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Research Article

Food Safety Knowledge Among Chicken Shawerma Food Handlers in Amman-Jordan

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Abstract

Aims. Several food poisoning outbreaks in Jordan were due to *Salmonella* species isolated from chicken shawerma. This study aimed to assess the food safety knowledge among chicken shawerma food handlers in Jordan. **Methods.** Forty chicken shawerma restaurants in Amman were selected randomly and 120 food handlers (Egyptians 53%, Jordanians 26% and Syrians 19%) were interviewed using a structured questionnaire. Descriptive and multivariate data analysis was conducted to assess their knowledge about food safety. **Results.** Low overall mean score of food safety knowledge (40%); the mean percent of correct answers about transportation, receiving of chicken shawerma, storage, preparation, selling, and controlling microorganisms were: 63%, 54%, 45%, 31%, and 26%, respectively. Ninety percent of the participants had no previous training in food safety concepts. Better food safety knowledge was significantly associated ($p > 0.05$) with higher educational levels, receiving special training in food safety and having a Jordanian nationality. **Conclusions.** This study recommends establishing a comprehensive food safety program in Jordan to build the capacity of the food handlers and enforce periodic evaluation of their food safety knowledge and evidence-based best practices.

Keywords: Food safety knowledge, Food handlers, Restaurants, Jordan

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1. Introduction

The World Health Organization (WHO) emphasizes the importance of food safety as a global public health concern due to the rising number of food safety problems, coupled with recurring consumers' uncertainties [1]. Food-borne diseases can occur in any step of the long food chain cycle and people can get sick (Alhaddad et al., 2013; Azizieh, 2012; McIntyre et al., 2013; Osaili et al., 2013)]. Food handlers are considered one of the most important factors in the food chain since they come in direct contact with food during its transportation, storage, preparation and selling. Food-borne diseases

can create an enormous burden on the economy, including medical, legal, and other expenses (Harakeh et al., 2005).

In Jordan most outbreaks of food poisoning have been attributed to *Salmonella* species isolated from chicken shawerma, which is consumed on a large scale by all classes of society (Kiswani and Nsour, 2007; Osaili et al., 2013). In 2007, the Jordan Food and Drug Administration (JFDA) set a new regulation of code of practices regarding handling shawerma (JFDA, 2007a). In the same year, a national food safety training program was initiated, and food handlers were compelled to get this training, especially those who work in shawerma restaurants. Unfortunately, this program was terminated with no justifiable reason. In 2010, the WHO published a comprehensive assessment of food safety in Jordan, that evaluation included major concerns about the health implications of poor knowledge and practices in food handling, limited human resources with food safety knowledge, inadequate consumer awareness and lack of regulation of street foods and food handlers [9]. Few studies were conducted in Jordan to estimate food handler's knowledge and practices. Osaili et al. published a study that aimed to assess the food safety knowledge among food workers in restaurants in Jordan (Osaili et al., 2013). The study revealed that the overall knowledge of food handlers on food safety concepts was fair. On the other hand, food handlers had poor knowledge about food-borne pathogens and safe storage, thawing, cooking and reheating of the foods but had good knowledge with regard to personal hygiene and symptoms of food-borne illnesses. Food handlers who received previous food safety training had a higher total food safety knowledge score than those who did not receive training.

Another study was conducted in Jordan by Sharif et al., which targeted 200 food handlers in military hospitals to assess their food hygiene knowledge, attitudes and practices [10]. The study found that food handlers in the military hospitals expressed high level of knowledge, positive attitudes and good practices in food safety. Still, there is a gap of knowledge in Jordan concerning the awareness of safety concepts among the workers in popular street food restaurants. Thus, this study aimed to investigate the food safety knowledge of chicken shawerma food handlers in Amman.

2. Methods

2.1. Settings

The Hashemite Kingdom of Jordan is divided into 12 governorates. Amman is considered the largest governorate in terms of its inhabitants, and it is the capital city of Jordan. Amman consists of 22 municipalities and has around 3070 restaurants. Out of

these restaurants, there are 400 restaurants specialized in chicken and meat shawerma and they are distributed throughout the city as per the April, 2014 JFDA statistics (JFDA, 2014) .

2.2. Study design

A cross-sectional study was designed to conduct face-to-face interviews with chicken shawerma food handlers by using a structured questionnaire. The data collection took place in the period starting from 1 April 2014 until 30 June 2014.

