe food handling is an important part of their job responsibility. All food vendors agreed with good personal hygiene and washing hand prior to food handling can reduce food poisoning and foodborne illness. Moreover, 10.5% of

Table 2. Assessment of the Food safety knowledge of food vendors.

Statement	Yes n (%)	No n (%)	p- value	Chi²- value
1. Washing hands regularly before work is one part of personal hygiene.	200 (100)	0	0.00	----
2. Washing hands regularly after work is one part of personal hygiene.	192 (96)	8 (4)	0.00	353.71
3. Washing hands properly reduces risk of food contamination.	183(91.5)	17 (8.5)	0.00	304.57
4. Washing hands with only water can't clean enough.	188 (94)	12 (6)	0.00	331.27
5. Wearing apron, mask, gloves, and caps is one part of personal hygiene.	150 (75)	50 (25)	0.00	156.37
6. Wearing mask is one part of personal hygiene.	151(75.5)	49 (24.5)	0.00	160.09
7. Wearing gloves is one part of personal hygiene.	159(79.5)	41 (20.5)	0.00	191.89
8. Wearing cap is one part of personal hygiene.	157(78.5)	43 (21.5)	0.00	183.37
9. Workers should avoid touching their hair after washing hands.	146 (73)	54 (27)	0.00	141.88
10. Eating and drinking in the workplace increase the risk of food contamination.	122 (61)	78 (39)	0.00	75.64
11. Proper cleaning and handling of instruments reduce the risk of food contamination.	189(94.5)	11 (5.5)	0.00	336.79
12. Worker cannot have long nails and make colouring it.	161(80.5)	39 (19.5)	0.00	202.93
13.Use gloves reduces the risk of transmitting infection to consumers.	148 (74)	52 (26)	0.00	149.92
14. Broken gloves need to be changed with new ones.	160 (80)	40 (20)	0.00	197.47
15. Cleaning equipment after work can reduce cross contamination.	183(91.5)	17 (8.5)	0.00	304.57
16. Using hot water to clean equipment still decrease risk of contamination.	151(75.5)	49 (24.5)	0.00	160.63
17. Separating dirty zone from clean zone can reduce cross contamination.	146 (73)	54 (27)	0.00	142.46
18. Contaminated foods always have some change in colour, odour or taste.	168 (84)	31 (16)	0.00	232.96
19. Reuse of oil is dangerous for health.	159(79.5)	41 (20.5)	0.00	197.29
20. Reheating cooked foods can contribute to food contamination.	104 (52)	96 (48)	0.00	32.44
21. Paper/polythene packs are unsafe for food packaging.	97 (48.5)	103(51.5)	0.00	23.41

Note: n = Number of vendors, p = Significance value.

food vendors denied producing safe food than made it tasty. Only 8.5% of the food vendors dissented with not to touch food with wounded hands. In addition, 11% (n = 22) of food vendors disagreed with not rubbing hands on the face or hair while working. Unexpectedly, 6% (n =12) did not know that foodborne illnesses can have deleterious health and economic effects on society. Almost one-fourth (n = 43) of the vendors had no idea that cooked food could be contaminated when stored together with raw food. Besides, we also found that about 27% (n = 55) of food vendors disagreed with the safety of polythene and paper bags in food packaging.

Table 5 summarizes the food safety attitudes of the vendors. In male and female vendors, 33.3% and 25% belonged to the good category of food safety attitude, respectively. Significant differences ($p \leq 0.05$) between food vendors in their food safety attitudes were observed by the area of residence and BMI, while other factors did not show a significant impact on the vendor's food safety attitudes. The duration of the vending years was not significant ($p = 0.322$) with their attitude towards food safety. A majority (49%) of the food vendors scored at a moderate attitude level of food safety whereas about one third (33%) scored at a good attitude level of food safety. In addition, range indicates that vendors individually achieved a minimum 30.95 and a maximum 100 food safety attitude score.

3.4 Food safety practice of street food vendors in Jashore city

Table 6 demonstrates the food safety practices of food vendors. 86% of the street food vendors reported washing their hands always before processing of foods. 49 percent (n = 98) of vendors always washed their hands before touching unwrapped raw food, while 49.5 percent sometimes and the rest never washed their hands. About 50% respondents always washed their hands after touching unwrapped raw foods while 33.5% sometimes did. Only 54% respondents kept their nails short and removed all adornments before starting activities regularly. During the observation, we found 58% food vendors washed their hands after touching prepared food. 4.5% food handlers worked when they had diarrhoea, while 72.5% cleaned the work area before starting work. This study also found that a good number of vendors (78.5%) washed their hands using soap or detergent after going to the toilet. Besides, over 90% vendors did not use apron, mask, cap and gloves during work. Disappointingly, when they were coughing or sneezing, just 18% used a tissue. Just below half (48%) of the vendors washed and sanitized their knife after chopping raw foods, where 59% used detergent to clean their equipment. Moreover, 42.5% of food handlers never rubbed their hands on their face and hair while working and 28.5% always reused oil.

