AMERICAN UNIVERSITY OF BEIRUT

BELIEFS, PRACTICES, AND KNOWLEDGE OF STREET FOOD VENDORS REGARDING FOOD SAFETY IN TRIPOLI - LEBANON

by
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ABSTRACT

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Title: Beliefs, Practices, and Knowledge of Street Food Vendors Regarding Food Safety in Tripoli – Lebanon.

Street food, defined as Ready to eat food and beverages sold on the streets, plays a vital role in providing employment, and nutritious food for less fortunate individuals and reflects the country's cultural cuisine. However, it poses a high health risk to the population. This study aims to assess the Knowledge, beliefs, and practices of street food vendors in Tripoli – Lebanon, and to investigate the Sociodemographic determinants of the beliefs, practices, and knowledge related to food safety among study participants. The study also aims to raise awareness among street food vendors. Through face-to-face interviews, food vendors filled in a multicomponent questionnaire containing two sections: (1) sociodemographic characteristics and work experience, and (2) knowledge, beliefs and practices related to food safety. A total of 100 street food vendors completed the survey. Results showed high knowledge scores, positive beliefs, and good practices. An association was also found between the knowledge score, income, and years of experience. The logistic regression model reflected that higher income, more years of experience, and being between the age of 31-38 increases the odds of having a high knowledge score. This study revealed positive beliefs of participants in Tripoli towards food safety and indicated important gaps in their practice and knowledge. The Lebanese government needs to put more effort into regulating the street food sector, and researches need to be performed to understand the condition of this sector in Lebanon.

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CHAPTER 1

INTRODUCTION

Street food is defined as ready–to–eat foods and beverages sold, sometimes also prepared, by hawkers or vendors on pushcarts, buckets, or shops having less than four permanent walls [1]. Vendors or hawkers of street food usually gather in densely populated public areas. The World Health Organization defines Street Food as ready–to–eat foods and beverages sold, sometimes also prepared, by vendors on the streets in public areas for direct consumption or consumption without further processing or cooking [2]. These foods can be of different types like meats, cereals, grains, fruits, vegetables, and many others.

Street food significantly enhances a country's economy by providing employment and nutritious food for less fortunate individuals. Since street food business requires minimum capital, low educational level, and no experience, people tend to take the risk and start such a business. Furthermore, it is always a suitable way to reflect the society's culture and thus attract tourists [3]. Finally, in the growing urbanization phenomena, street food supplies workers with tight schedules with tasty, sometimes nutritious, easily accessible food [4].

Even with Street Food playing an essential role in many aspects, Street Food still causes risk to the population's health and thus, generates a burden on the country's economy. Since it does not require a lot of experience to work as a street food vendor, this can increase the probability of violating good food safety practices and cause unintentional food poisoning outbreaks. Starting a business with very few overheads indicates the usage of cheap, low-quality raw materials. Using such materials with fast

cooking to convey the fast service nature of street food might lead to producing contaminated food.

According to some studies conducted in Africa, the enormous, unchecked expansion of street food vendors has significantly strained city resources, such as water and sewage systems. It occasionally interferes with city planning through congestion and littering, negatively impacting daily lives [5].

Most developing countries have made many efforts to enhance food safety education between vendors. However, the aim must not always be to increase education but also to make sure that this knowledge is translated into good practices and a better attitude or belief [6].

1.1. Background of the Study

Street food is an urban phenomenon rapidly expanding with the extension of urban areas in low- and middle-income countries. It is well known that individuals of different ages and educational levels depend on street food in one way or another since it is relatively cheaper, sometimes nutritious, and tasty. Furthermore, a study conducted in 2016 revealed that consumers and street food vendors usually share similar sociocultural profiles [7].

Even though it is widely spreading, street food, like any other food production sector, this informal food sector is suffering from many problems leading to several outbreaks due to food-borne diseases. It is estimated that around the globe, two million people die each year from consuming contaminated food or water [8]. In Lebanon, the Ministry of Public Health (MoPH) indicated that in 2015, 2738 illness cases were reported due to food and water-borne diseases compared to only 134 cases reported by

the Ministry of Health and Social Services in Namibian during the same year. In the latter case, it has been found that most patients were reported in locations where street food vendors show poor hygiene practices [9] [10]. The vast difference in the number of cases sheds light on Lebanon's problematic public health situation.

A study conducted on the streets of Beirut, Lebanon, revealed that 100% of the sample were males, and 33% of them carried a High School degree. Furthermore, the study showed that the food sold on the streets of Beirut does not meet satisfactory levels of proper hygiene and quality [11].

The different agencies concerned with street food in Lebanon, like the MoPH and the various municipalities, work independently. This lack of collaboration between the agencies leads to disregarding the safe vending qualifications, and thus laws are barely enforced or implemented on the street.

Despite the enormous advantages of street food for the economy and culture, it is still a global concern since these foods are generally prepared and sold in unhygienic areas and under hazardous temperatures. However, when displaying the problem of street food, one must not only talk about vendors' practices but also assess vendors' food safety knowledge and beliefs.

In summary, Globally, the problem of food-borne illnesses is becoming of great concern. The informal street food sector has now burdened the economies of many developing countries [3]. The case in Lebanon, which is a developing country, remains unknown. And thus, more researches need to be performed in this field to understand the situation better.

1.2. Research Objectives

Since the country is going through several challenges, it is thought that food safety is not a public concern anymore. The economic crisis had led many untrained individuals to start vending businesses. That is why the condition of these vendors' knowledge, beliefs, and practices need to be assessed. Therefore, the main objectives of our study are to (1) Assess the beliefs, practices, and knowledge related to food safety among street food vendors in Tripoli. (2) Investigate the socio-demographic determinants of the beliefs, practices, and knowledge related to food safety among study participants. Finally, (3) Identify areas of improvement, and raise awareness by providing recommendations that could benefit street food vendors.

1.3. Significance of the Study

Very few researches have been done of the Street Food sector in Lebanon. The findings of the study would help to increase the knowledge regarding the safety of this informal sector. Furthermore, it might help the government in establishing a new framework to implement the present laws and regulations. Therefore, the significance of this study is mainly portrayed by paving the way for researchers in this field and giving insight into the missing parts in our food safety system and how to improve it.

CHAPTER 2

LITERATURE REVIEW

In this chapter, we will discuss some of what has been found in the literature, sectioned to illustrate each idea on its own, and explain how each section is related to this research topic. First, the food served is introduced alongside the health risks associated with some kinds of street food served. Second, the food safety knowledge of street food vendors is discussed and the third section is dedicated to explaining the vendors' hygiene practices and beliefs. The last heading explains the importance of training and reflect the results of several interventions.

2.1. Types of Food Served and the Corresponding Health Risks

Street food has been acknowledged as an essential stimulus for attracting tourists to visit a destination. As a result of the tourism business, diverse experiences have been viewed as one of the critical aspects of generating favorable opinions about an area [12]. In addition, they contribute significantly to the preservation of cultural and social legacy through local cuisine [13]. The type of cuisine varies by location but typically includes hot and cold dishes alongside beverages.

The importance of consuming street food depends on the location. For instance, a large portion of Asian culture is symbolized by street food. Asian countries, like Thailand, attract tourists due to the link between street cuisine and culture. Street food is one of the important considerations for travelers when deciding whether to visit or even re-visit a country, according to a study conducted by Mak A. and his colleagues in 2013

[14]. Additionally, a Korean study found that the street food industry is crucial to attracting tourists, making a food tourism organizing party highly advised[12].

In the MENA region, each country has a signature street food dish. For example, Egypt is well known for its Falafel, a fried ball composed of ground chickpeas and fava beans [13]. On the Lebanese streets, one can also find Falafel being sold with several sauces and additions. However, the Cheese Kaak and Balila are frequently sold and are some of the favorite signature products consumed on the streets of Tripoli – Lebanon. Recently, vendors tend to sell products that need simpler processing, like jelly candy and peanuts. However, poor street food vending practices might still produce high-risk products even with simple dishes. In the following subheadings, we will discuss the health hazards associated with the top products sold on the streets of Tripoli.

2.2.1. Cheese Kaak

Kaak is a traditional Levantine pastry covered with sesame and made in unique bakeries. It is a thick and fluffy piece of bread that looks like a bagel sold traditionally on the streets of Tripoli. The kaak is usually stuffed with zaatar (thyme), sumac, or cheese. The cheese is usually the Akkawi cheese, a soft white salty cheese. Many vendors try to upgrade the traditional cheese kaak by adding different types of vegetables, olives, and even chips. Regardless of the ingredients, Akkawi cheese puts the consumers' health at risk if not handled well since it may be contaminated with bacteria like *Escherichia coli* and *Listeria*.

Escherichia coli (E. coli) is one of the common biological contaminations of soft white cheese. Some pathogenic strains of *E. coli* are known to cause diarrhea, vomiting, and bad stomach cramps [15]. A master's student at AUB isolated 135 *E. coli*

strains from Akkawi cheese and brine samples in Lebanon. A disk diffusion assay showed that, out of the 135 samples, 100% were resistant to Penicillin, and 75.6% showed multidrug resistance [16].

Listeria is another biological contaminant of cheese; its infection is called Listeriosis which causes Meningitis, abortion, stillbirth, and sometimes death. A study published by the United Nations Industrial Development Organization (UNIDO) revealed that 15.6% of locally produced cheeses are contaminated with *Listeria* [17]. The above numbers trigger an alarm regarding the safety of cheese sold on the shelves of Lebanon.

