



## FOOD SAFETY KNOWLEDGE AND HYGIENE PRACTICES AMONG FOOD VENDORS OF STREET FOOD TRUCKS

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### ABSTRACT

The popularity of street food in both developed and developing countries is seen as a major concern because of its potentially harmful effects on the public's health and well-being, implying that proper food safety knowledge and hygienic practices must be observed among street food vendors. However, only limited related studies have been conducted in Saudi Arabia. This study aimed to determine the food safety knowledge of food vendors in street food trucks and their hygiene practices and to provide possible guidelines on policies and regulations of food vendors in street food trucks in Jeddah. In this cross-sectional study, 123 food vendors in street food trucks in Jeddah City, Saudi Arabia, were given a self-administered questionnaire to evaluate their socio-demographic, employment profile, and food safety knowledge. Furthermore, the observational checklist was used to evaluate food vendors' personal and environmental hygienic practices in street food trucks. The overall food safety knowledge among the participating food vendors was found to be good. Vendors exhibited a satisfactory level of hygienic practices. Among other socio-demographic factors, only their educational attainment was found significant to their food safety knowledge. On the other hand, factors such as gender, marital status, and place of preparation were also found significant concerning their hygiene practices. Socio-demographic and employment characteristics of food trucks street vendors revealed a substantial effect on their food safety. Thus, continuous efforts to educate and guide food handlers on the proper safety protocols should be enhanced.

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### Introduction

Food vended on the streets, otherwise known as "street food," includes meals and beverages that can be easily prepared and sold by vendors along the streets and crowded areas. However, this classification is not limited to these products. The World Health Organization (WHO) also categorizes fresh fruits and vegetables marketed in front of legal grocery stores under this classification [1]. Contrary to their given name, these meals and beverages do not necessarily have to be sold along the streets. They may also be vended in food trucks or carts that can be found in front of various malls or crowded areas.

When these meals and beverages are improperly handled and delivered to the public, they may become carriers of foodborne diseases. Odu and Ameweiye noted that the prevalence of these health issues is due to the food vendors' low knowledge about basic food safety protocols [2].

Various factors may cause foodborne diseases in a food service environment. For instance, a food vendor's poor personal hygiene may be one of the most common reasons for this issue. In addition to this, improper handling, storing, and cooking of these products' raw materials might have a significant adverse effect on their quality and safety. Furthermore, when the ingredients of these meals and beverages are procured from unsafe sources, they may become possible carriers of harmful bacteria or substances [3].

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Street foods do not usually meet the proper hygiene protocols, leading to increasing numbers of diseases and other accompanying consequences on trade and development [4, 5]. For instance, the most known sickness from food contamination is associated with diarrheal diseases. More than 550 million people experience such conditions, while more than 230,000 deaths occur every year [6].

The Center for Disease Control and Prevention (CDC) reported that around 9.4 million illnesses occurring in the United States yearly are caused by foodborne diseases. Additionally, more than 839 foodborne disease outbreaks were reported in 2016, resulting in over 14,000 illnesses, 800 hospitalizations, and even worse, 17 deaths. Moreover, the World Health Organization (WHO) also evaluated that around 600 million citizens experience symptoms of various sicknesses after consuming contaminated food. In addition to this, more than 420,000 deaths occur yearly, resulting in a reduction of 33 million life-years [7].

So, retail food services must ensure the quality and safety of their products. Hence, this research aims to gain insights into the food safety knowledge and hygiene practices of food vendors in street food trucks in Jeddah City, one of the biggest tourist cities in the Kingdom of Saudi Arabia.

#### *Rationale*

Food safety is a critical issue that must be closely regulated and monitored in every aspect, including its delivery to the public. Therefore, the findings of this research may pave the way for the authorities to evaluate the current situation of the food vendors of street food trucks. With the insights concerning food safety knowledge and hygiene practices of the food trucks vendors, authorities may establish and implement policies and regulations to assist, monitor, and control food vendors of street food trucks.