The food safety activity ratings of the vendors as a function of their socio-demographic characteristics are summarized in Table 7. About 75% of male and female vendors belonged to the poor category of food safety practice. Interestingly we found that vendors below 25 years and over 50 years of age did not have good hygiene practice while one vendor aged 25-50 years had good practice status. We found their mean score was all about same and age was not significant to mean score of practice ($p = 0.558$). According to the years of vending experience, there was only one vendor who had good food safety practice. We

Table 3. Effect of gender, age, education level, residence area, smoking and BMI on the food safety knowledge of food vendors.

Characteristics	Number of respondents (%)			p† - value	Mean ± SD	p-value	Range
	Poor (<50)	Medium (≥50 to <75)	Good (≥ 75)				
Gender							
Male	14(7.3)	40(20.8)	138(71.9)	0.57	78.74 ± 14.91	0.727‡	42.86-100
Female	0	1(12.5)	7(87.5)		82.73 ± 6.70		71.43-90.48
Age (years)							
<25	2(5.3)	11(28.9)	25(65.8)		75.56 ± 13.83		42.86-95.24
25 to 50	11(7.8)	26(18.4)	104(73.3)	0.66	79.39 ± 14.99	0.127¥	42.86-100
>50	1(4.8)	4(19.0)	16(76.2)		81.63 ± 13.65		47.62-100
Vending experience (year)							
<5	3(5.6)	13(24.1)	38(70)		77.77 ± 14.21		42.86-100
5-9	7(9.3)	18(24)	50(66.7)	0.406	77.26 ± 16.13	.190¥	42.86-100
10-20	4(7.4)	6(11.1)	44(81.5)		80.24 ± 13.85		42.86-100
>20	0(0.0)	4(23.5)	13(76.5)		85.43 ± 10.30		66.67-100
Education level							
Illiterate	6(10.9)	14(25.5)	35(63.6)		75.84 ± 15.43		42.86-100
Primary	8 (8.5)	26(27.7)	60(63.8)	0.005**	75.48 ± 14.87	0.005*¥	42.86-100
Secondary	0 (0)	1 (2.3)	43 (97.7)		87.55 ± 7.83		57.14-100
Higher	0 (0)	0 (0)	7 (100)		94.55 ± 5.78		85.71-100
Monthly income (BDT)							
<5000	8(7.2)	3(21.4)	10(71.4)		79.25 ± 15.12		42.86-100
5000-10000	9(10.5)	18(20.9)	59(68.6)	0.673	77.68 ± 15.94	.846¥	42.86-100
10001-15000	3(3.9)	17(22.1)	57(74)		79.53 ± 13.94		42.86-100
>15000	1(4.3)	3(13)	19(82.6)		81.15 ± 12.22		47.62-100
Civil status							
Single	1(6.2)	3(18.8)	12(75)		79.46 ± 14.72		47.62-100
Married	13(7.1)	37(20.2)	133(72.7)	0.414	78.89 ± 14.75	.816	42.86-100
Widow	0(0.0)	1(100)	0(0.0)		71.42		71.43
Residence area							
Rural	6 (6.3)	17(17.7)	73(76)		80.00 ± 14.25		42.86-100
Urban	5 (5.4)	23 (25)	64 (69.6)	0.07	78.51 ± 14.52	0.316¥	42.86-100
Slum	3 (25)	1 (8.3)	8 (66.7)		73.01 ± 18.75		42.86-90.48
Smoking							
Yes	10(6.5)	32(20.6)	113(72.9)	0.85	78.80 ± 14.41	0.683‡	42.86-100
No	4 (8.9)	9(20)	32 (71.1)		79.25 ± 15.76		42.86-100
BMI							
Under weight	1(25)	0(0)	3(75)		75.00 ± 21.42		42.86-85.71
Normal weight	3 (4.3)	16(22.9)	51 (72.9)	0.65	80.06 ± 13.88	0.534¥	42.86-100
Over weight	8 (7.6)	20 (19)	77 (73.3)		79.04 ± 14.76		42.86-100
Obese	2 (9.5)	5 (23.8)	14 (66.7)		75.05 ± 16.00		42.86-95.24
Total	14(7)	41(20.5)	145(72.5)		78.90 ± 14.68		42.86-100