A study conducted in North Lebanon assessed the food safety practices of 30 street food vendors. The study revealed that 100% of the kaak vendors did not wash hands before and after money transaction and 100% did not have water supply connectivity [18]. These numbers are alarming since a study conducted in 2016 indicated that food contamination with *Staphylococcus aureus* is correlated with bad practices of vendors who did not wash their hands frequently or after the money transaction.

2.2.2. Balila

Balila is made up of boiled chickpeas and fava beans with lemon juice, salt, and cumin. Recently, people have been tending to add different types of vegetables or fruits to elevate the dish, such as boiled beetroots or sometimes fresh carrots and pomegranates. The dish is well known on Tripoli's streets and served on a plastic plate; toothpicks are used as forks. Even with the low processing needed for the dish to be done, it possesses several health risks from the different ingredients.

Fava beans can be contaminated with different contaminants, with aflatoxins being one of the most dangerous. Aflatoxins are carcinogenic chemicals naturally produced by fungi like *Aspergillus flavus* and *Aspergillus parasiticus.* A study conducted in the MENA region in Egypt revealed that 29.4% of sampled fava beans were contaminated with aflatoxins B1(AFB1). Furthermore, Aflatoxin and a positive HCV-PCR were found to be positively correlated with the advancement of liver disease to G3S3, a sign of hepatocellular carcinoma [19].

Another contamination source can be the water used for boiling; the water used can be from different unknown sources. The frequency of water changing is also unknown, which means that the same water can be used to boil several batches of dried beans, increasing the risk of cross-contamination. Choosing the right source of water is very critical. A study conducted in Lebanon reflected high contamination of northern Lebanese water, with 68.2% contaminated samples. Further investigations revealed that the isolated pathogens were ESBL and carbapenemase-producing *Enterobacteriaceae* [20].

The health risk associated with the Balila dish is enormous; chickpeas, additional elevating ingredients, and spices can also be contaminated. One must not underestimate the risks associated with cooking and storing the ingredients with aluminum pots and serving hot food on plastic plates.

2.2.3. Gummy Candy

Gummy or soft candy is classified to be as a Sugar Confectionery product. These products are rarely to become spoiled. However, microbiological contaminants like yeast can grow easily if not stored correctly. Moreover, the pH and the water

activity play an important role in yeast growth. The most frequently detected spoilage is due to *Zygosaccharomyces rouxii* yeast microorganism. Mold contamination is usually obvious on the affected product. *Aspergillus, Penicillium, Verticillium, Rhizopus, Mucor, and Trichotheciu* were also detected on affected soft candy products. It is highly recommended to control the pH and water activity to reduce the probability of spoilage [21].

In Kozhikode, a city in India, a four years old boy died after eating jelly toffee sold in a small market. His mother, who shared the toffee with him, was hospitalized two days after the boy's death since she developed uneasiness. Even though no further investigations were done on the incident, the police report indicated that no other poisonous substance was found in the body. Thus the candy was banned later on [22]. The research on soft candy in the MENA region remains limited. More research needs to be done to evaluate the soft candys' situation.

2.2. Food Safety Knowledge

Food safety Knowledge is assumed to play an important role in protecting food consumers from food-borne illnesses when translated into practices [23]. Even with having it as a base for working in the food serving sector, only 51 out of the 441 scoped articles from the literature tackled the issue of street vendors' knowledge[24]. The Chief director of the Ministry of Environment Science and Technology in Ghana indicated that street food vendors usually produce food with very limited knowledge of food safety practices. Furthermore, vendors tend to work in environments that compromise clean preparation, storage, and even sale [25].

A study conducted in Kuching city, Malaysia, revealed that knowledge positively influences beliefs and the recipient's comprehension of health facts. It is known that a positive belief eventually leads to positive behavior or practices. On the other hand, superficial knowledge will lead to misunderstanding and the development of negative beliefs [10].

As indicated by a study conducted in Saudi Arabia, general food safety knowledge is affected by many variables. Sociodemographic characteristics such as gender and higher educational level significantly increase individuals' knowledge scores [26]. However, it is always important to remember that high knowledge does not always mean safe food since knowledge needs to be accompanied by positive belief and good practices [10].

2.3. Food Safety Beliefs and Practices

The beliefs of an individual are affected by several factors, such as knowledge. High knowledge increases a person's attitude since knowing something makes a person more comfortable dealing with challenges [10]. In return, these attitudes or beliefs directly affect one's practices.

Poor or bad food safety practices done by street food vendors can negatively affect consumers' health. These poor practices might make the food served unsafe for consumption and increase the risk of diseases spreading. If food is not properly cooked or processed, the contaminating pathogens in raw materials cannot be killed. In 2002 a study in Ghana revealed that poor practices such as using bare hands to prepare and serve food increases contamination [25].

Several factors can influence the practices of street food vendors. The sociodemographic status of the personnel can be one of these factors (such as age, sex, marital status, educational level, and many others). However, many factors are considered external, which means that a vendor cannot control these factors. For example, the lack of water connectivity, waste disposal, and public facilities at the site of vending is a factor that a vendor cannot control. In summary, the knowledge, beliefs and practices of street food vendors are all combined and cannot benefit from one without having the other [25].

2.4. Training and Intervention

The Food and Agriculture Organization (FAO) highlights that food handlers in any sector should have the minimum necessary knowledge and skills to handle food safely. Therefore, all vendors should undergo basic training sessions in food hygiene and safety before getting licensed. Governments should establish systems to ensure that food handlers know all practices and procedures to keep food safe and stable [27].

A cross-sectional study on 80 street food vendors showed the change in existing attitudes and practices after training the vendors. The significant difference between the responses before and after the training showed a significant change in the vendors' perception of practices and food safety knowledge. The knowledge score of the street vendors increased from an average of 24.35% to an average of 66.2% after the training [10].

Other than formal training sessions, interventions from the government side need to be done. No matter how much a street food vendor knows or what training they undergo, street food vendors cannot apply most of the good practices if there is a lack of

reliable infrastructure. The absence of public services like waste disposal systems and public toilets makes it difficult for the vendor to implement their knowledge. These interventions will make it easier for street food vendors to practice their food safety expertise [23].

CHAPTER 3

RESEARCH METHODOLOGY

This chapter covers details on how the research was designed and conducted. It will include the research design, sampling methodology, study population, questionnaire, data analysis, compensation to participants, data confidentiality, and risks and benefits.

3.1. Research Design

The researcher used a quantitative, descriptive, cross-sectional approach in this study. It was quantitative since it measured all relative variables at a specific time and did not include a control group or an experiment. Furthermore, it was counted as a cross-sectional study since it aims to describe the situation of a known population at a specific time.

3.2. Study population

The study population with all its elements was defined to meet particular inclusion and exclusion criteria. Since the study was conducted in Tripoli, Lebanon, street vendors above the age of 18, regardless of their Gender, Nationality, Religion, and Ethnicity, were set to be the study population. Vendors under 18 were excluded due to the difficulty of obtaining parental informed consent.

3.3. Data Collection Methodology

The data collection methodology, also known as the sampling technique, was chosen as the convenience sampling method. The researcher selected the convenience sampling method since it is easier to apply and convenient for low- or zero-funded research. After observing the streets of Tripoli, the researcher estimated that a sample of 100 street food vendors was considered sufficient to represent the vendors' population.

After obtaining the approve of Institutional Review Board at the American University of Beirut, an approved oral informed consent and a well-designed questionnaire (7.1. Informed Consent and 7.2. Questionnaire, respectively) were used to collect data. A total of 108 street food vendors were approached and asked to participate. However, only 100 vendors accepted the invitation, making the response rate 92.6%. The 100 vendors were interviewed after obtaining informed consent. All data collection was done on-site (i.e., on the streets of Tripoli). After the end of the interview, the researcher prepared a leaflet (APPENDIX 6) in Arabic that was explained and given to the participant to raise awareness regarding food safety and good practices.

3.4. Questionnaire

A structured questionnaire was used as the research instrument. The questionnaire was developed by adapting questionnaires applied for the same objectives in different countries with slight modifications to suit the study population. The questionnaire was sectioned into four different sections. The first was used to collect data regarding the sociodemographic of the participants. The second contained questions used to assess the knowledge of the vendors regarding food safety using yes/no questions. For the third section, eight Likert scale questions were used to

evaluate the beliefs of the vendors. And finally, the fourth section was composed of yes/no questions to assess the practices of the street food vendors.

3.5. Data Entry and Analysis

For data entry, Microsoft Office Excel was used. The researcher then exported the data to IBM SPSS Statistics version 25 for further analysis.

Descriptive statistics is presented as means and standard deviations (SD) for continuous variables or as frequencies and proportions for categorical variables. Chi-square and independent t-tests are used to explore whether groups significantly differed in knowledge, attitudes and practices responses. Univariate and multivariate logistic regressions were applied to determine which factors (social or work characteristics) are associated with the Knowledge, Beliefs and Practices scores. In the regression model, the score is used as the dependent variable. Characteristics that showed statistical significance in the univariate analysis were included in the multivariate model as independent variables. For all analysis done, a p-value of less than 0.05 will be considered statistically significant.

3.6. Compensation to Participants

As mentioned in the consent form (7.1. Informed Consent), participants did not receive compensation since the interview circumstances did not result in any loss to the vendor. Participating vendors did not have to pay for transportation and were not stopped from selling their products. If during the interview a customer approached, the researcher stepped back and allowed the vendor to sell freely.

3.7. Confidentiality of Data

The collected data was kept confidential throughout the research. Collected data was kept on the researcher's computer, protected with a strong password. The researcher did not collect any identifying information and did not link the participant's identity and the study code. The researcher did not keep Audio/Visual records of the interviews. The data will be kept secure for five years after the end of the study to meet AUB archive requirements and then destroyed using special software.