2.3. Ethical approval

The ethical clearance for this study was issued by the University of Jordan Research Ethics Committee and the JFDA. Confidentiality and autonomy of the participants were insured. They were informed of the purpose of the study, the voluntary nature of their participation, and their right to access findings. Informed written consent was signed by all the participants. All the procedures performed in this study were in accordance with the ethical standards of the 1964 Helsinki declaration.

2.4. Food safety knowledge questionnaire

We developed the food safety knowledge questionnaire for this study based on the JFDA Shawerma food safety code of practice (JFDA, 2007b) and after an in-depth review of literature (Bolton et al., 2008; Municipality of Dubai, 2013; Osaili et al., 2013). The first part of the questionnaire was designed to collect socio-demographic characteristics, whereas the second section covered major food safety knowledge categories including safe food handling during:

- transportation and receiving of chicken shawerma (4 questions).
- storage of chicken shawerma (13 questions).
- preparation of chicken shawerma (18 questions).
- selling of chicken shawerma (12 questions).

In addition, there were 7 questions about the knowledge of controlling microorganisms' growth and multiplication in food.

2.5. Instrument validity and reliability

The food safety knowledge questionnaire was carefully examined by professors from renowned local universities. They checked the appropriateness of the questions and provided valuable comments. Furthermore 'Cronbach' alpha coefficient was used to find out the reliability of the food safety knowledge questionnaire.

2.6. Pilot study

The questionnaire was pilot tested by using a concurrent 'think -aloud' technique (Firestone, 1987) on 16 chicken shawerma food handlers for the purpose of seeking comments on the clarity of statements and length of time needed to complete the developed questionnaire. Questions were then modified to come up with the final version. The questionnaire was completed within 20 minutes by the food handlers.

2.7. Study sample

This study targeted the chicken shawerma food handlers in the 400 restaurants in Amman. Assuming that each restaurant has at least three food handlers involved in shawerma preparation; one is responsible for preparation of shawerma skewers and storage inside the operational room, the second is responsible for slicing the chicken shawerma while the third is responsible for preparing, wrapping, and selling sandwiches. Hence, the minimum number of shawerma food-handler workers in the 400 restaurants will come up to approximately 1,200 workers.

Geographical stratification was carried out for the 400 restaurants, then Percentage per geographical location of the restaurants was computed, the number of restaurants to be taken from each area was calculated using simple random sampling. A total of 40 restaurants were selected from each geographical area. After that, three food handlers were taken from each of these restaurants. The total sample of participants was 120 chicken shawerma food handlers.

2.8. Data collection

A total of 120 questionnaires were distributed among chicken shawerma food handlers to assess their food safety knowledge. The interviews were conducted by the first

author to ensure that all the respondents equally understood the questions. All questionnaires were collected, making the response rate 100%. Upon checking and validating the collected questionnaires, 3 were discarded because of incomplete responses; hence the final sample was 117 participants.

2.9. Statistical analysis

The statistical analysis for this study was carried out using SPSS version 20. Descriptive data analysis was conducted (means, frequencies, and standard deviations). Student t-test, One-way Analysis of Variance (ANOVA), and Pearson correlation were used to assess the food safety knowledge and the associations between knowledge and various socio-demographic characteristics of the study participants. Fisher exact test was used for categories with < 5 frequency. P-value was set at < 0.05 to be considered statistically significant.

The knowledge level of chicken shawerma food handlers was calculated by adding the scores of correct answers in each category including transportation, receiving, storage, preparation, selling, and controlling microorganisms in chicken shawerma sandwiches. The Mean percent of total knowledge was calculated for each studied socio-demographic variable. Furthermore, standard deviation and significant association were computed. The total number of questions in all the categories was 54 questions. Each correct answer was given 1 score and incorrect answers or I do not know were given a 0 score. The highest possible score was 54. Independent sample t-test and One-way ANOVA test were used to compare the mean knowledge scores among different educational levels, nationality, and scope of experience of the food handlers.

3. Results

3.1. Study participants

Almost half of the participants were within 30–39 years age group. Of the participants in our study, 43% had diploma degree. More than half of the correspondents (53%) held the Egyptian nationality, while 26% were Jordanians, and 19% were Syrians. The majority of the food-handling workers (90%) did not receive training on food safety. Only 11% of the correspondents have been in the current job for 7 or more years, while 56% have been in the current job for 1–3 years. The socio-demographic characteristics of the respondents are presented in Table 1.