#### *Aim*

This research aims to obtain new and profound insights concerning food safety knowledge and hygiene practices of food truck street vendors in Jeddah City.

#### *Objectives*

1. To assess the food safety knowledge of food truck street vendors.
2. To determine the food hygiene practices of food truck street vendors
3. To identify the relation between hygiene practices of food truck street vendors, and their socio-demographic profile, as well as their food safety knowledge.

#### *Literature Review*

Previous related literature showed the relation between the importance of proper and adequate food safety knowledge among street food handlers worldwide, and its impact on their hygienic practices.

#### *Food Safety Knowledge*

##### *Food Contamination*

In 2012, a study stated that foodborne diseases are among the most common illnesses caused by food contamination. There are more than 250 known diseases that contribute to the significant mortality and morbidity rates globally. The main culprits of which include various pathogens and contaminants [8]. In line with this, Fung *et al.* noted that contaminated food results in millions of illnesses worldwide, with hundreds of thousands of deaths every year. Such a study also showed that this issue mostly impacts the disability-adjusted life years (DALYs) for children aged 5 years old and below. Their study described the four primary concerns regarding food safety challenges, namely microbiological, chemical, and personal and environmental hygiene safety. The first two of which are similar to the findings of the previous study. In addition, the food handlers' hygiene, as well as the food service's environmental sanitation, are also significant factors that should be considered when dealing with food safety [9].

##### *Food Safety*

According to WHO, food safety is essential in preventing the prevalence of foodborne diseases, and symptoms such as stomach pains, vomiting, and diarrhea. The core protocols for safer food include proper storage, preparation, and delivery, as well as good hygiene and sanitation [10].

Related studies conducted in China and Ghana showed several common unhygienic handling activities done by food handlers, such as inadequate hand washing, ineffective protection from flies and other unwanted pests, and the inefficient wearing of masks, gloves, and hair caps [11, 12].

##### *Food Safety among Street Food Vendors*

The findings of Trafiałek *et al.* in 2017 revealed that street food vendors had caused the greatest number of non-compliances to global hygienic standards. However, this research is limited to employees in Asia and Europe [13]. In line with this, another cross-sectional study conducted by Trafiałek and colleagues [14] in Greece showed the impact of being knowledgeable about food safety among the hygiene practices of food vendors. Among the 110 participating street food vendors, several showed

non-compliance with the recommended food safety protocols. Furthermore, their findings manifested the need to implement and manage food safety and hygienic practices compliance better [15].

#### *Factors Affecting Food Safety Knowledge and Practices*

##### *Socio-demographic Characteristics*

Cross-sectional research among 811 Saudi women was done. The results of the study showed that the respondents had greater personal hygiene knowledge and practices. Furthermore, women with higher educational attainment and those aged 60 years old and above also exhibited better overall compliance with standard food safety and hygienic protocols [16].

Similarly, a study conducted in hospitals situated in Al Madinah, Saudi Arabia also had comparable findings. The researchers noted that food safety knowledge significantly varied depending on the participants' age, training experience, and educational attainment [17]. Furthermore, a cross-sectional study on 87 employees at King Saud University showed that different nationalities had an acceptable level of understanding of food safety, personal cleanliness, and food contamination [18].

##### *Employment Characteristics*

Cross-sectional research of 93 vendors was done in the Philippines in 2015, that showed low correlations between a street food vendor's rental and working hours and personal and hand-hygiene practices. Furthermore, prior attendance to food safety and sanitation seminars exhibited a low negative correlation with hand maintenance, illness, and injury [19]. In another study in the United States, it was revealed that the overall knowledge and compliance with food safety and hygienic protocols significantly improved with the post-training participants. This research is in line with the cross-sectional study of 73 vendors in Japan in 2014. Similarly, the findings revealed the significance of putting food vendors' food safety knowledge into practice [20, 21]. Moreover, the cross-sectional study conducted at King Saud University showed the substantial significance of their attitudes and behaviors toward food safety. Comparably, research conducted in Jizan city, Saudi Arabia in 2012, exhibited similar findings among street food vendors. The researchers noted poor results on food handling protocols, particularly from the ingredients' procurement to the management of leftovers [18, 22].