3.8. Risks and Benefits

As mentioned in the consent form 7.1. Informed Consent the risk of participating in the study is considered null since no sensitive data is collected. Furthermore, there will be zero anticipated benefits to participating vendors.

CHAPTER 4

RESULTS

This chapter will present the results of the analyzed data using the questionnaire from the 100 street food vendors sample from Tripoli. The results will be sectioned into the Sociodemographic, Knowledge, Beliefs, and Practices sections alongside the associations between different sociodemographic characteristics and the three outcomes (Knowledge, Beliefs, and practices). Finally, a section is dedicated to illustrating the results of the Logistic Regression models.

4.1. Sociodemographic Characteristics

Results revealed that vendors sold different types of food, with the Kaak being the most frequent (27%). Figure 1 illustrates the percentages of the dishes sold.

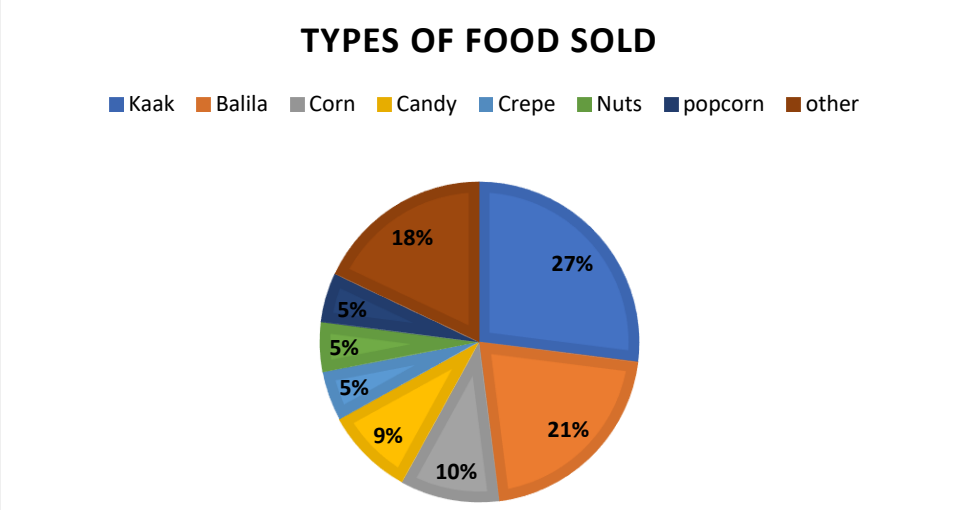

Figure 1: Pie Chart showing the percentages of each food type sold on the streets of Tripoli

Table 1 below, summarizes the Socio-demographic characteristics of the interviewed Street Food Vendors. Most of the participants were males (99%). The

participants' ages varied from 18 to 66 years old, having the <24 age group as the most prevalent group (31%). More than half of the participants were married (64%). Most vendors had a minimum educational level, with 47% attended elementary school. More than half of the vendors had >3 years of experience in the vending field. Most vendors learned how to vend by observation (96%). Only 25% of the vendors were employees. The rest were owners of the carts. Finally, 66% of the vendors had an income of more than 1,500,000 LBP.

Table 1 Summarize the Socio-demographic Characteristics of the Street Food Vendors

Characteristics	**Frequency**	**Percentage (%)**
Gender		
Male	99	99
Female	1	1
Age Group		
<24	31	31
[25-30]	23	23
[31-38]	22	22
>38	24	24
Marital Status		
Married	64	64
Single	36	36
Education Level		
Illiterate	17	17
Elementary	47	47
Secondary	8	8
High School	24	24
University	4	4

Years Working		
<1	22	22
1-3	19	19
>3	59	59
Knowledge Acquisition		
Observation	96	96
Training	4	4
Employment Type		
Employee	25	25
Owner	75	75
Income (in LBP)		
<1,500,000	27	29
>1,500,000	66	71

4.2. Street Food Vendors Knowledge

Tabl summarizes the food safety knowledge of street food vendors in Tripoli-Lebanon. The median knowledge score was 11; thus, vendors scoring higher than 11 were counted to have high knowledge. Thus, 64% of the vendors had high food safety knowledge scores. Most vendors were able to list the food poisoning symptoms (Fever, Vomiting, Diarrhea, Stomach cramps, and body ache). More than half of the participants knew that food poisoning could cause death and abortion in some cases. Only 44% of the vendors knew that microbes normally exist on the skin of a healthy individual. Most participants knew about microbes' transmission through jewelry (72%), food separation (raw from cooked) (75%) as well as the importance of hand washing (84%). However, 80% of the participants had the misconception that viruses, like influenza, can be transmitted through food. Only 66% of vendors knew that drinking, eating, and smoking while vending can cause cross-contamination. And

finally, around half (51% and 59%) of participants knew that food handlers need to wear a special costume and that each product has a different storing temperature, respectively.

Table 2: knowledge score of the participants

Question	Right Answer %	Wrong Answer %
Fever is a Food Poisoning symptom	72	28
Nausea/vomiting are Food Poisoning symptom	91	9
Diarrhea is a Food Poisoning symptom	87	13
Stomach cramps are a Food Poisoning symptom	90	10
Feeling tiered / having aches are a Food Poisoning symptom	77	23
Food poisoning can cause death in some cases	68	32
Food poisoning can cause abortion	67	33
Microbes normally live in the skin, mouth and, nose of a fully healthy person	44	56
Jewelries can transmit microbes	72	28
Diseases like influenza can be transmitted through food	20	80
Raw food must be separated from cooked food	75	25
Washing hands must take place every certain time even if I didn't leave my work station	84	16
Eating, drinking and smoking (during work) can increase the risk of food contamination	66	34
Wearing special costume during vending is important for food safety (full costume, aprons, gloves..)	51	49
Each food product has its own storing temperature	59	41

Table 2 presents the associations between the knowledge score and different sociodemographic variables. Crosstabulation showed a significant association between

the age group and the knowledge score (χ^2=8.033 and p=0.045). The years of working or experience in street-food vending also showed a significant association with the knowledge score ($\chi^{2=}$6.637and p=0.036. Furthermore, the income variable also showed a significant positive association with the knowledge score (χ^2=8.453 and p=0.004). All the other variables did not show a significant association with the knowledge score.

Table 2: The association between the knowledge score and the different sociodemographic variables

Participants	**Frequency (Percentage)**			
		Knowledge Score		**Significance (p<0.05)**
	Total n=100	**Low 36 (36)**	**High 64 (64)**	
Gender				
Male	99 (99)	36 (100)	63 (98.4)	χ^2=0.568
Female	1 (1)	0 (0)	1 (1.6)	P=0.451
Age				
<= 24	31 (31)	14 (38.9)	17 (26.6)	
[25-30]	23 (23)	12 (33.3)	11 (17.2)	χ^2=8.033
[31-38]	22 (22)	4 (11.1)	18 (28.1)	**P=0.045**
>38	24 (24)	6 (16.7)	18 (28.1)	
Marital Status				
Married	64 (64)	24 (66.7)	40 (62.5)	χ^2=0.174
Single	36 (36)	12 (33.3)	24 (37.5)	P=0.677
Education Level				
Illiterate	17 (17)	9 (25)	8 (12.5)	
Elementary	47 (47)	13 (36.1)	34 (53.1)	χ^2=8.429

Secondary	8 (8)	1 (2.8)	7 (10.9)	P=0.077
High School	24 (24)	10 (27.8)	14 (21.9)	
University	4 (4)	3 (8.3)	1 (1.6)	
Years Working				
<1	22 (22)	13 (36.1)	9 (14.1)	
1-3	19 (19)	5 (13.9)	14 (21.9)	χ^2=6.637
>3	59 (59)	18 (50)	41 (64.1)	**P=0.036**
Knowledge Acquisition				
Observation	96 (96)	36 (100)	60 (93.8)	χ^2=2.344
Training	4 (4)	0 (0)	4 (6.3)	P=0.126
Employment Type				
Employee	25 (25)	9 (25)	16 (25)	χ^2=0
Owner	75 (75)	27 (75)	48 (75)	P=1
Income				
<1,500,000	27 (27)	16 (47.1)	11 (18.6)	χ^2=8.453
>1,500,000	66 (66)	18 (52.9)	48 (81.4)	**P=0.004**

4.3. Street Food Vendors Beliefs

The Likert scale used to evaluate the beliefs was translated into numbers from 1 to 5, with 1 being strongly disagree and 5 being strongly agree. The median of beliefs score was found to be 2.75; thus, any vendor with an average below 2.75 had a negative belief. As a result, more than half of the vendors had positive beliefs (54%). The beliefs of the participants are shown in **Table 3** below. Most vendors believed that food poisoning is common in Tripoli (64%) and that street food is not safe for consumption

(68%) while, surprisingly, only 25% of the participants indicated that street food vendors know the food safety measures. Slightly more than half (53%) of the vendors thought that the surrounding environment does not have any risk to the stall. A good number of vendors believed that rules need to be initiated to organize street food and that the government is responsible for providing clean working stations alongside toilet cabins (71% and 83%, respectively). Most participants (91%) believed that the economic crisis affected how vendors deal with food safety measures. And finally, 42% of vendors thought that health workers often exaggerate the idea of safe food and hygiene.