Table 1: Frequency and percentage of socio-demographic and personal characteristics of the respondents.

Characteristics		*n*	%
Educational level	Can read and write	3	2.6
	Elementary	3	2.6
	Preparatory	19	16
	Secondary	30	26
	Diploma	50	43
	Bachelor	12	10
Age	< 30	39	33
	30–39	57	49
	≥40	21	18
Nationality	Jordanian	30	26
	Egyptian	62	53
	Syrian	22	19
	Other	3	2.6
Experience in current job	1–3 years	65	56
	4–6 years	39	33
	≥ 7	13	11
Scope of past experience	In shawerma restaurants	44	38
	In restaurants in general	51	44
	Other	22	19
Years of past experience in food handling	≤ 5	69	59
	6–10	38	33
	≥ 11	10	8.5
Training in food safety	Has training	12	10
	No training	105	90

3.2. Food safety knowledge

This study tested the workers' knowledge in several elements concerning food safety in regards to transporting and receiving (Table 2), storing (Table 3), preparing (Table 4), selling (Table 5) and controlling microorganisms (Table 6) in chicken shawerma.

Regarding transportation and receiving of chicken shawerma, the percent average of correct responses was 63%. Although 97% of the correspondents believed that it is necessary to check the temperature of the transporting vehicle of chilled and frozen meat, only 45% and 39% knew the correct temperature of the transportation vehicle, respectively. Seventy-one percent of the correspondents knew the optimal time needed for transporting chicken shawerma prepared outside the restaurant from the chilled truck to the restaurant fridge.

The percent average of correct responses regarding optimal storage of chicken shawerma was 54%. Ninety-eight percent of the correspondents believed that it is necessary to check the temperature of the refrigerators and freezers in the restaurant. However, only 38% and 33% knew the correct running temperature of the refrigerators and freezers, respectively. Most of the correspondents (83%) believed that it is necessary to separate raw chicken from vegetables, but when they were asked about the correct place for storing vegetables in the refrigerator that is used also for storing/thawing meat, only 43% knew that vegetables should be stored in the upper shelves and meat should be stored in the lower shelves. The majority of the correspondents (98%) believed that it is necessary to cover marinated chicken in the refrigerators, however, only 50% knew that this practice is necessary to prevent cross contamination.

Table 2: Frequency and percent of the correct answers in food safety knowledge regarding storage of Chicken Shawerma.

Query Statement	*n*	(%)
1-Is it necessary to checkup the temperature of the fridge in your restaurant periodically?	115	98
2-What is the optimal temperature for storing chilled chicken?	44	38
3-What is the optimal temperature for storing frozen chicken?	39	33
4-In the chilling room with shelves for storing vegetables and chicken, where is the suitable place for storing chicken?	50	43
5-What is the dangerous temperature zone range in which the microorganisms multiply?	22	19
6-Is it necessary to cover the marinated chicken inside your fridge?	115	98
7-Why, it is necessary to cover the marinated chicken inside the fridge	59	50
8-If you have a food item in your restaurant with expiry date in the next month. What is the correct procedure from the following choices (i.e. Disposal 1st day of the month, last day of the month, return it to the supplier, or unsure)?	37	32
9-Is it safe to keep the shawerma skewer outside the fridge during summer without affecting its safety and quality?	41	35
10-Is it safe to keep the shawerma skewer outside the fridge during winter without affecting its safety and quality?	14	12
11-What are the signs of meat deterioration?	93	79
12-What is the best way to deal with the remnants of the shawerma skewer?	100	85
13- Is it necessary separate raw chicken from vegetables and other materials?	97	83
Mean % of correct answers to food safety knowledge in this category	**54%**	

Regarding the preparation of chicken shawerma, all the participants answered correctly that stainless steel or glass are best material of utensils for marinating chicken shawerma. However, only 54% of them correctly justified why they chose these materials. Only 7% of food handlers knew that frozen chicken was safer than fresh chicken.

Fifty-six percent of the correspondents knew that frozen meat should be thawed in the refrigerator but only 15% knew the optimal temperature of the shawarrma preparation room.

Table 3: Frequency and percent of the correct answers in food safety knowledge regarding Chicken Shawerma preparation.