##### *Overall Food Safety Knowledge and Hygienic Practices among Street Food Vendors*

A cross-sectional study in Malaysia in 2016 examined the overall knowledge of food vendors using a self-administered questionnaire. The researchers concluded the need for better awareness programs despite having satisfactory findings [23]. Meanwhile, a descriptive survey study carried out in Alexandria city in 2014 among 100 street food vendors exhibited similar findings [24].

##### *Operational Definition of Terms*

*Food Safety Knowledge:* "It is the awareness of food vendors in street food trucks about food safety."

By adopting the calibration system proposed by Ma L, Chen H 2019 in their study [13], the results of this research will be evaluated as follows:

If the food handlers obtain a score between 0 to 12 (< 50%), 13 to 18 (50-75 %), 19 to 25 (> 75%), these will indicate that they have "poor", "satisfactory", and "acceptable" food safety knowledge, respectively.

*Food Hygiene Practices:* "Habitual food vendors in trucks involvement in applying and maintaining food safety throughout food production."

By adopting the calibration system proposed by Ma L, Chen H 2019 in their study [13], the results of this research will be evaluated as follows:

If the food handlers obtain a score between 0 to 19 (< 50%), 20 to 30 (50-75 %), 31 to 40 (> 75%), these will indicate that they have a "low level", "satisfactory level", and "acceptable level" of food hygiene practices, respectively.

*Street Food:* "Food and beverages cooked and/or vended by food handlers along the streets and in crowded areas."

*Food Trucks:* "Food vending unit that utilizes wheels to maintain a standard and consistent location."

## **Materials and Methods**

### *Study Design*

The research utilized a cross-sectional analytic study design, following the use of a self-administered questionnaire to assess the knowledge of the participating food vendors in food safety in street food trucks, and the use observational checklist to evaluate their hygiene practices.

### *Study Duration*

The research was carried out five months after the authorization of the Institutional Review Board (IRB). Thus, the data was mainly collected from May to September.

*Study Variables**Independent Variables*

The independent variables include the following factors:

1. Socio-Demographic Profile: Age, gender, marital status, educational attainment, and nationality
2. Employment Characteristics: Employment status, duration of being a street food vendor, kind of vendor, place of preparation of food, previous food safety training, worker health certificate, and license
3. The overall food safety knowledge among vendors in street food trucks

*Dependent (Outcome) Variables*

The dependent variables include the overall food hygienic practices among food vendors in street food trucks.

*Study Population*

A total of 203 registered and licensed food vendors in street food trucks, for the year 2019.

*Eligibility Criteria**Inclusion Criteria*

Only food trucks selling fast food and beverage along the streets and public spaces will be considered in the study.

*Exclusion Criteria*

All food trucks not selling fast food or hot beverages will not be included.

*Sample Size*

From the given population, 20 vendors were selected to undergo a pilot study. The total sample size was then calculated using the equation  $n = N / (1 + N \cdot (e)^2)$ , where N corresponds to the total population size and e for the margin of error at a 95% confidence interval. The results of which indicated a study group of 134 street food vendors. However, 11 refused to participate in the research, while the remaining 123 food vendors met the inclusion criteria.

*Sampling Technique*

The principal investigator employed a random sampling technique.

*Data Collection**Data Collection Technique*

The researcher evaluates food safety knowledge and hygiene practice through an observational checklist and self-administered questionnaire with the food vendors, like the techniques done by Czarniecka-Skubina *et al.* in 2018 [25]. Furthermore, the researcher used a checklist for quicker evaluation.