Table 3 Summarize the Beliefs of the participants

Question	% of Strongly Disagree or Disagree	% of Neutral	% of Strongly Agree or Agree
1. Food poisoning is not common in Tripoli	64	7	29
2. Street Food in Tripoli is safe to consume	68	2	30
3. Street vendors are aware of the food safety measures	70	5	25
4. surrounding environment of the stall does not cause any risk on the food	47	0	53
5. rules and regulations need to be initiated to organize street vending	27	2	71
6. government is responsible to provide clean working stations alongside toilet cabins	16	1	83
7. the economic crisis affected the way vendors deal with food safety	9	0	91
8. Health workers often exaggerate the idea of safe food	56	2	42

From **Table 4**, it is evident that most vendors had a positive belief. However, no significant association was found between the sociodemographic variables and the belief score.

Table 4 shows the association between the Beliefs and the different sociodemographic variables

Participants	**Frequency (Percentage)**			
		Beliefs		**Association α=0.05**
	Total n=100	Negative 37 (37)	Positive 63 (63)	
Gender				
Male	99 (99)	36 (97.3)	63 (100)	χ^2=1.72
Female	1 (1)	1 (2.7)	0 (0)	P=0.19
Age				
<= 24	31 (31)	12 (32.4)	19 (30.2)	
[25-30]	23 (23)	7 (18.9)	16 (25.4)	χ^2=0.692
[31-38]	22 (22)	8 (21.6)	14 (22.2)	P=0.875
>38	24 (24)	10 (27)	14 (22.2)	
Marital Status				
Married	64 (64)	22 (59.5)	42 (66.7)	χ^2=0.526
Single	36 (36)	15 (40.5)	21 (33.3)	P=0.468
Education Level				
Illiterate	17 (17)	5 (13.5)	12 (19)	
Elementary	47 (47)	19 (51.4)	28 (44.4)	χ^2=2.158
Secondary	8 (8)	4 (10.8)	4 (6.3)	P=0.707
High School	24 (24)	10 (27.8)	14 (21.9)	
University	4 (4)	2 (5.4)	2 (3.2)	
Years Working				
<1	22 (22)	11 (29.7)	11 (17.5)	
1-3	19 (19)	7 (18.9)	12 (19)	χ^2=2.178
>3	59 (59)	19 (51.4)	40 (63.5)	P=0.337
Knowledge Acquisition				
Observation	96 (96)	35 (94.6)	61 (96.8)	χ^2=0.302
Training	4 (4)	2 (5.4)	2 (3.2)	P=0.583
Employment Type				
Employee	25 (25)	10 (27)	15 (23.8)	χ^2=0.129
Owner	75 (75)	27 (73)	48 (76.2)	P=0.72
Income				
<1,500,000	27 (27)	8 (25)	19 (31.1)	χ^2=0.385
>1,500,000	66 (66)	24 (75)	42 (68.9)	P=0.535

4.4. Street Food Vendors Practices

To evaluate the practices of street food vendors, for positive questions (1,2,3,7, and 8 from table 6), a yes answer was given a score of 1, and for negative questions (4,5, and 6), a yes answer was given a score of zero. The median of the answers was 5, and thus, any participant who scored a total below 5 was considered to have bad practices, and any participant who scored a total above 5 was considered to have good food practices.

Table 5 summarizes the results of these practices. Most of the vendors started working by washing their hands first (86%) and covered food when not in use (55%). However, only 26% of them stored food based on their safe temperature. Most vendors (77%) kept food products from one day to another. All vendors handled money while working with food. The majority of vendors cleaned their surrounding environment (80%), while only around half (54%) of them cleaned the utensils more than once during a working day.

Table 5: The practices scores of the food vendors

Question	Answered Yes %	Answered No %
1. Starts working by washing hands	86	14
2. Store food based on their safe temperature	26	74
3. Fully cover products when not in use	55	45
4. Food products are stored from day to day	72	28
5. Handle money while handling food	100	0
6. Smokes while working	52	48
7. Clean the surrounding environment	80	20
8. Clean utensils more than once per day	54	46

Table 6 shows that the educational level is associated with the practices (χ^2=10.33 and p=0.035). This means that the higher the educational level the better practices a vendor can show.

Table 6: The associations between vendors' practices and the different sociodemographic variables

Participants	**Frequency (Percentage)**			
		Practices		**Association α=0.05**
	Total n=100	Bad 40 (40)	Good 60 (60)	
Gender				
Male	99 (99)	40 (100)	59 (98.3)	χ^2=0.673
Female	1 (1)	0 (0)	1 (1.7)	P=0.412
Age				
<= 24	31 (31)	12 (30)	19 (31.7)	
[25-30]	23 (23)	11 (27.5)	12 (20)	χ^2=2.434
[31-38]	22 (22)	6 (15)	16 (26.7)	P=0.487
>38	24 (24)	11 (27.5)	13 (21.7)	
Marital Status				
Married	64 (64)	26 (65)	38 (63.3)	χ^2=0.029
Single	36 (36)	14 (35)	22 (36.7)	P=0.865
Education Level				
Illiterate	17 (17)	10 (25)	7 (11.7)	
Elementary	47 (47)	19 (47.5)	28 (46.7)	χ^2=10.33
Secondary	8 (8)	0 (0)	8 (13.3)	**P=0.035**
High School	24 (24)	8 (20)	16 (26.7)	
University	4 (4)	3 (7.5)	1 (1.7)	
Years Working				
<1	22 (22)	10 (25)	12 (20)	
1-3	19 (19)	8 (20)	11 (18.3)	χ^2=0.489
>3	59 (59)	22 (55)	37 (61.7)	P=0.783
Knowledge Acquisition				
Observation	96 (96)	39 (97.5)	57 (95)	χ^2=0.391
Training	4 (4)	1 (2.5)	3 (5)	P=0.532
Employment Type				
Employee	25 (25)	11 (27.5)	14 (23.3)	χ^2=0.222
Owner	75 (75)	29 (72.5)	46 (76.7)	P=0.637
Income				
<1,500,000	27 (27)	15 (38.5)	12 (22.2)	χ^2=2.898
>1,500,000	66 (66)	24 (61.5)	42 (77.8)	P=0.089

4.5. Logistic Regression

Since the outcomes: knowledge scores, beliefs, and practices, were divided into low and high knowledge, positive and negative beliefs, and good or bad practices, logistic regression was used to predict the odds of having a positive outcome based on the different sociodemographic independents.

Table 7 shows the results of the simple Logistic regression alongside the Multiple Logistic regression for the variables that showed significance. For the Age variable, we can see that being in the age group [31-38] increases the odds of scoring a high knowledge score 3.71 times more than being $\leq$ 24 (p=0.047 and 95% CI (1.016,13.515)). Moreover, having 1-3 years of experience increases the odds of scoring a high knowledge score 4.04 times more than having < 1 year of experience in the field (p=0.039 and 95% CI (1.071,15.27)). The case is the same for having >3 years of experience in the vending field since the odds of scoring a high knowledge score are 3.29 times higher than the individuals with <1 year of experience (p=0.021 and 95% CI (1.193,9.075)). Finally, an individual with an income >1,500,000 LBP is more likely to score a high knowledge score than an individual with an income <1,500,000 LBP by a factor of 3.9 (p=0.005 and 95% CI (1.516,9.925).

The above significant associations were put together in a multiple logistic regression model. Both the income and Age variables stayed significant. An individual with an income >1,500,000 LBP is more likely to have a high knowledge score than an individual with an income <1,500,000 LBP by a factor of 5.5 with a p value=0.002 and 95% CI (1.849,16.116). The Age group [31-38] showed 7.074 times higher odds than other groups for scoring a high knowledge with a p-value of 0.016 and 95% CI (1.449,34.523).

Table 7 Simple and Multiple Logistic Regressions analysis for the associations of the sociodemographic characteristics and the odds of having high knowledge score.

	Simple Logistic Regression OR (95% CI)	Multiple Logistic Regression OR (95% CI)
Gender		
Female	1	
Male	0 (0,), p=1	
Age		
<= 24	1	1
[25-30]	0.755 (0.256,2.226), p=0.61	0.675 (0.197,2.313), p=0.532
[31-38]	**3.706 (1.016,13.515), p=0.047**	**7.074 (1.449,34.523), p=0.016**
>38	2.471 (0.772,7.91), p=0.128	2.125 (0.517,8.724), p=0.296
Marital Status		
Single	1	
Married	0.833 (0.353,1.965), p=0.677	
Education Level		
Illiterate	1	
Elementary	2.942 (0.934,9.264), p=0.065	
Secondary	7.875 (0.788,78.671), p=0.079	
High School	1.575 (0.451,5.504), p=1.575	
University	0.375 (0.032,4.369), p=0.434	
Years Working		
<1	1	1
1-3	**4.044 (1.071,15.27), p=0.039**	3.143 (0.725,13.618), p=0.126
>3	**3.29 (1.193,9.075), p=0.021**	1.705 (0.517,5.62), p=0.38
Knowledge Acquisition		
Observation	1	
Training	969284905.7 (0,), p=0.999	
Employment Type		
Employee	1	
Owner	1 (0.389,2.568), p=1	
Income		
<1,500,000	1	1
>1,500,000	**3.879 (1.516,9.925), p=0.005**	**5.458 (1.849,16.116), p=0.002**

For the Beliefs and Practices outcomes, **Table 8**and **Table 9** show the results of the simple Logistic regression, respectively. However, none of the associations showed significant results; thus, a multiple logistic regression model was not performed.

Table 8 Simple and Multiple Logistic Regressions analysis for the associations of the sociodemographic characteristics and the odds of having positive Beliefs.