Query Statement	*n*	%
1-What is safer to use for shawerma; frozen or chilled chicken?	8	6.8
2-If you choose either one in the previous question, why?	64	55
3-What is the safest method for thawing the frozen chicken?	66	56
4-If you thaw frozen chicken in the fridge, what is the optimal temperature for that?	20	17
5-What is the optimal temperature of the room where chicken shawerma is prepared?	17	15
6- What is the best source of water for preparing shawerma?	110	94
7-What is the best material of utensils for marinating chicken shawerma?	117	100
8-Why is stainless steel considered the best of these materials?	63	54
9-What is the maximum approved weight and diameter for the shawerma skewer by JFDA?	51	44
10-Is it important to distinguish knives used for chicken shawerma preparation from knives used for preparing other food items?	116	99
11-What is the best way for distinguishing knives used for chicken shawerma preparation from others?	14	12
12-Where is the best place for keeping shawerma skewer after preparation?	53	45
13-What is the optimal temperature for keeping chicken shawerma skewer?	17	15
14-What is the best way for cleaning utensils?	43	37
15- What is the best way for cleaning refrigerators?	44	38
16- What is the best way for cleaning hands?	43	37
17- What is the best way for cleaning tables before and after preparation of chicken shawerma?	37	32
18-What is the best and safest disinfectants of hands and tables?	71	61
Mean % of correct answers to food safety knowledge in this category	**45 %**	

The percent average of correct responses to questions about food safety in selling chicken shawerma was 30%. While 96% of food handlers answered correctly when asked about the necessity to wash their hands before using gloves, only 10% knew the best duration of hand washing as per the JFDA recommendations (for at least 20 seconds) .

The percent average of correct answers to the knowledge questions related to the effect of chilling and freezing on microorganisms was 26% (Table 5).

Total food safety knowledge scores were significantly (P <0.05) higher among respondents with bachelor's degree, had Jordanian nationality, and those who had previous training in food safety measures.

Table 4: Frequency and percent of the correct answers in food safety knowledge regarding selling of Chicken Shawerma.

Query Statement	*n*	%
1- Is it necessary to wash your hand before using gloves?	112	96
2- What is the best duration for hands washing?	12	10
3-Where is the best and safest place for knives sharpening?	28	24
4-What is the best way for knives cleaning after sharpening?	17	15
5-What is the best way for measuring the chicken shawerma temperature on the grill?	40	34
6-What is the safe temperature for chicken shawerma meat before serving?	24	21
7-What is the best way to know that chicken shawerma is well done and ready to serve?	14	12
8-If you are using forceps, is it necessary to wash your hands before serving.	115	98
9-What is in your opinion the best way for receiving the money from a customer?	11	9.4
10- Is it safe to use handmade mayonnaise? Why?	46	39
11- Where is the safest place for reserving sliced shawerma pieces?	4	3.4
12-What is the optimal temperature for keeping sliced chicken shawerma pieces?	9	7.6
Mean % of correct answers to food safety knowledge in this category	**30%**	

Table 5: Frequency and percent of the correct answers in food safety knowledge regarding controlling microorganisms in food.

Query Statement	*n*	%
1-Is there is a risk for microorganisms multiplication in shawerma?	113	97
2-What are the most common microorganisms responsible for food poisoning?	31	26
3- What are the bacteria types responsible for shawerma poisoning in Jordan?	40	34
4-What are the needed precautions to control microorganisms?	22	19
5-What is the effect of chilling on microorganisms?	2	1.7
6- What is the effect of freezing on microorganisms?	2	1.7
7-What is the time needed for microorganisms to multiply in optimal conditions?	5	4.2
Mean % of correct answers to food safety knowledge in this category	**26%**	

4. Discussion

The results of this study showed low overall food safety knowledge among the chicken shawerma handlers which is a matter of public health concern in Jordan. The participants had a relatively fair knowledge about food safety measures regarding transportation, receiving of chicken shawerma, storage and preparation. However, their knowledge scores were poorer regarding the safety measures during selling the

Table 6: Variations in the knowledge level of Chicken Shawerma food handlers across different educational levels, nationality, scope of experience and training in food safety.