*Data Collection Tool*

A questionnaire was created by the principal investigator and filled by the principal investigator and a medical colleague who was trained in conducting inspections and in using a hygienic practice checklist (Annex I). The questionnaire was based on the following references: the International Codex Alimentarius of Regional Code of Hygiene Practice for Street Vended Food in Asia, which was embraced by the World Health Organization and the Food and Agriculture Organization of the United Nations in 2017 [26], the National Food Truck Guidelines on Practices and Hygiene Requirement for Food Vendors in Street Food Trucks in Saudi Arabia in 2018 which proposed by Ministry of Municipality and Rural Affairs [27] and previous studies conducted Czarniecka-Skubina *et al.* in 2018 [25] and Akabanda F. in 2017 [12].

The questionnaire consisted of three sections. Section one was designed to measure the socio-demographic data of food vendors in street food trucks. Section two dealt with the street food vendor's food safety knowledge. Section three contained a checklist of food hygienic practices among food vendors in street food trucks.

*Pilot Study*

An initial study was carried out on 10% of the total sample size in street food trucks to guarantee that all the proposed prompts in the survey were clear and concise. The researcher then conducted the Cronbach analysis to assess the said questionnaire's reliability and obtained a result of 0.7.

*Statistical Analysis*

The data for this study was examined using the IBM SPSS version 23. Simple descriptive statistics were used to demonstrate the nominal and categorical study variables through counts and percentages. Meanwhile, continuous variables were shown using the mean and standard deviations. Two scores are calculated and used as the main variables for correlation.

**Results and Discussion**

*Characteristics of the Study Group*

Descriptive statistics were utilized to evaluate the socio-demographic and employment characteristics of the participating street food truck vendors. The results of which are summarized in **Table 1**.

**Table 1.** Socio-demographic and Employment Characteristics among Street Food Vendors

| Demographics                                 | N                         | Min          | Max | Mean     | SD  |
|--|---------------------------|--------------|-----|----------|-----|
| Age (in years)                               | 123                       | 21           | 37  | 28.3     | 3.4 |
| Duration of being street vendor (in years)   | 123                       | 0            | 3   | 0.6      | 0.7 |
|  |                           | <b>Count</b> |     | <b>%</b> |     |
| Total  |                           | 123          |     | 100.0    |     |
|  | ≤25                       | 25           |     | 20.3     |     |
| Age (in years)                               | 26-30                     | 66           |     | 53.7     |     |
|  | >30                       | 32           |     | 26.0     |     |
|  | Male                      | 101          |     | 82.1     |     |
| Gender                                       | Female                    | 22           |     | 17.9     |     |
|  | Single                    | 66           |     | 53.7     |     |
|  | Married                   | 46           |     | 37.4     |     |
|  | Divorced                  | 8            |     | 6.5      |     |
|  | Widowed                   | 3            |     | 2.4      |     |
|  | Primary                   | 3            |     | 2.4      |     |
| Level of Education                           | Secondary                 | 43           |     | 35.0     |     |
|  | Senior Secondary And More | 77           |     | 62.6     |     |
|  | Stationary                | 113          |     | 91.9     |     |
| Type of vendor                               | Mobile                    | 10           |     | 8.1      |     |
|  | Less Than A Year          | 71           |     | 57.7     |     |
| Duration of being a street vendor (in years) | 1-3 Years                 | 52           |     | 42.3     |     |
|  | Truck                     | 54           |     | 43.9     |     |
| Place of preparation of food                 | Both                      | 69           |     | 56.1     |     |

*Overall Food Safety Knowledge among Street Food Vendors*

The percentage for each food safety knowledge is shown in **Table 2**.