Note: SD = Standard deviation, p = Significance value, BMI = Body Mass Index; BDT = Bangladeshi Taka (1 USD = 84.83 BDT); †Significance values by Chi-square test; ¥Significance values by one-way ANOVA; ‡Significance values by independent sample "t" test; *Tests significant at p ≤ 0.01.

found that 82.4% of the vendors had poor food hygiene practice despite having more than 20 years of experience. There was only one primary educated vendor, who had good score on food safety practice. Higher educated vendors had lowest poor food safety practice level and highest mean of food safety practice score than that of illiterate, primary and secondary passed vendors. The degree of education had significance (p = 0.015) on food safety practice of vendors. Vendors who earned more than 15,000 BDT, 78.3% (n = 18) of them had poor hygiene practice, where 1.3% of the vendors whose monthly income was between 10,001 and 15,000 BDT had good food safety practice. We found one married vendor had good practice and there was only one widow who scored poor level of practice. Among the vendors living in the urban area, 80.4% of them had poor hygiene practice while 1.1% had good hygiene score. In addition, 33.3% of slum area vendors had medium level of food safety practice. Vendors who had smoking habit, 74.8% of them had bad hygiene practice and 77.8% of non-smokers had poor scores. Moreover, 90.5% of obese vendors had poor food safety practice and only 1% of overweight vendors had good hygiene practice. Furthermore, the minimum and maximum

Table 4. Assessment of Food safety attitude of food vendors.

Statements	Strongly Agree n (%)	Agree n (%)	Disagree n (%)	p-value	Chi²-value
1. Food safety knowledge will benefit to personal life.	121 (60.5)	79 (39.5)	00	0.00	8.82
2. Food safety knowledge will benefit to consumers.	103 (51.5)	97(48.5)	00	0.67	0.18
3. Safe food handling is an important part of your job responsibility.	71 (35.5)	127 (63.5)	2 (1)	0.00	117.6
4. Good personal hygiene can prevent foodborne illness.	82(41)	118(59)	00	0.00	6.48
5. Washing hands before handling food reduces risk of food poisoning.	99(49.5)	101(50.5)	00	0.01	97.09
6. Producing safe food is more important than tasty food.	76(38)	103(51.5)	21(10.5)	0.00	52.39
7. Nails are short and clean to reduce the risk of food contamination.	65(32.5)	129(64.5)	6(3)	0.00	113.53
8. Food should not be touched with wounded hands.	84(44)	95(47.5)	17(8.5)	0.00	55.87
9. Reuse of oil is harmful for health.	121(60.5)	59(29.5)	20(10)	0.00	77.83
10. Should not rub your hand on face, hair, etc. while working.	65(32.5)	113(56.5)	22(11)	0.00	62.17
11.Must need tissue or cloth when coughing or sneezing.	80(40)	113(56.5)	7(3.5)	0.00	88.27
12. Using mask is important in reducing risk of food contamination.	76(38)	115(57.5)	9(4.5)	0.00	86.23
13. Using cap is important in reducing risk of food contamination.	67(33.5)	117(58.5)	15(7.5)	0.00	79.57
14. Using apron is important in reducing risk of food contamination.	66(33)	112(56)	22(11)	0.00	60.76
15. Using gloves is important in reducing risk of food contamination.	60(30)	122(61)	18(9)	0.00	82.12
16. Protective clothing reduces the risk of food contamination.	68(34)	118(59)	14(7)	0.00	81.16
17. Foodborne illnesses can have deleterious health and economic effects on the society.	69(34.5)	119(59.5)	12(6)	0.00	85.99
18. Food hygiene training for workers is an important issue in reducing risk of food contamination.	78(39)	107(53.5)	15(7.5)	0.00	66.37
19. Well-cooked foods are free of contamination.	82(41)	88(44)	30(15)	0.00	30.52
20. Raw and cooked foods should be stored separately to reduce the risk of food contamination.	66(33)	91(45.5)	43(21.5)	0.00	17.29
21. Paper/polythene packs are unsafe for food packaging.	64(32)	81(40.5)	55(27.5)	0.07	5.23

Note: n = Number of vendors, p = Significance value.

practice score of food safety achieved by any individual vendor were 30.43 and 63.04 respectively.

Figure 3 illustrates that there was a downward trend in food safety awareness, attitude and practice score of food handlers. The average knowledge and attitude score were much greater than that of practice. The KAP scores were converted to 100 points and the scores below 50% was accepted as poor, scores within 50 to 75% as moderate and the scores 75 to 100% as good. So, our obtained score of knowledge (78.9 ± 14.68) and attitude (66.23 ± 16.04) were categorized as good and moderate respectively, whereas, the practice scores (46.40 ± 7.06) lower than 50% was classified as poor.