Characteristics		*n*	Mean	% correct answers	SD	F	*p*-value
Education level	Bachelor	12	30.0833	56%	91.13991	3.154	0.011*
	Diploma	50	22.2000	41%	6.07437		
	Secondary	30	21.9474	41%	7.70281		
	preparatory	19	21.6667	40%	6.44182		
	elementary	3	20.6667	38%	2.51661		
	Write and read	3	20.000	37%	3.60555		
Nationality	Jordanian	30	27.3667	51%	9.40830	6.417	0.000*
	Egyptian	62	21.0645	39%	5.63325		
	Syrian	22	21.4545	40%	5.32494		
	Other	3	20.3333	38%	2.08167		
Scope of experience	In shawerma restaurants	44	23.0455	43%	7.35149	0.246	0.782
	Restaurants in general	51	22.8824	42%	7.87565		
	Other	22	21.7727	40%	5.00411		
Training	Has training	12	34.5000	64%	7.96013	5.543	0.000*
	No training	105	21.3905	40%	5.74204		

* *P*-value < 0.05, it is significant, meaning that the study have a significant association between variables.

n: Sample Size; SD = standard deviation = calculated value for ANOVA test; Significant value = *p*-value; Knowledge level % = (Mean /54).

chicken shawerma and controlling microorganisms. Higher overall food safety knowledge scores were found among respondents with bachelor's degree, had Jordanian nationality and those who had previous training in food safety measures.

In our study, only 10% of food handlers received training in food safety compared to a study conducted in Turkey, which revealed that 88.3% of food handlers received training on hygiene (Yard mc et al., 2015). Both studies show that those who have received training and are university graduates express the best knowledge on food handling safety measures (Yard mc et al., 2015). DeBess et al. also found that college graduates scored better on questions about safety measures (DeBess et al., 2009).

No significant relation was found between the years of experience food handlers had and their food safety knowledge, which is in concordance with the results obtained by Osaili et al. (Osaili et al., 2013).

Most of the food handlers (97%) knew it was necessary to check the temperature of chilled and frozen chicken trucks before receiving the chicken, but only 45% and 39% knew what the optimal temperature for chilled transportation and frozen transportation of food was. Moreover, it was found that 98% of food handlers believed that it was

necessary to periodically check the temperature of the refrigerators at the restaurant, but only 38% and 33% of them knew what the optimal temperatures for storing chilled chicken and frozen chicken, respectively, were, similar to the results Onyrnrho and Hedberg (Onyeneho and Hedberg, 2013) obtained: only 38% of the participants knew the ideal refrigerator temperature. On the other hand, a study conducted in Ireland (Bolton et al., 2008) where 80% of food handlers received training in food safety showed that 97% of them knew the recommended temperature range for storing chilled and frozen food. This pattern of knowledge displayed by the food handlers we interviewed shows that most of them have a general idea about safety measures, but lack knowledge about the important specific guidelines because of the insufficient food safety training received.

We found that only 37% of food handlers knew the best way to clean their hands before preparing food, and 10% knew the best duration to wash their hands before selling food, which is significantly less than the result obtained by Osaili et al. (Osaili et al., 2013): 32% of their correspondents knew the best duration of hand-washing. The results obtained are alarming, as contaminated hands could contribute to the spreading of *Salmonella paratyphi A* (Nimri et al., 2014) and may be the main method of transmission of enteric viruses (Lillquist et al., 2005). However, a satisfactory 96% of correspondents knew that hands should be washed before wearing gloves.

Only 37% of food handlers knew the best way to clean utensils. This might be a major contributor to the spread of food-borne pathogens, as supported by the results of a study conducted in France by Gallay et al. (Gallay et al., 2008) that showed that poor utensil hygiene in the kitchen is a significant factor to acquiring *Campylobacter* infection.

Ninety-nine percent of the correspondents knew that it was important to distinguish knives used to prepare the chicken shawerma from other knives, but disconcertingly, only 12% of them knew how to do so. This could be a major contributor to cross-contamination, as revealed by Redmond et al. (Redmond et al., 2004).

The food handlers had the poorest knowledge regarding controlling microorganisms in food among other food safety measures (26%). Only 34% of the correspondents knew what the most common type of bacteria to cause food poisoning in Jordan is. Additionally, only 4.2% knew the time needed for microorganism to multiply in optimal conditions. These results emphasize the need for food safety training so that food handlers can know the different strains of pathogens found in different food types, the optimal conditions for microorganism growth, and the best methods to control microorganism and avoid contamination (Bolton et al., 2008).