**Table 2.** Percentage of Food Safety Knowledge (n = 123)

| Food Safety Knowledge  | Count | %    |
|--|-------|------|
| All food should come from KSA FDA approved source  | 120   | 97.6 |
| The raw food should be free from signs of apparent change in color, taste, smell & textures              | 115   | 93.5 |
| The growth of microorganisms is faster at room temperature than in a refrigerator                        | 121   | 98.4 |
| The cutting board should be separated for raw & cooked food  | 106   | 86.2 |
| Should not use heavy metal utensils.   | 95    | 77.2 |
| Should not use knives with wooden knobs  | 80    | 65.0 |
| It is safer to cook food according to the estimated daily need   | 92    | 74.8 |
| Food should be cooked at a temperature not less than 70 ° C  | 64    | 52.0 |
| Raw food should be stored in a refrigerator at a temperature of 4 ° C or below                           | 65    | 52.8 |
| Food handlers must have valid health certificates indicating that they are free from infectious diseases | 105   | 85.4 |
| Food handlers should have short & clean nails  | 104   | 84.6 |
| Sick food handlers can be a source of foodborne outbreaks  | 107   | 87.0 |
| Cooked food should not be tasted by fingers or unclean spoon   | 107   | 87.0 |
| Flies or vectors or rodents in or around the stall increase the risk of food contamination               | 100   | 81.3 |
| Dust & dirt around the stall increase the risk of food contamination                                     | 109   | 88.6 |
| Washing utensils with detergents leave them free of contamination  | 103   | 83.7 |
| Should be taken leave from work in case of infectious disease of the skin                                | 108   | 87.8 |

|  |     |      |
|--|-----|------|
| HIV cannot be transmitted by food  | 112 | 91.1 |
| Food handlers should have health check-ups every two years                           | 109 | 88.6 |
| Washing hands before work reduce the risk of food contamination                      | 115 | 93.5 |
| Improper heating of food causes foodborne illnesses                                  | 106 | 86.2 |
| Food contamination increases when food handler eats and drinks in the workplace      | 107 | 87.0 |
| Food contamination is minimized when gloves are used during work                     | 112 | 91.1 |
| Other food items like vegetables can be stored together with the meat in the freezer | 121 | 98.4 |
| Hepatitis A virus is a food born pathogen  | 107 | 87.0 |

#### Overall Hygienic Practices among Street Food Vendors

**Table 3** shows the percentage for each food hygienic practice.

#### Relationship between Food Safety Knowledge and Food Hygiene Practices and Socio-Demographic and Employment Characteristics

**Table 4** shows the relationship between food safety knowledge and the socio-demographic and employment profile of the participants.

**Table 3.** Percentage of Hygiene Practices Checklist (n = 123)

| Food hygiene production and environment  | Count | %    |
|--|-------|------|
| Raw and cooked food stored separately  | 101   | 82.1 |
| Using the separate cutting board for raw & cooked food                           | 85    | 69.1 |
| Cleaning of utensils & equipment's by using safe water                           | 119   | 96.7 |
| Drying of utensils & equipment's by using paper tissue                           | 91    | 74.0 |
| The production is hygienic   | 80    | 65.0 |
| Production process functional well   | 89    | 72.4 |
| Raw material stored at a proper temperature                                      | 95    | 77.2 |
| Ready to eat product and waste stored separately                                 | 117   | 95.1 |
| All utensils and equipment clean   | 90    | 73.1 |
| It is possible to clean/disinfect the equipment                                  | 77    | 62.6 |
| No mobile phone near cooking stoves  | 77    | 62.6 |
| No insects or pests visible in the workplace                                     | 95    | 77.2 |
| There is a waste container covered by a plastic bag                              | 89    | 72.4 |
| Served food in disposable covered plastic material                               | 90    | 73.1 |
| The facility walls clean, washable, and nonabsorbent                             | 81    | 65.8 |
| The floor in clean condition   | 79    | 64.2 |
| The package, plate, and cutlery clean  | 90    | 73.1 |
| The food separated from the consumer in a way to exclude secondary contamination | 97    | 78.8 |
| There are no unauthorized people in the production area                          | 104   | 84.5 |
| There is the separation of catering equipment during the preparation of the meal | 101   | 82.1 |
| <b>Personal Hygiene practice</b>   |       |      |
| Card   | 81    | 65.9 |
| Washing hand   | 118   | 95.9 |
| Wash frequent  | 74    | 60.2 |
| Drying   | 72    | 58.5 |
| Gloves Changing  | 66    | 53.7 |
| Touching   | 106   | 86.2 |
| Gloves wearing   | 121   | 98.4 |
| Apron  | 70    | 56.9 |
| Head cap   | 67    | 54.5 |
| Mouth sheet  | 83    | 67.5 |
| Jewelry  | 90    | 73.2 |