Table 8 indicates the correlation between the different socio-demographic variables and KAP scores. Knowledge of food safety had a positive correlation with the level of education (r =0.33) and negative relation with smoking status (r = -0.01). We found Significant positive correlation within education level and monthly income and food safety knowledge (r = 0.14*, r = 0.16*, r = 00.38**) and negative correlation of BMI (r = -0.08) with food safety attitude. Food safety practice had a positive relation with education level (r = 0.17*) and food safety knowledge (r = 0.16*) and attitude (r = 0.24**), whereas smoking had no relation with hygiene practice. However, BMI had a negative relation with KAP score of vendors. Besides, vending experience in terms of years had significant negative relation (r = -0.01*) with food safety practice. Therefore, as attitudes and practice are positively correlated with knowledge, it can be anticipated that if knowledge level rises, attitude and practice will also improve.

4 Discussion

This present study provides the food safety KAP of the street food vendors in the Jashore region of Bangladesh. The mean scores of knowledge and practice of the vendors were 78.90 ± 14.68 and 46.40 ± 7.06, respectively, showing Bangladeshi street food vendors' good knowledge and poor food handling practice in terms of food safety.

Many of the vendors in this sample were male (96%). This contrasted with the results of similar studies in other countries like Brazil (Hanashiro et al., 2005); China (Ma et al., 2019); Nigeria (Omemu & Aderoju, 2008) and Zimbabwe (Gadaga et al., 2008) where female were 56.6%, 66%, 78%, and 81% respectively, but was congruent to the findings reported by previous two studies conducted in India where males were 70% and 93.0% (Bhowmik & Saha, 2012; Singh et al., 2017; Thakur & Singh, 2018). This can be explained by the fact that the lower proportion of women in Bangladesh are interested in food sales because they engage more in the traditional household and maternal roles (Asaduzzaman et al., 2015). Approximately the same number of vendors were living in rural (48%) and urban (46%) areas, not according to a study in Mohali, India where more street vendors (66%) lived in rural areas (Singh et al., 2017). The majority of the vendors (70.5%) were into a broader age range; 25 to 50 years old. This was strikingly similar to studies in Ghana (Monney et al., 2014) and India (Bhowmik & Saha, 2012), with around 70% each of their vendors were also within this age range. Parallel social conditions may have existed behind this same age range of vendors in those countries. But not in accordance with the current study, a similar study conducted in Brazil

Table 5. Effect of gender, age, education level, residence area, smoking and BMI on the food safety attitude of vendors.

Characteristics	Number of respondents (%)			p†-value	Mean ± SD	p- value	Range
	Poor (<50)	Medium (≥50 to <75)	Good (≥ 75)				
Gender							
Male	34(17.7)	94(49)	64(33.3)	0.82	66.36 ± 16.20	0.573‡	30.95-100
Female	2(25)	4(50)	2(25)		63.09 ± 12.14		47.62-76.19
Age (years)							
<25	8(21.1)	20(52.6)	10(26.3)		64.28 ± 16.08		30.95-92.86
25 to 50	25(17.7)	71(50.4)	45(31.9)	0.34	66.07 ± 15.87	0.315¥	30.95-100
>50	3(14.3)	7(33.3)	11(52.4)		70.86 ± 17.03		38.10-100
Vending experience (year)							
<5	12(22.2)	23(42.6)	19(35.2)		67.19 ± 16.78		30.95-97.62
5-9	12(16)	37(49.3)	26(34.7)	0.710	65.74 ± 15.62	0.322¥	30.95-92.86
10-20	11(20.4)	28(51.9)	15(27.8)		64.10 ± 16.13		30.95-100
>20	1(5.9)	10(58.8)	6(35.3)		72.12 ± 14.93		50.00-10
Education level							
Illiterate	14(25.5)	22(40)	19(34.5)		65.19 ± 17.30		30.95-100
Primary	21(22.3)	48(51.1)	25(26.6)	0.02*	64.00 ± 16.65	0.055¥	30.95-100
Secondary	1(2.3)	25(56.8)	18(40.9)		71.21 ± 12.22		30.95-92.86
Higher	0(0)	3(42.9)	4(57.1)		73.12 ± 12.34		54.76-90.48
Monthly income (BDT)							
<5000	4(28.6)	8(57.1)	2(14.3)		61.56 ± 19.89		30.95-97.62
5000-10000	18(20.9)	48(55.8)	20(23.3)	0.066	63.73 ± 15.39	0.090¥	30.95-90.48
10001-15000	11(14.3)	32(41.6))	34(44.2)		69.35 ± 16.37		30.95-100
>15000	3(13)	10(43.5)	10(43.5)		68.01 ± 13.35		38.10-90.48
Civil status							
Single	3(18.8)	7(43.8)	6(37.5)		66.81 ± 16.57		30.95-92.86
Married	33(18)	90(49.2)	60(32.8)	0.872	66.22 ± 16.08	0.908¥	30.95-100
Widow	0(0.0)	1(100)	0(0.0)		59.52		59.52-59.52
Residence area							
Rural	12(12.5)	51(53.1)	33(34.4)		68.62 ± 15.15		30.95-100
Urban	18(19.6)	42(45.7)	32(34.8)	0.02*	65.86 ± 16.08	0.001*¥	30.95-92.86
Slum	6(50)	5(41.7)	1(8.3)		50.00 ± 14.06		30.95-76.19
Smoking							
Yes	26(16.8)	77(49.7)	52(33.5)	0.70	66.69 ± 16.03	0.454‡	30.95-100
No	10(22.2)	21(46.75)	14(31.1)		64.65 ± 16.16		30.95-92.86
BMI							
Under weight	1(25)	1(25)	2(50)		71.42 ± 30.11		33.33-100
Normal weight	9(12.9)	33(47.1)	28(40)	0.42	68.97 ± 14.79	0.048*¥	30.95-100
Over weight	20(19)	53(50.5)	32(30.5)		65.82 ± 15.42		30.95-97.62
Obese	6(28.6)	11(52.4)	4(19)		58.16 ± 18.23		30.95-92.86
Total	36(18)	98(49)	66(33)		66.23 ± 16.04		30.95-100