	Simple Logistic Regression OR (95% CI)
Gender	
Female	1
Male	2827077968 (0,), p=1
Age	
<= 24	1
[25-30]	1.444 (0.459,4.537), p=0.53
[31-38]	1.105 (0.357,3.421), p=0.862
>38	0.884 (0.298,2.621), p=0.884
Marital Status	
Single	1
Married	1.364 (0.589,3.158), p=0.469
Education Level	
Illiterate	1
Elementary	0.614 (0.186,2.028), p=0.424
Secondary	0.417 (0.074,2.361), p=0.323
High School	1.012 (0.258,3.962), p=0.986
University	0.417 (0.045,3.838), p=0.440
Years Working	
<1	1
1-3	1.714 (0.49,5.995), p=0.399
>3	2.105 (0.776,5.713), p=0.144
Knowledge Acquisition	
Observation	1
Training	0.574 (0.077,4.255), p=0.587
Employment Type	
Employee	1
Owner	1.185 (0.468,3), p=0.720
Income	
<1,500,000	1
>1,500,000	0.737 (0.28,1.937), p=0.536

Table 9 Simple and Multiple Logistic Regressions analysis for the associations of the sociodemographic characteristics and the odds of having good practices.

	Simple Logistic Regression OR (95% CI)
Gender	
Female	1
Male	0 (0,), p=1
Age	
<= 24	1
[25-30]	0.689 (0.231,2.053), p=0.504
[31-38]	1.684 (0.515,5.505), p=0.388
>38	0.746 (0.253,2.199), p=0.596
Marital Status	
Single	1
Married	0.93 (0.403,2.144), p=0.865
Education Level	
Illiterate	1
Elementary	2.105 (0.681,6.504), p=0.196
Secondary	2307821204 (0,), p=0.999
High School	2.857 (0.79, 10.336), p=0.11
University	0.476 (0.041,5.577), p=0.555
Years Working	
<1	1
1-3	1.146 (0.332,3.953), p=0.829
>3	1.402 (0.520,3.777), p=0.505
Knowledge Acquisition	
Observation	1
Training	2.053 (0.206,20.464), p=0.54
Employment Type	
Employee	1
Owner	1.246 (0.499,3.116), p=0.638
Income	
<1,500,000	1
>1,500,000	2.187 (0.881,5.433), p=0.092

CHAPTER 5

DISCUSSION

The present study investigated knowledge, beliefs, and practices regarding food safety of street food vendors in Tripoli- Lebanon. This study showed that vendors had relatively high knowledge in food safety, positive general beliefs regarding the safety of the food, and good safety practices. Our results showed that 99% of the vendors were males and 72% had less than a High school educational level which is consistent with what has been found in the study conducted by Hassan et al. in Tripoli. Furthermore, only 4% of our participants received official training. This number is considered to be low. Similar to what has been found by Neha et al. in India[28].

Results revealed that the presence of good food safety knowledge among Street Food Vendors is associated with several sociodemographic variables which are, age group, higher years of experience, and higher income. The findings of a study conducted in Africa are consistent with one of our findings, which indicates that the higher an individual's income, the better the knowledge they reflect [10]. Furthermore, the findings of our study revealed that the more experience a vendor has the more they know about food safety which means that spending more time in the field might influence a vendor's knowledge positively. However, high knowledge does not always indicate good practices. Even though 75% of participants seemed aware that raw and cooked food should be kept separate, this knowledge was not put into practice, as evidenced by a study conducted in Tripoli [18], which found that 70% of participants did not store raw materials separately. The latter might be due to the lack of space on the stalls or that the vendors cannot afford to have separate storing boxes such

as tapper wares or rapping film. Furthermore, only 51% of the participants knew that wearing a special costume while vending is important for food safety. However, very few vendors were observed to have a special uniform for vending. A study conducted In Lomé showed a high number of total aerobic bacteria in food samples and suggested that the deficiency of aprons and caps wearing could be the causative factor of contamination [29]. The usage of inappropriate clothing might increase the risk of served food since it is proven that cloth can contain and transmit different contaminants like *Staphylococcus, Shigella,* and many other bacteria. The transmission usually happens through direct contact like hand contact [30]. A study conducted in Sudan revealed that even though the average knowledge score was 47.2% and 65% of the food-borne illness symptoms were known, many food samples were contaminated. For instance, fava beans (representing 6.8% of the samples) contained several biological contaminants like *Escherichia coli, Staphylococcus aureus,* and *Bacillus sp* [31]. Our study showed that 59% of the vendors know that each food product has its own storing temperature while only 26% of the participants stored each product at its safe temperature. This number is alarming since many products can deteriorate. For example, the Akkawi cheese used in Kaak, when not stored in a cold environment (at around 4°C) contaminants like *Listeria, E. coli,* and several other contaminants can grow [15, 17]. A study conducted to observe the kinetic behavior of *E. coli* growth in different cheese types revealed that changing the storing temperature from 4°C to 30°C can change the growth rate from null to 1.03log CFU/g/h [32] [33].Many examples show that knowledge is not always translated into practice due to many factors such as the lack of resources, and the absence of refrigeration due to the lack of electrical power.

Even though the vendors' general beliefs were positive, however, it was anticipated that the vendors would have negative beliefs concerning the living circumstances and the laws that are in place. It is highly concerning that 68% of vendors believe that Tripoli's street food is not safe for consumption. This belief is critically alarming since it is based on street food vendors' perspectives. Results have also revealed that 47% of the participants disagree with the fact that food quality and safety are affected by the surrounding environment. Microbiological testing of Sudanese food showed a significantly increased chance of having contaminated products when sold in crowded open areas. The intense traffic present in the tested location increases the dust formation which is a major source of enterotoxigenic *Bacillus cereus* [34] which causes different gastrointestinal diseases[35]. The surrounding environment can also pose chemical contaminants like Cadmium (Cd) and Lead (Pb) where Abdulmajid et al. study showed that the amount of Cd and Pd in grilled chickens' small intestine (isaw) increases up to twice upon exposure of isaw into the environment for two hours[36]. Another study conducted in the Philippines showed heavy metal contamination of street food[37]. In both mentioned studies, the concentration of heavy metals present in street food may vary depending on the location of vending[36]. Furthermore, our results showed that 71% and 83% of the vendors said that the government should work harder to regulate street selling and be held accountable for maintaining hygienic working conditions. These beliefs are justifiable since a study conducted in Khartoum revealed that many street food vendors can not practice what they believe is correct due to the lack of basic public facilities at the vending sites like water connectivity and toilets. And thus, the provision of basic infra-structure and public facilities is highly recommended. Furthermore, several vendors indicated that they don't trust street food

since many vendors do not hold license from the Municipality, which makes the municipality responsible for enforcing the present regulations.

Our study's findings revealed that 40% of the vendors had poor practices. This finding is in line with those of Hasan et al. [18]. Poor practices can include uncleaned utensils, poor packaging, and bad storage of raw materials and leftovers. All these malpractices were found to be associated with the exceeding levels of *S. aureus* in street food sampled in Tripoli[18]. Even though the number of vendors with poor practices is much lower than what has been found in Africa (71% showed poor hygienic practices), the number is still alarming[25]. A study conducted in Palemro, Italy, revealed that 42% of analyzed cheese samples contained *Enterobacteriaceae* and 50% contained *Staphylococcaceae*. The study refered these findings to the poor hygenic practices at the different stages of cheese production and handiling [38]. In both studies conducted in Tripoli, 100% of the vendors handled money while working with food which might be the cause of having *S. aureus* in the samples found in the cheese kaak and shawarma in Tripoli, knowing that the numbers were a bit higher than what was found in Africa [18]. In our study, results showed a significant association between the practices score and the educational level of the vendor ($p=0.035$). This finding coincides with the results of a study conducted by Z. Liu et al. where they indicated that vendors with lower education level are less deceptive to sanitation knowledge and thus, practices. Furthermore, the same study showed that more than half of these vendors do not cover the food when not served which is similar to our finding (55%) [39]. Leaving RTE uncovered increases the risk of being contaminated with different types of contaminants like chemical, biological and physical. A study conducted in Brazil, recommended that street food handlers need to fix their malpractices, such as keeping food uncovered after

finding that all juice samples contaminated with different organisims[40]. A high number (72%) of the participants stored food products from day to day. If these food products are not stored in suitable conditions, it puts the consumers' health at risk. A study conducted in 2016, Jigjigia city by Tesfaye W. et al. showed the association between the high number of the unacceptable microbiological condition of the samples and improper storage practices [41]. Furthermore, only half (54%) of our participants cleaned the utensils more than twice per day. This malpractice poses a risk on the consumers health since it is proven that serving utensils used by street food vendors, are often contaminated with *Micrococcus spp. and Staphylococcus spp* [42]. Ensuring good practices is critical in maintaining safe food. A study conducted in Brazil, revealed that 75% of sampled street food hotdogs were contaminated total coliforms. The researchers indicated that these results might be due to the unhygenic practices done by the vendors like inadequate cooling, not using themperature control measures and the usage of non-potable water. All the malpractices presented by the vendors needs to be treated. Having good knowledge and basic infrastructure might give positive practices in the future.

It was anticipated that having more experience and earning more money would improve one's knowledge score, with the age group of 31 to 38 showing better odds of getting a high knowledge score. Additionally, the study did not reveal a significant correlation between knowledge acquisition and knowledge score due to the small number of trained individuals. Furthermore, the sociodemographic variables did not change the odds of having better beliefs.

The low number of trained participants present in our sample is eye-catching. When vendors, come from a low socioeconomic background, with low educational level, and being untrained, it is predicted to observe low knowledge and malpractices.