|                     |     |      |
|---------------------|-----|------|
| Eating              | 92  | 74.8 |
| Smoking             | 83  | 67.5 |
| Mobile              | 93  | 75.6 |
| Earing pod          | 96  | 78.0 |
| Payment transaction | 65  | 52.8 |
| Cough               | 101 | 82.1 |
| Touching Face       | 92  | 74.8 |
| Nails               | 84  | 68.3 |
| Skin                | 101 | 82.1 |

**Table 4.** Association between the Level of Food Safety Knowledge and Socio-demographic and Employment Profile

| Demographics                    | Total                     | Food Safety Knowledge |           | $\chi^2$ | p-value |                     |
|---------------------------------|---------------------------|-----------------------|-----------|----------|---------|---------------------|
|                                 |                           | Satisfy               | Good      |          |         |                     |
| Total                           | 123                       | 10(8.1)               | 113(91.9) | -        | -       |                     |
| Age (in years)                  | ≤25                       | 25                    | 1(4.0%)   | 24(96.0) | 3.052   | 0.217               |
|                                 | 26-30                     | 66                    | 8(12.1%)  | 58(87.9) |         |                     |
|                                 | >30                       | 32                    | 1(3.1%)   | 31(96.9) |         |                     |
| Gender                          | Male                      | 101                   | 9(8.9%)   | 92(91.1) | 0.461   | 0.689               |
|                                 | Female                    | 22                    | 1(4.5%)   | 21(95.5) |         |                     |
| Marital Status                  | Single                    | 66                    | 5(7.6%)   | 61(92.4) | 2.942   | 0.401               |
|                                 | Married                   | 46                    | 3(6.5%)   | 43(93.5) |         |                     |
|                                 | Divorced                  | 8                     | 1(12.5%)  | 7(87.5%) |         |                     |
|                                 | Widowed                   | 3                     | 1(33.3%)  | 2(66.7%) |         |                     |
| Level of Education              | Primary                   | 3                     | 3(100.0)  | 0(0.0%)  | 37.760  | <0.001 <sup>a</sup> |
|                                 | Secondary                 | 43                    | 5(11.6%)  | 38(88.4) |         |                     |
|                                 | Senior Secondary and more | 77                    | 2(2.6%)   | 75(97.4) |         |                     |
| Duration of being street vendor | Less than a year          | 71                    | 7(9.9%)   | 64(90.1) | 0.672   | 0.516               |
|                                 | 1-3 years                 | 52                    | 3(5.8%)   | 49(94.2) |         |                     |
| Type of vendor                  | Stationary                | 113                   | 9(8.0%)   | 104(92.) | 0.051   | 0.586               |
|                                 | Mobile                    | 10                    | 1(10.0%)  | 9(90.0)  |         |                     |
| Place of preparation of food    | Truck                     | 54                    | 5(9.3%)   | 49(90.7) | 0.164   | 0.747               |
|                                 | Both                      | 69                    | 5(7.2%)   | 64(92.8) |         |                     |

<sup>a</sup>-significant using Chi-square Test @<0.05 level.