Note: SD = Standard deviation, p = Significance value, BMI = Body Mass Index, BDT = Bangladeshi Taka (1 USD = 84.83 BDT); †Significance values by Chi-square test; ¥Significance values by one-way ANOVA; ‡Significance values by independent sample "t" test; *Tests significant at ≤ 0.05.

reported that the majority of the vendors aged between 40 to 59 years (Cortese et al., 2016). In the current report, about 72% of vendors were smokers, while the proportion of smokers among ordinary Bangladeshis was only 36.3% (Nargis et al., 2015). In a related study in India, prevalence of smokers among street food vendors reported was 68.5% (Kapoor et al., 2019). Nicotine and other harmful heavy metals will accumulate on the open food at the time of smoking by vendors, which can then present significant health risks to customers, such as coronary heart disease (Barnoya & Glantz, 2004). To our surprise, significant numbers of vendors have been identified with abnormally obese body weight according to health status measurement by BMI. Overwhelmingly, 52.5% and about 10% of the vendors respectively were overweight and obese. Where in Bangladeshi people, 18.9% were overweight and 4.6% were obese (Biswas et al., 2017). This might be due to the physical inactivity noticed among vendors while selling foods. They most frequently sit on one position for a long time, regular intake of energy-dense fast foods away from home can often lead to their exceptionally high weight. A study in the UK reported that meal away from home

Table 6. Assessment Food safety practice of street food vendors.

Statement	Always n (%)	Sometimes n (%)	Never n (%)	p-value	Chi^2 -value
1. Washing hands before processing food.	172(86)	28(14)	-------	0.00	103.68
2. Washing hands before touching unwrapped raw foods.	98(49)	99(49.5)	3(1.5)	0.00	91.21
3. Washing hands after touching unwrapped raw foods.	100(50)	67(33.5)	33(16.5)	0.00	33.67
4. Using soaps/detergents to wash hands.	139(69.5)	60(30)	1(0.5)	0.00	143.83
5. Keeping your nails short and remove all adornments before starting activities.	108(54)	83(41.5)	9(4.5)	0.00	79.51
6. Washing hands after touching prepared foods.	116(58)	72(36)	12(6)	0.00	81.76
7. Handling foods at work while having diarrhoea.	9(4.5)	40(20)	151(75.5)	0.00	167.23
8. Cleaning the work area before starting work.	145(72.5)	45(22.5)	10(5)	0.00	147.25
9. Washing hands after going to toilet.	157(78.5)	26(13)	17(8.5)	0.00	184.21
10. Using apron at work daily.	12(6)	11(5.5)	177(88.5)	0.00	273.91
11. Using mask at work daily.	6(3)	11(5.5)	183(91.5)	0.00	304.69
12. Using cap at work daily.	5(2.5)	7(3.5)	188(94)	0.00	331.27
13. Using gloves at work daily.	6(3)	5(2.5)	189(94.5)	0.00	336.73
14. Washing hands before using gloves.	5(2.5)	7(3.5)	188(94)	0.00	331.27
15. Washing and sanitizing the working clothes.	22(11)	67(33.5)	111(55.5)	0.00	59.41
16. Using a tissue/cloth when coughing or sneezing.	36(18)	104(52)	59(29.5)	0.00	36.07
17. Washing and sanitizing the knife after chopping raw chicken or meat or other raw food.	96(48)	100(50)	4(2)	0.00	88.48
18. Using detergent to clean equipment.	118(59)	73(36.5)	9(4.5)	0.00	90.01
19. Eating or drinking in the workplace.	28(14)	124(62)	48(24)	0.00	76.96
20. Using jewelleries and wearing watch while working.	13(6.5)	73(36.5)	114(57)	0.00	77.41
21. Rubbing hands on face, hair, etc. while working.	26(13)	89(44.5)	85(42.5)	0.00	37.33
22. Smoking in workplace.	8(4)	69(34.5)	123(61.5)	0.00	99.31
23. Reusing of oil.	57(28.5)	66(33)	77(38.5)	0.222	3.01