Furthermore, the presence of these stalls in random places puts more pressure on the police department of the Municipalities. Since these stalls often obstruct the movement of cars and people walking on the sidewalks. And thus, the Lebanese government must at least imply the already existing rules and regulations. The main authority responsible for street food vending is the ministry of interior represented by the Municipalities. According to the Municipality of Tripoli, rules to regulate street food vending puts the vendor responsible for the following: paying a small number of fees to the Municipality, vending in specified places, selling only allowed food types (food that does not pose a high risk on the consumer), establish a palate for the stall by creating a health certificate card. The health certificate card is obtained after undergoing a simple physical assessment and a chest X-ray to eliminate the presence of Tuberculosis and is done by the health department of the municipality. This health certificate must be renewed every 3 months. If the vendor fails to meet any of the above requirements, a penalty will be issued and sometimes the stall is removed. Currently, these regulations are not implied, and issuing plates for the stalls is paused. This is due to the randomness of the Lebanese street in general because of the economic crisis and political corruption. The municipality cannot stop street food vendors from selling because, for many of them, it is the only current income. However, this must not exclude the fact that random unhygienic stalls need to be removed and only certified stalls need to be allowed. In ideal conditions, the municipality can choose an open area, which is easily accessible to the different socioeconomic levels present, and provide it with waste/sewage disposal systems, water connectivity, and easily cleanable stalls made up of low-risk materials like stainless steel. Then the municipality can imply a small rent on these stalls and issue health certificates. Regular training sessions can be held in this area and the

already present health inspectors employed by the municipality can inspect the area regularly.

This study showed several strength points which include the fact that it is one of few studies conducted regarding street food vending in Lebanon. Most of the participants (59%) had >3 years' experience which means our results are representative. Furthermore, the sample number used is larger than the sample used in other studies conducted in the country [11, 18]. However, the study showed limitations which include, the researcher did not asses the practices based on an observational checklist and relied on the vendors' answers which might increase information bias. Furthermore, the study covered only Tripoli and it is recommended to cover all the Lebanese Governorates. Additionally, it is strongly advised that the researcher collect food samples to assess the microbiological state of the ready-to-eat food sold on the streets. Since it is essential to establish a link between the microbiological test results and the vendors' various knowledge, beliefs, and practice scores.

CHAPTER 6

CONCLUSION

In summary, even with street food playing an important role in providing income and nutritious food for less fortunate individuals, this cannot eliminate the risks associated with the poor conditions of the vendor's knowledge and practices. Food-borne illnesses are one of the most public health concerns. In Lebanon, the number of cases of food-borne diseases reported by the MoPH is quite alarming and probably underestimated since we do not have an adequate reporting system. Therefore, more studies need to be done to assess the condition of this informal sector, especially in the recent challenges the country is going through, like electrical power shortage and the lack of clean and trusted raw materials sources. The Lebanese government needs to take immediate actions and try to enforce laws and regulate this sector to protect the population's health from the unleashed critical condition of the ready-to-eat food sold in the streets of Tripoli.

APPENDIX

7.1. Informed Consent

Oral Consent Script

Beliefs, Practices, and Knowledge of Street Food Vendors regarding food safety in Tripoli - Lebanon

PI: Dr. Samer Kharroubi
Investigator: Nour Elkork

Hello, my name is Nour Elkork. I am a graduate student in the Department of Nutrition and Food Sciences at the American University of Beirut (AUB). I'm currently majoring in Food Safety and would like to invite you to participate in my thesis. The research study seeks to assess your beliefs, practices and Knowledge regarding food safety as a street food vendor in Tripoli - Lebanon i.e., how much you know about handling food in a safe manner and how do you practice it. As a food safety student, I'm highly interested in knowing what is missing in this sector and assess what interventions can be made to make it safer for you, as a vendor, and for the consumer.

Before we start, I would like to take few minutes to explain why I am inviting you to participate and what will be done with the information you provide. You will be asked to participate in a short interview in which you will be answering simple questions asked by me. Please stop me at any time if you have questions about the study.

I am doing this study as a part of my studies at AUB. I will be interviewing 100 street vendors in Tripoli and will use the collected information as the basis for my master's thesis. I may also use this information in articles that might be published, as well as in academic presentations. Your individual privacy (such as your name) and confidentiality of the information you provide will be maintained in all published and written data analysis resulting from the study. This information will not be shared with any other research team and/or any governmental party.

Your participation should not take any more than minutes of your time. Please note that your participation is completely voluntary and you have the right to withdraw your consent or stop your participation at any time without penalty. Your participation in this study(interview) will not involve any distress and is of minimal risk. If you refuse to participate in this study, your

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relation with AUB will not be affected by anyway. Participating in this study will not provide you with any payments or direct benefits.
However, this study will insight us into how much street food vendors know about safely handling food and what are the practices and attitudes done towards street food.

If at any time and for any reason, you would prefer not to answer any of the interview question, please feel free to ask to skip the question. We can take a break during the interview if you need to.

If you have any question, you are free to ask them now. If you have questions later, you may contact me Nour Elkork, at my email address nne23@mail.aub.edu .
Or you contact the primary investigator Dr Samer Kharroubi at sk157@aub.edu.lb
If you have questions regarding your rights as a participant in this research, you can contact the following office at AUB: Social and Behavioral Institutional Review Board (IRB) at irb@aub.edu.lb or by calling AUB at the extension: 5445.

Are you interested in participating in this study?

7.2. Questionnaire

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الجامعة الأميركية في بيروت

Questionnaire

Type of food served: _____

A. Socio-demographic

1. Gender:
   a. Male
   b. Female
   c. other
2. Age: _____
3. Marital Status:
   a. Single
   b. Married
   c. Divorced
   d. Widowed
4. Education Level:
   a. Illiterate
   b. Primary
   c. High school
   d. Technical high school
   e. University
5. Years of working:
   a. <1
   b. 1-3
   c. >3
6. Acquisition of knowledge of work:
   a. Observation
   b. Formal training
7. Type of employment:
   a. Owner
   b. Full time Employed
   c. Part time employed
8. Average monthly income:
   a. <500,000 LBP
   b. 500,000 – 1,000,000 LBP
   c. 1,000,000 – 1,500,000 LBP
   d. >1,500,000 LBP

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B. Knowledge:

Food poisoning symptoms include (check all what applies):

- ☐ Fever
- ☐ Nausea / vomiting
- ☐ Diarrhea
- ☐ Stomach cramps
- ☐ Feeling tired / having aches

Yes / No questions:

1. Food poisoning can cause death in some cases	☐ Yes	☐ No	☐ Don't know
2. Food poisoning can cause abortion	☐ Yes	☐ No	☐ Don't know
3. Microbes normally live in the skin, mouth and, nose of a fully healthy person	☐ Yes	☐ No	☐ Don't know
4. Jewelries can transmit microbes	☐ Yes	☐ No	☐ Don't know
5. Diseases like influenza can be transmitted through food	☐ Yes	☐ No	☐ Don't know
6. Raw food must be separated from cooked food	☐ Yes	☐ No	☐ Don't know
7. Washing hands must take place every certain time even if I didn't leave my work station	☐ Yes	☐ No	☐ Don't know
8. Eating, drinking and smoking (during work) can increase the risk of food contamination	☐ Yes	☐ No	☐ Don't know
9. Wearing special costume during vending is important for food safety (full costume, aprons, gloves..)	☐ Yes	☐ No	☐ Don't know
10. Each food product has its own storing temperature	☐ Yes	☐ No	☐ Don't know

C. Attitude:

In your opinion:

1. Food poisoning is not common in Tripoli	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
2. Street Food in Tripoli is safe to consume	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
3. Street vendors are aware of the food safety measures	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
4. surrounding environment of the stall does not cause any risk on the food	☐ Strongly agree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
5. rules and regulations need to be initiated to organize street vending	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
6. government is responsible to provide clean working stations alongside toilet cabins	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree
7. the economic crisis affected the way	☐ Strongly disagree	☐ Disagree	☐ Neutral	☐ Agree	☐ Strongly agree

vendors deal with food safety	
8. Health workers often exaggerate the idea of safe food	☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

D. Practices:

Yes / No questions:

1. Start working by washing hands	☐ Yes	☐ No	☐ Not applicable
2. Separate raw food from cooked	☐ Yes	☐ No	☐ Not applicable
3. Store food based on their safe temperature	☐ Yes	☐ No	☐ Not applicable
4. Fully cover products when not in use	☐ Yes	☐ No	☐ Not applicable
5. Food products are stored from day to day	☐ Yes	☐ No	☐ Not applicable
6. Handle money while handling food	☐ Yes	☐ No	☐ Not applicable
7. Smokes while working	☐ Yes	☐ No	☐ Not applicable
8. Blows in the plastic bag / use wet fingers to open	☐ Yes	☐ No	☐ Not applicable
9. Clean the surrounding environment	☐ Yes	☐ No	☐ Not applicable
10. Clean utensils more than once per day	☐ Yes	☐ No	☐ Not applicable

7.3. Arabic Informed Consent

نص الموافقة الشفهية

معتقدات وممارسات ومعرفة بائعي أغذية الشوارع فيما يتعلق بسلامة الغذاء في طرابلس - لبنان

الباحث الرئيسي: د. سامر خروبي

الباحث: نور القرق

مرحبا اسمي نور القرق. أنا طالبة دراسات عليا في قسم علوم التغذية والأغذية في الجامعة الأمريكية في بيروت (AUB).