**Table 5** shows the relationship between the food-handling practices and the socio-demographic and employment profile of the participants. According to Chi-square test at 0.05 level of significance, statistically significant association were found between the hygiene practices and socio-demographic factors such as gender, marital status, and place of preparation. However, educational attainment, duration of being a street vendor, and type of vendor showed no significant effect on the cleanliness practices of the participants. Furthermore, the Chi-square test and Fisher's exact test correction revealed no relationship between knowledge and practice among vendors

**Table 5.** Association between the Level of Food Hygiene Practices and Socio-demographic and Employment Profile

| Demographics   | Total  | Food hygiene Practices |            | $\chi^2$  | p-value |                    |
|----------------|--------|------------------------|------------|-----------|---------|--------------------|
|                |        | Satisfactory level     | Good level |           |         |                    |
| Total          | 123    | 93(75.6%)              | 30(24.4%)  | -         | -       |                    |
| Age (in years) | ≤25    | 25                     | 18(72.0%)  | 7(28.0%)  | 5.294   | 0.071              |
|                | 26-30  | 66                     | 55(83.3%)  | 11(16.7%) |         |                    |
|                | >30    | 32                     | 20(62.5%)  | 12(37.5%) |         |                    |
| Gender         | Male   | 101                    | 82(81.2%)  | 19(18.8%) | 9.528   | 0.002 <sup>a</sup> |
|                | Female | 22                     | 11(50.0%)  | 11(50.0%) |         |                    |
| Marital Status | Single | 66                     | 55(83.3%)  | 11(16.7%) | 9.136   | 0.028 <sup>a</sup> |

| Pharmacophore, 12(2) 2021, Pages 83-92 |                           |     |           |           |       |                    |
|--|---------------------------|-----|-----------|-----------|-------|--------------------|
|  | Married                   | 46  | 28(60.9%) | 18(39.1%) |       |                    |
|  | Divorced                  | 8   | 7(87.5%)  | 1(12.5%)  |       |                    |
|  | Widowed                   | 3   | 3(100.0%) | 0(0.0%)   |       |                    |
| Level of Education                     | Primary                   | 3   | 3(100.0%) | 0(0.0%)   |       |                    |
|  | Secondary                 | 43  | 37(86.0%) | 6(14.0%)  | 5.426 | 0.066              |
|  | Senior Secondary and more | 77  | 53(68.8%) | 24(31.2%) |       |                    |
| Duration of being street vendor        | Less than a year          | 71  | 54(76.1%) | 17(23.9%) |       |                    |
|  | 1-3 years                 | 52  | 39(75.0%) | 13(25.0%) | 0.018 | 0.893              |
| Type of vendor                         | Stationary                | 113 | 85(75.2%) | 28(24.8%) |       |                    |
|  | Mobile                    | 10  | 8(80.0%)  | 2(20.0%)  | 0.114 | 0.736              |
| Place of preparation of food           | Truck                     | 54  | 36(66.7%) | 18(33.3%) |       |                    |
|  | Both                      | 69  | 57(82.6%) | 12(17.4%) | 4.175 | 0.041 <sup>a</sup> |

<sup>a</sup>-significant using Chi-square Test @<0.05 level.

With the increasing demand and popularity for street food, its safety becomes a general concern for the public. Previous related literature reported the possible factors affecting food safety.

#### *Overall Food Safety Knowledge*

The food safety knowledge of the vendors in street food trucks resulted in an overall good score, suggesting that the participants had a prior background with such matter. Furthermore, the resulting high rate also implies complicate in practicing food safety protocols during the procurement and storage phases. The majority of the participants were aware that their sourcing and storage practices may affect the quality of the food and boost the growth of microorganisms. Furthermore, these findings are following the study of Moutz and coworkers [22], which revealed poor results on food handling protocols, particularly from the ingredients' procurement to the management of leftovers in Jizan City.

The participants of the present study also observed the significance of handwashing (93.5%), sanitation of utensils (83.7%), and the use of gloves (91.1%).

On the other hand, the participants also had the least knowledge with temperature (52.0%), and time management (52.8%). This result is supported by another literature [18], conducted in King Saud University, Riyadh City, indicating the need for better storage, preparation, and cooking skills in foodservice operations despite the employees' excellent food safety knowledge and hygienic practices. The studies of Roberts, *et al.* [21] in the United States and Lin and Yamao [20] in Japan emphasized the importance of educating food handlers concerning this matter for them to put their food safety knowledge into practice. Studies conducted from other countries, such as Haiti and Oklahoma, have also reported inadequate knowledge of food with temperature controls [28, 29]. These findings can be attributed to their lack of resources, namely their cutlery and storage equipment.