Note: n = Number of vendors, p = Significance value.

is higher in fat and lower in fibre, which increases consumer's BMI (Rennie et al., 2005).

The mean ± SD of knowledge score was 78.90 ± 14.68, which was comparably higher than street vendors surveyed in Malaysia (Toh & Birchenough, 2000) and Turkey (Baş et al., 2006). We found that vendor's education has a major positive impact on their existing awareness about food hygiene, hence, vendors with a higher education status were found to have higher knowledge on food safety than those less qualified. A comparable research in Kuching Town, Malaysia, also noted the vital role of education level in awareness of food safety (Rahman et al., 2016). On the other hand, there were no significant differences in the street food vendors' level of awareness about food safety with regards to their gender and age in Jashore city. These findings are supported by previous studies in Malaysia (Muyanja et al., 2011) and Haiti (Samapundo et al., 2015). A research conducted in Canada found that age had a major effect on the awareness of food safety of food handlers (McIntyre et al., 2013). In our research, the age of food vending experience was not significantly linked to the vendor's awareness of food safety. However, this study found an acceptable knowledge level on food safety among the vendors studied.

99% of food vendors claimed that proper handling of foods is an essential aspect of their job responsibilities. Where they all knew good personal hygiene would avoid customer's foodborne illness. Just a small proportion of the vendors (10.5%) felt it was more important to prepare tasty food than to make healthy food. This belief is in line with another study in the United Kingdom, where 97% of respondents thought it was necessary to produce healthy food than tasty food (Worsfold et al., 2004).

This study found significant variances in the food safety attitude of vendors according to their educational levels and vending locations. In slum areas, vendors had the worst food safety scores compared to those of urban and rural areas. The current study found that the majority of the vendors were less educated, maybe like other developing countries where educated individuals seek jobs in the capital city (Addo-Tham et al., 2020). However, with the increase in education level of the vendors, their food safety attitude improved. In Malaysia, there was also found a significant effect of education level on food safety attitudes of food handlers (Toh & Birchenough, 2000). Education has been stated to play a key role in growing the awareness of food safety of food handlers and thereby improving their attitudes to food safety and hygiene (World Health Organization, 2015). As previously mentioned, a relatively more significant proportion of vendors were overweight and obese. Interestingly, with the decrease of BMI level, food safety attitude of vendors significantly improved in this study.

Furthermore, the self-reported hygiene practice showed that about 90% of the vendors in the present study did not use any personal protective equipment as well as safety procedures. The poor socio-economic condition with lacking proper food safety knowledge among the street food vendors is one of the potential reasons of their lower use of personal

protective equipment (Gadaga et al., 2014). These findings were quite similar to the findings in Kenya (87.7%) and contrast with the studies undertaken in Haiti and Uganda, where 40% and 54% food vendor used personal hygiene (Muinde & Kuria, 2005; Muyanja et al., 2011; Pincemail et al., 2012; Samapundo et al., 2016).

Table 7. Effect of gender, age, education level, residence area, smoking and BMI on the food safety practice of food vendors.