أنا أتخصص حاليًا في سلامة الأغذية وأود أن أدعوك للمشاركة في أطروحتي. تسعى الدراسة البحثية إلى تقييم معتقداتك وممارساتك ومعرفتك فيما يتعلق بسلامة الغذاء كبائع أغذية متجولة في طرابلس – لبنان. أي ما تعرفه عن التعامل مع الطعام بطريقة آمنة وكيف تمارسه. بصفتي طالبًة في مجال سلامة الغذاء ، فأنا مهتمة للغاية بمعرفة ما هو مفقود في هذا القطاع وتقييم التدخلات التي يمكن إجراؤها لجعله أكثر أمانًا لك بصفتك بائعًا وللمستهلك.

قبل أن نبدأ ، أود أن أستغرق بضع دقائق لشرح سبب دعوتك للمشاركة وما الذي سيتم فعله بالمعلومات التي تقدمها. سيُطلب منك المشاركة في مقابلة قصيرة تجيب فيها على أسئلة بسيطة طرحتها. من فضلك أوقفني في أي وقت إذا كان لديك أسئلة حول الدراسة.

أقوم بهذه الدراسة كجزء من دراستي في الجامعة الأميركية في بيروت. سأجري مقابلات مع 100 بائع متجول في طرابلس وسأستخدم المعلومات التي تم جمعها كأساس لرسالة الماجستير الخاصة بي. قد أستخدم هذه المعلومات أيضًا في المقالات التي قد يتم نشرها ، وكذلك في العروض التقديمية الأكاديمية. سيتم الحفاظ على خصوصيتك الفردية (مثل اسمك) وسرية المعلومات التي تقدمها في جميع تحليلات البيانات المنشورة والمكتوبة الناتجة عن الدراسة. لن يتم مشاركة هذه المعلومات مع أي فريق بحثي آخر و / أو أي جهة حكومية.

يجب ألا تستغرق مشاركتك أكثر من عشر دقائق من وقتك. يرجى ملاحظة أن مشاركتك طوعية تمامًا ولديك الحق في سحب موافقتك أو إيقاف مشاركتك في أي وقت دون عقوبة. مشاركتك في هذه الدراسة (المقابلة) لن تنطوي على أي ضائقة وهي قليلة المخاطر. إذا رفضت المشاركة في هذه الدراسة ، فلن تتأثر علاقتك بالجامعة الأميركية في بيروت بأي حال من الأحوال. لن توفر لك المشاركة في هذه الدراسة أي مدفوعات أو مزايا مباشرة.

ومع ذلك ، ستدرس هذه الدراسة مدى معرفة بائعي الطعام في الشوارع حول التعامل الآمن مع الطعام وما هي الممارسات والمواقف التي يتم اتخاذها تجاه طعام الشارع.

American University of Beirut
Institutional Review Board
21 April 2022
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إذا كنت تفضل في أي وقت ولأي سبب عدم الإجابة على أي سؤال من أسئلة المقابلة ، فلا تتردد في طلب تخطي السؤال. يمكننا أخذ قسط من الراحة أثناء المقابلة إذا كنت بحاجة إلى ذلك.

إذا كان لديك أي سؤال ، فأنت حر في طرحه الآن. إذا كانت لديك أسئلة لاحقًا ، فيمكنك الاتصال بي نور القرق على عنوان بريدي الإلكتروني nne23@mail.aub.edu

أو يمكنك الاتصال بالباث الرئيسي الدكتور سامر خروبي على بريده الالكتروني sk157@aub.edu.lb

إذا كانت لديك أسئلة بخصوص حقوقك كمشارك في هذا البحث ، يمكنك الاتصال بالمكتب التالي على AUB: Social and Behavioral Institutional Review Board (IRB) على irb@aub.edu.lb

أو عن طريق الاتصال بـ AUB على الرقم الداخلي: 5445.

هل أنت مهتم بالمشاركة في هذه الدراسة؟

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7.4. Arabic Questionnaire

1866
AUB
American University of Beirut
الجامعة الأميركية في بيروت

استبيان

نوع الطعام المقدم: _____

أ. الاجتماعية والديموغرافية

ب. تدريب رسمي

1. الجنس

أ. ذكر

ب. أنثى

ج. اخر

2. العمر:

3. الحالة الإجتماعية:

4. المستوى التعليمي:

أ. أمي

ب. ابتدائي

ج. المدرسة الثانوية

د. المدرسة الثانوية الفنية

ه. جامعة

5. سنوات العمل:

أ. أقل من 1

ب. 1-3

ج. أكثر من 3

6: اكتساب المعرفة بالعمل عبر:

أ. الملاحظة

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ج. 1،000،000 - 1،500،000 ليرة لبنانية

د. > 1،500،000 ليرة لبنانية

7. طبيعة الوظيفة:

أ. صاحب/ة العمل

ب. موظف/ة بدوام كامل

ج. موظف/ة بدوام جزئي

أ. غير مرتبط/ة

ب. متزوج/ة

ج. مطلق/ة

د. أرمل/ة

8. متوسط الدخل الشهري

أ. <500,000 ليرة لبنانية

ب. 500،000 - 1،000،000 ليرة لبنانية

ب. المعرفة:

تشمل أعراض التسمم الغذائي (أختر كل ما ينطبق):

- ☐ حمى
- ☐ عثيان / قيء
- ☐ إسهال
- ☐ تقلصات في المعدة
- ☐ الشعور بالتعب / الأوجاع

أجب ب نعم أو لا:

1. يمكن أن يسبب التسمم الغذائي الموت في بعض الحالات	☐ نعم	☐ لا	☐ لا أعلم
2. يمكن أن يسبب التسمم الغذائي الإجهاض	☐ نعم	☐ لا	☐ لا أعلم
3. تعيش الميكروبات عادة في جلد وفم وأنف الشخص الذي يتمتع بصحة جيدة	☐ نعم	☐ لا	☐ لا أعلم
4. يمكن للمجوهرات أن تنقل الميكروبات	☐ نعم	☐ لا	☐ لا أعلم
5. يمكن أن تنتقل أمراض مثل الإنفلونزا عن طريق الطعام	☐ نعم	☐ لا	☐ لا أعلم
6. يجب فصل الطعام النيء عن الطعام المطبوخ	☐ نعم	☐ لا	☐ لا أعلم
7. يجب أن يتم غسل اليدين من وقت لوقت محدد حتى لو لم أغادر مركز عملي	☐ نعم	☐ لا	☐ لا أعلم
8. الأكل والشرب والتدخين (أثناء العمل) يمكن أن يزيد من خطر تلوث الطعام	☐ نعم	☐ لا	☐ لا أعلم

9. ارتداء زي خاص أثناء البيع مهم لسلامة الغذاء (زي كامل ، ومآزر ، وقفازات ..)	☐ نعم	☐ لا	☐ لا أعلم
10. كل منتج غذائي له درجة حرارة التخزين الخاصة به	☐ نعم	☐ لا	☐ لا أعلم

ج. الوقف:

في رأيك:

1. التصميم الغذائي ليس شائعا في طرابلس	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
2. الطعام الذي يباع في الشارع في طرابلس آمن للاستهلاك	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
3. الباعة المتجولون على دراية بتدابير سلامة الغذاء	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
4. البيئة المحيطة بالكشك لا تسبب أي خطر على الطعام	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
5. يجب وضع قواعد وشروط لتنظيم بيع الطعام في شوارع المدينة	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
6. الحكومة مسؤولة عن توفير محطات عمل نظيفة و مراحيض مخصصة للبائعين المتجولين	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة
7. أثرت الأزمة الاقتصادية	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة

على طريقة تعامل البائعين مع سلامة الغذاء					
8. غالبًا ما يبالغ العاملون في مجال الصحة في فكرة سلامة الغذاء	☐ لا أوافق مطلقا	☐ لا أوافق	☐ حيادي	☐ أوافق	☐ أوافق بشدة

د. الممارسات:

أجب بنعم أو لا:

1. ابدأ العمل بغسل اليدين	☐ نعم	☐ لا	☐ لا يطبق	
2. افصل الطعام النيء عن المطبوخ	☐ نعم	☐ لا	☐ لا يطبق	
3. أقوم بتخزين الطعام بدقة على درجة حرارته الآمنة	☐ نعم	☐ لا	☐ لا يطبق	
4. أقوم بتغطية كاملة للمنتجات عندما لا تكون قيد الاستخدام	☐ نعم	☐ لا	☐ لا يطبق	
5. اخزن المنتجات الغذائية من يوم لآخر	☐ نعم	☐ لا	☐ لا يطبق	
6. أتعامل مع النقود أثناء تناول الطعام	☐ نعم	☐ لا	☐ لا يطبق	
7. أدخن أثناء العمل	☐ نعم	☐ لا	☐ لا يطبق	
8. أنفخ الكيس البلاستيكي / استخدم أصابع مبللة للفتح	☐ نعم	☐ لا	☐ لا يطبق	
9. أنظف البيئة المحيطة بمكاني	☐ نعم	☐ لا	☐ لا يطبق	
10. أنظف الأواني أكثر من مرة في اليوم	☐ نعم	☐ لا	☐ لا يطبق	

7.5. Leaflet


Food Safety
&
Its Importance
What is Food Safety?
-Good food handling
-Good food cooking
-Good food storing
Why is it important?
-prevent Food Poisoning
Keep consumer satisfied
Main Food Poisoning symptoms
NAUSEA
DIARRHEA
CRAMPS
FEVER
HEADACHE
DIZZINESS
PREVENTION METHODS
CLEAN YOUR HANDS & SURFACES
SEPARATE FOOD
COOK TO RIGHT TEMPERATURE
STORE FOOD CORRECTLY
YOU MAKE A DIFFERENCE