Lastly, the knowledge of the participants concerning HIV/AIDS and Hepatitis A transmission is also noteworthy since the majority disagreed that the former disease can be transmitted by food (91.1%), and were aware that the latter was foodborne pathogen (87.0%).

#### *Overall Hygiene Practice*

In the present study, results revealed that the highest compliance level was achieved particularly in the sanitation of utensils (96.7%), and wearing gloves (98.4%). This is in line with the previously discussed related literature.

The overall non-compliance rate of respondents in the current study was determined to be 27%. Changing gloves after transactions (52.8%), and wearing supplementary safety apparel aside from masks and gloves (head caps: 54.5% and aprons: 56.9%) were the least practiced measures, thereby possibly imposing harmful risks to consumers, especially during preparation and delivery stages.

#### *Relationship between Food Safety and Food Hygiene Practices and Socio-Demographic Profile*

The results of the current study suggest a strong relationship between the level of food safety knowledge and hygiene practices among older and educated participants. This is in line with works of Farahat, *et al.* [16], Alqurahi, *et al.* [17] and Al-Shabib, *et al.* [18], which were all conducted in Saudi Arabia. Similar findings have been reported in Brazil [7], King Saud University Riyadh [18], and Malaysia [23]. All of the studied vendors in the present study were Saudi nationals that had been trained by the ministry of municipal on food safety, had licenses for food truck operation at the time of the study, and had respective health certificates. This implies good restrict legislation of the Ministry of municipal and rural affairs [8, 28]. Previous related research also reported that food safety training significantly improved the knowledge of food vendors on food safety issues [19-21]. Since all the respondents had prior food safety training in the present study, this factor could have influenced the overall food safety knowledge and hygiene practices of the study group, such as the maintenance of their hands. Furthermore, seminars and a better food safety curriculum might be among the most practical instruments to enhance the food safety



knowledge and hygiene practice of street food vendors. Nevertheless, it is important to note that increased understanding is not always associated with positive food handling behaviors. This is consistent with previous related studies that emphasized the need to put this knowledge into practice [18, 20, 21, 23].

The general analysis of the current study may be associated with the study conducted by Alsayeqh in 2015 [30]. Similar to such findings, a revised and expanded food safety and hygiene education is suggested to be implemented to reduce and eliminate misconceptions and wrong practices in this discipline. Alsayeqh [30] also explained the primary causes of the repeated infractions imposed on restaurants in Saudi Arabia. These violations are connected to labor and regulatory factors, namely below-average wages for the employees and inspectors, lack of education, and governmental drawbacks.

Bakri *et al.* [31] reviewed similar researches conducted in Saudi Arabia. They discovered that raw food handlers like street food vendors and butchers are among the origins of food contamination and food poisoning in the country for the past ten years. Moreover, another study conducted in Makkah, Saudi Arabia, associated the understanding, behavior, and practices of food handlers with their socio-demographic and employment characteristics. Their findings revealed that educational attainment has the most significant impact on the attitude and practices of the participants, similar to this study [32].

#### *Limitations*

Limitations of this study include studying only one city, Jeddah City, in Saudi Arabia. Studying also the food knowledge and hygiene practices of other cities in Saudi Arabia, and conducting comparison analyses, may provide a bigger perspective and detailed understanding (such as similarities and variations) of food safety and practices at a larger scale .

#### **Conclusion**

In this study, food truck street vendors in Jeddah City, Saudi Arabia. In addition, the participating street food vendors were determined to have a satisfactory level among the given prompts. Nevertheless, these findings did not reflect better food hygiene practices.

#### *Recommendations*

The research shows the need to improve and expand the current food safety educational programs, monitoring, and training conducted among street food vendors in Jeddah, City, Saudi Arabia. Furthermore, the socio-demographic profile and employment characteristics play a massive role in this undertaking.

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