Characteristics	Number of respondents (%)			p†-value	Mean ± SD	p-value	Range
	Poor (<50)	Medium (≥50 to <75)	Good (≥ 75)				
Gender							
Male	145(75.5)	46(24)	1(0.5)	0.97	46.32 ± 7.00	0.423‡	30.43-63.04
Female	6(75)	2(25)	0(0)		48.36 ± 8.75		34.78-60.87
Age (years)							
<25	26(68.4)	12(31.6)	0(0)		47.34 ± 7.95		34.78-63.04
25 to 50	108(76.6)	31(22.7)	1(0.7)	0.73	46.30 ± 6.87	0.558¥	30.43-63.04
>50	17 (81)	4(19)	0(0.0)		45.34 ± 6.78		32.61-56.52
Vending experience (year)							
<5	39(72.2)	15(27.8)	0(0.0)		46.29 ± 7.30		30.43-63.04
5-9	54(72)	20(26.7)	1(1.3)	0.71	46.85 ± 7.74	0.694	30.43-63.04
10-20	44(81.5)	10(18.5)	0(0.0)		45.55 ± 6.04		32.61-60.87
>20	14(82.4)	3(17.6)	0(0.0)		47.44 ± 6.34		34.78-58.70
Education level							
Illiterate	42(76.4)	13(23.6)	0(0.0)		45.47 ± 7.33		56.52-60.87
Primary	72(76.6)	21(22.3)	1(1.1)	0.48	45.80 ± 7.36	0.015*	56.52-63.04
Secondary	34(77.3)	10(22.7)	0(0.0)		47.67 ± 5.41		56.52-63.04
Higher	3(42.9)	4(57.1)	0(0.0)		53.60 ± 5.94		56.52-63.04
Monthly income (BDT)							
<5000	11(78.6)	3(21.4)	0(0.0)		45.18 ± 6.55		36.96-58.70
5000-10000	60(69.8)	26(30.2)	0(0.0)	0.565	46.55 ± 7.748	0.917¥	30.43-63.04
10001-15000	62(80.5)	14(18.2)	1(1.3)		46.34 ± 6.55		30.43-63.04
>15000	18(78.3)	5(21.7)	0(0.0)		46.74 ± 6.66		34.78-60.87
Civil status							
Single	13(81.2)	3(18.8)	0(0.0)		45.38 ± 6.86		34.78-58.70
Married	137(74.9)	45(24.6)	1(0.5)	0.951	46.53 ± 7.09	0.485¥	30.43-63.04
Widow	1(100)	0(0.0)	0(0.0)		39.1304		39.13
Residence area							
Rural	69(71.9)	27(28.1)	0(0.0)		46.67 ± 7.43		30.43-63.04
Urban	74(80.4)	17(18.5)	1(1.1)	0.40	46.02 ± 6.77	0.772¥	30.43-63.04
Slum	8(66.7)	4(33.3)	0(0)		47.10 ± 6.57		36.96-58.70
Smoking							
Yes	116(74.8)	39(25.2)	0(0)	0.14	46.47 ± 6.86	0.798‡	30.43-63.04
No	35(77.8)	9(20)	1(2.2)		46.16 ± 7.79		30.43-60.87
BMI							
Under weight	2(50)	0(0)	0(0)		49.45 ± 4.11		43.48-52.17
Normal weight	51(72.9)	19(27.1)	0(0)	0.52	46.74 ± 7.64	0.524¥	30.43-63.04
Over weight	79(75.2)	25(23.8)	1(1)		46.41 ± 7.00		30.43-60.87
Obese	19(90.5)	2(9.5)	0(0)		44.61 ± 5.65		34.78-58.70
Total	151(75.5)	48(24)	1(0.5)		46.40 ± 7.06		30.43-63.04

Note: SD = Standard deviation, p = Significance value, BMI = Body Mass Index; BDT = Bangladeshi Taka (1 USD = 84.83 BDT); †Significance values by Chi-square test; ¥Significance values by one-way ANOVA; ‡Significance values by independent sample "t" test; *Tests Significant at ≤0.05.

Table 8. The correlation between different socio-demographic variables and KAP score of food safety vendors.

Variables	Age	SM	EL	MI	VEXP	BMI	FSK	FSA	FSP
Age	1[b]								
SM	0.12[b]	1[b]							
EL	-.06[b]	-.07[b]	1[b]						
MI	.23[b]	.04[b]	.16[b]	1[b]					
VEXP	.56[b]**	.08[b]	-.02[b]	.20[b]**	1[b]				
BMI	0.01[b]	-.14[b]	-.00[b]	-.05[b]	-.09[b]	1[b]			
FSK	.117[b]	-.01[b]	.33[b]**	.06[b]	.13[b]	-.08[b]**	1 [a]		
FSA	0.1[b]	.06[b]	.14[b]*	.16[b]*	.02[b]	-.08[b]*	.38[a]**	1[a]	
FSP	-.07[b]	.00[b]	.17[b]*	.03[b]	-.01[b]*	-.01[b]*	.16[a]*	.24[a] **	1[a]