7.6. Arabic Leaflet

REFERENCES

1. Charles Muyanja, L.N., Namugumya Brenda, George Nasinyama, *Practices, knowledge and risk factors of street food vendors in Uganda.* Food Control, 2011. **22**: p. 1551-1558.
2. Organization, W.H., *Essential safety requirements for street vended foods* in *Food safety issues*. 2014: Geneva.
3. Manisha Choudhury, L.M., Jayashree Goswami, Minakshi Mazumder and Barnali Pegoo, *Socio-economic profile and food safety knowledge and practice of street food vendors in the city of Guwahati, Assam, India.* Food Control, 2011. **22**: p. 196-203.
4. Nesci, D.P.a.F.S., *Globalization vs. local. The role of street food in the urban food system.* ScienceDirect, 2015. **22**: p. 716-722.
5. Akintaro, O.A., *Food Handling, Hygiene and the Role of Food Regulatory Agencies in Promoting Good Health and Development in Nigeria.* International Journal of Health and Medical Information, 2012. **1**.
6. WHO, *Essential safety requirements for street-vended foods, Revised Edition*. 1996.
7. European Food Safety Authority, E.C.f.D.P.a.C., *The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2016.* eFSA Journal, 2017.
8. FAO, *Food safety: a right or a privilege* 2018.
9. MoPH. *General surveillance data*. 2022 12 July 2022 1 August 2022]; Available from: https://www.moph.gov.lb/en/Pages/2/194/%D8%A7%D9%84%D8%A8%D9%8A%D8%A7%D9%86%D8%A7%D8%AA-%D8%A7%D9%84%D9%88%D8%A8%D8%A7%D8%A6%D9%8A%D8%A9#/en/view/195/general-surveillance-data-current-year.
10. shaanika, e.s., *assessing the knowledge, attitudes and practices of street food vendors with regard to food hygiene and safety in tobias hainyeko constituency windhoek, khomas region, namibia*. 2020, The University of Namibia. p. 79.
11. Myriam Loukieh, E.M., Chantal Abou Jaoudeh, Lara Hanna Wakim, Francesco Fancello and Marc Bou Zeidan, *Street foods in Beirut city: An assessment of the food safety practices and of the microbiological quality.* Journal of Food Safety, 2018.
12. Sangmook Lee, H.P.a.Y.A., *The Influence of Tourists' Experience of Quality of Street Foods on Destination's Image, Life Satisfaction, and Word of Mouth: The Moderating Impact of Food Neophobia.* International Journal of Environmental Research and Public Health, 2020. **17**.
13. Ceyhun Sezgin, A., and Şanlıer, N., *Street food consumption in terms of the food safety and health.* Journal of Human Sciences, 2016. **13**(3): p. 4072-4083.
14. Mak, A.H.N.L., M. ; Eves, A. ; Chang, R. C. Y., *An application of the repertory grid method and generalised procrustes analysis to investigate the motivational factors of tourist food consumption.* International Journal of Hospitality Management, 2013. **35**: p. 327-338.

15. (MFMER), M.F.f.M.E.a.R. *E. coli*. 2022; Available from: https://www.mayoclinic.org/diseases-conditions/e-coli/symptoms-causes/syc-20372058?p=1.
16. Daher Hussein, N.H., *Assessment of the Microbiological Acceptability of Akkawi Cheese in Beirut and the Antimicrobial Resistance Profiles of Associated Escherichia coli*, in *Department of Nutrition and Food Sciences*. 2022, American University of Beirut: AUB ScholarWorks.
17. UNIDO, *Biological risk assessment of Dairy Sector in Lebanon*. 2009.
18. Hassan, H.E.D., Nada; and Al Khatib, Alissar, *FOOD SAFETY PRACTICES AMONG FOOD CARTS IN -NORTH LEBANON*. BAU Journal - Health and Wellbeing, 2022. **4**(2).
19. m.s. hifnawy, e.a., *the role of aflatoxin-contaminated food materials and hcv in developing hepatocellular carcinoma in al-sharkia governorate, egypt.* Journal of the Egyptian Society of Parasitology, 2004. **34**(1).
20. Mohamad Diab, M.H., Richard Bonnet, Estelle Saras, Jean-Yves Madec, Marisa Haenni, *Extended-spectrum beta-lactamase (ESBL)- and carbapenemase-producing Enterobacteriaceae in water sources in Lebanon.* Veterinary Microbiology, 2018. **217**: p. 97-103.
21. Thompson, S., *Microbiological Spoilage of High-Sugar Products*, in *Compendium of the Microbiological Spoilage of Foods and Beverages*, M.P.D. William H. Sperber, Editor. 2009: Food Microbiology and Food Safety.
22. chronicle, d. *Four-year-old dies after eating jelly toffee in Kozhikode*. 2017 16/04/2022; Available from: https://www.deccanchronicle.com/nation/current-affairs/160417/four-year-old-dies-after-eating-jelly-toffee-in-kozhikode.html.
23. Aderoju, A.M.O.a.S.T., *Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria.* Food Control, 2008. **19**: p. 396-402.
24. Abrahale K., S.S., Albuquerque G., Padrao and L.N. P., *Street food research worldwide: a scoping review.* J Hum Nutr Diet, 2019. **32**: p. 152-174.
25. abbey, d.a., *food safety and hygienic practices among food vendors in shukura community, able kuma central submetro*, in *college of health sciences* 2017, University of Ghana.
26. Ayad, A.A.A., N.M.; Khateeb, N.A.; Hijazi, M.A.; Williams, L.L, *Saudi Arabia Household Awareness and Knowledge of Food Safety.* foods, 2022. **11**.
27. FAO, *Report of an technichal meeting on street foods*. 2013.
28. Neha Chauhan, V.U.a.D.S.R., *Microbial profiling of street foods of different locations at Dehradun city, India.* International Journal of Current Microbiology and Applied Sciences, 2015. **4**(1): p. 340-347.
29. Adjrah, Y., Soncy, K., Anani, K., Blewussi, K., Karou, D. S., Ameyapoh, Y., de Souza, C. and Gbeassor, M, *Socio-economic profile of street food vendors and microbiological quality of ready-to-eat salads in Lomé.* International Food Research Journal, 2013. **20**(1): p. 1835-1840.
30. Sally F. Bloomfield, M.E., Carlo Signorelli, Kumar Jyoti Nath, Elizabeth A. Scott, *The infection risks associated with clothing and household linens in home and everyday life settings, and the role of laundry*. 2011: International Scientific Forum on Home Hygiene.
31. M. A. Abdalla, S.E.S.a.A.O.B., *Food safety knowledge and practices of street foodvendors in Atbara City (Naher Elneel State Sudan).* African Journal of Biotechnology, 2009. **8**.

32. K. Kim, H.L., E. Gwak, and Y. Yoon, *Kinetic Behavior of Escherichia coli on Various Cheeses under Constant and Dynamic Temperature.* Asian-Australasian Journal of Animal Sciences 2014. **27**(7): p. 1013-1018.
33. Caroline Isabel Kothe, C.H.S., Eduardo César Tondo, Patrícia da Silva Malheiros, *Microbiological contamination and evaluation of sanitary conditions of hot dog street vendors in Southern Brazil.* Food Control, 2016: p. 346-350.
34. Abdallah, M.N.a.M., *bacteriological quality of street -vended um-jingir: a traditional sudanese food.* African Journal of Food, Agriculture Nutrition and Development, 2011. **11**(5).
35. *Bacillus cereus*. Available from: http://www.bccdc.ca/health-info/diseases-conditions/bacillus-cereus#:~:text=Bacillus%20cereus%20is%20a%20foodborne,ingestion%20of%20the%20contaminated%20food.
36. Abdulmajid, N., Bautista, M. K., Bautista, S., Chavez, E., Dimaano, W. and Barcelon, E, *Heavy metals assessment and sensory evaluation of street vended foods.* International Food Research Journal, 2014. **21**(6): p. 2127-2131.
37. Callano, A.A., *Rancidity of used cooking oil and heavy metal analyses on selected street vended foods.* UIC Research Journal, 2012. **18**(1): p. 77-86.
38. Giovanni M. Giammanco, A.P., Aurora Aleo, Valentina D'Agostino,Samuela Milone, Caterina Mammina, *Microbiological quality of Pecorino Siciliano "primosale" cheese on retail sale in the street markets of Palermo, Italy.* New Microbiologica, 2011. **34**(2): p. 179-185.
39. Zengran Liu, G.Z., Xiangmei Zhang, *Urban street foods in Shijiazhuang city, China: Current status, safety practices and risk mitigating strategies.* Food Control, 2014. **41**: p. 212-218.
40. Mota PF, M.L., Shadday L, Araújo C, Mendes KGB, Reis AKV, Brandão F., *Parasitological analysis of sugarcane juice marketed in the Federal District.* 2020. **9**(1): p. 65-76.
41. Tesfaye Wolde Bereda, Y.M.E., Melese Abate Reta, Henok Sileshi Asfaw, *Microbiological Safety of Street Vended Foods in Jigjiga City, Eastern Ethiopia.* Ethiopian Journal of Health Sciences, 2016. **26**(2).
42. Rane, S., *Street Vended Food in Developing World: Hazard Analyses.* Indian Journal of Microbiology, 2011. **51**(1): p. 100-106.
43. Caroline Isabel Kothe, C.H.S., Eduardo César Tondo, Patrícia da Silva Malheiros, *Short communication Microbiological contamination and evaluation of sanitary conditions of hot dog street vendors in Southern Brazil.* Food Control, 2016: p. 346-350.