Note: SM = Smoking, EL = Education level, MI = Monthly Income, VEXP = Vending Experience, BMI = Body mass index, FSK = Food safety knowledge, FSA = Food safety attitude, FSP = Food safety practice; [a]Pearson linear correlation; [b]Spearman correlation; *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

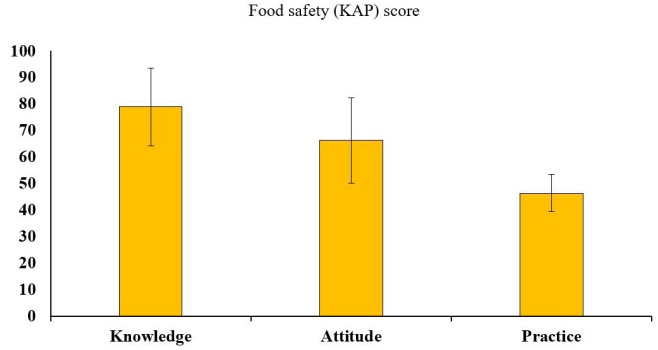

Figure 3. Food safety percent KAP score (mean ± SD).

Unfortunately, the proportion of vendors belonging to good food safety practice level was negligible, 0.5%. Around three-fourths of food vendors were poorly trained when it came to food hygiene. Corresponding with our outcomes, a similar study conducted on the street food vendors in Vietnam revealed that vendors had poor food handling practices and operated foods under highly unhygienic conditions (Ngoc & Thanh, 2015). However, this was slightly incongruous with earlier studies in Malaysia (Rahman et al., 2016) and Nigeria (Bamidele et al., 2015) where respondents had above 15% of good hygiene practice. Also, the length of the selling training was not directly related to their knowledge of food safety practices. We found that only the degree of education had a positive effect on their general practice of hygiene. On the contrary, a comparable study in Ghana reported that the food safety practice was not associated with the safety knowledge and education level of the vendors (Addo-Tham et al., 2020). We found that monthly income wasn't significant to their food safety and hygiene practice. But, another related study in Ethiopia showed that the increase of monthly income raised the level of food safety practice (Adane et al., 2018).

In the present analysis, each food safety parameter (KAPs) was positively associated with each other; the level of practice increased with an increased level of knowledge and attitude. Many earlier studies found that the level of awareness, attitude and food safety training were significantly related to the street food vendors' hygienic practices (Afolaranmi et al., 2015; Rahman et al., 2016; Tessema et al., 2014). In comparison, studies in Nigeria found that the attitude of food hygiene practices in vendors was not important (Otu, 2014), and another study in Ghana reported that knowledge was not closely associated to hygiene practice which indicated that existing socio-cultural context might have a greater impact on food hygiene practices (Rheinländer et al., 2008).

From our observation, as food vendors have enough safety knowledge, they need to be encouraged in related food hygiene and safety practices. It was found that socio-economic conditions of food vendors have a significant influence on their food safety behaviour and hygienic practices, of which level of education was an important factor influencing their reaction towards food safety. So, education will make the system better counter towards the promotion of food hygiene. Nevertheless, vendors themselves should follow the food safety precautions at the time of food preparation, preservation, and serving food to the consumers.

In order to increase the current level of food safety and hygiene practice Government should impose safety policy on vendors and provide them proper training on food safety and hygiene (Liu et al., 2014). Establishment of safety tools such as risk assessment, HACCP, FSO (Food Safety Objective) is also an effective step towards improving food safety practices (Trafialek et al., 2018).

5 Conclusion

The study demonstrated that the level of food hygiene knowledge was satisfactory in food vendors of the studied area. Although the food vendors had adequate food safety knowledge and attitudes, they had a poor understanding of safe food handling, which was reflected in their largely inadequate facilities and unhygienic practices during the vending of the foods. Most street food vendors interviewed in this study had low educational levels, which significantly contributed to their poor food safety practices. The government should take necessary steps and impose suitable food hygiene rules and regulations to increase good food handling practices. This investigation provides data necessary for the development of policies and standards that will help to ensure the safety of street foods. Initiatives like the arrangement of training programs on standard food safety and hygiene practice for street food vendors can improve the overall safety of street foods and also reduce related public health risks among the consumers.

Acknowledgements

We thank Monokesh Kumer Sen for some relevant suggestions and Daniel Ta for his efforts in correcting few grammatical mistakes in preparing this article.

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