In our study, overall food safety knowledge scores were higher among respondent with bachelor's degree, those that had a Jordanian nationality, and those who had

previous training in food safety measures. The Social Cognitive Theory (SCT) states that behavior is shaped by the dynamic interaction between three determinants: behavioral, personal, and environmental influences (Versnik Nowak and Dorman, 2008). According to Bandura, self-efficacy construct of the SCT "refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Bandura, 1995). Educating and training food handlers about food safety measures and hygiene will undoubtedly increase their self-efficacy and contribute to better food management. Nieto-montenegro et al. found that the best approach to improve safety measures undertaken by food handlers is by combining standard training and social cognitive behavioral interventions (Nieto-montenegro et al., 2008). They suggest that to increase the effectiveness of a training program, food handlers' behavior, beliefs, and knowledge, and the interaction between these three factors must be understood, as well as by targeting the food handlers' motivational systems. Furthermore, they found that there was a beneficial outcome when supervisors adopted the position of role models.

Regarding personal influences, in a training program conducted by Soon and Baines, cases of victims of food poisoning were shared to improve the attitude of farm workers toward hand-washing by incorporating fear and enhancing risk perception (Soon and Baines, 2012).

As for environmental influences, Pilling et al. believe that adequate hand washing facilities and time will encourage food employees to wash their hands properly (Pilling et al., 2008). Moreover, food handlers should be reminded to perform food safety behavior (Pilling et al., 2008). Posters could serve as a proper reminder (Nieto-montenegro et al., 2008).

4.1. Strengths and limitations

The relatively small sample size of 120 food handlers is a limitation in this study. A larger sample size would have certainly contributed to more generalizable results, this was not feasible due to time and financial constraints.

This study was based on the assumption that there is a maximum of three food handlers involved in chicken shawerma preparation in every restaurant, which is not necessarily true. Ideally, all food handlers must be interviewed and their food knowledge assessed in order to get a better picture of the situation. However, this could not be performed because the restaurant owners did not allow all the employees to participate in the study as to not affect the restaurants' work flow.

The study covered the chicken shawerma restaurants in Amman only. Other provinces, which might probably have lower monitoring level of control by the supervisory authorities, where not addressed in the study.

The strength behind this cross-sectional study lies in the fact that it is a snapshot of a very specialized sector of restaurants that recorded the largest food-poisoning outbreak in the country, which has not been covered in any published article before. Moreover, to minimize the sampling bias, the restaurants were subjected to a geographical stratification, a percentage per geographical location was computed and a simple random sample amounting to 40 restaurants were selected from each geographical area, then three food handlers were taken from each of these restaurants.

There are some studies conducted in Jordan that have estimated food handler's knowledge and practices, but the uniqueness of this research resides in studying the preparation and selling of the shawerma sandwiches specifically. That is why the research team developed an exclusive questionnaire to assess the food safety knowledge of restaurant workers in this field.

The questionnaire covered all the processes of chicken-shawerma handling in order to provide a clear representation of the knowledge and practices of restaurant workers in this field.

5. Conclusion

This study revealed that food handlers' overall knowledge was poor in food safety issues that were assessed in the questionnaire. We assume that the poor knowledge of the workers will lead to incompliant practices, which could be a major contributing factor to a microbial contamination of the chicken shawerma sandwiches. Likewise, the statistical analysis of the collected data showed that there was a significant variation in the knowledge of chicken shawerma food handlers across different educational levels for the favor of bachelor degree holders. Our data also indicated that there was a significant variation seen in the assessment of the knowledge of chicken shawerma food handlers across different nationalities for the favor of the food handlers holding Jordanian nationality.

6. Recommendations

This study provided important data about the level of the knowledge of chicken shawerma food workers in Amman. We recommend further studies to investigate the impact of food safety knowledge among chicken shawerma food handlers' on their compliance with food safety practices. It is indisputable that poor knowledge about

safety measures undertaken by food handlers is a major cause of food contamination and illnesses, and might yield future outbreaks of food poisoning. However, other factors play a role in food safety, including limited human resources, inadequate consumer awareness, the overlap of responsibilities across the food chain, the lack of multidisciplinary inspection teams and regulation of street foods and food handlers, and limited laboratory services (Nimri et al., 2014). All of these issues must be properly addressed to ensure food safety.

Therefore, this study proposes the following recommendations

The Ministry of Labor in Jordan must reconsider the instructions and regulations related to food handlers. For example, the workers must obtain training certificate in food safety before they start working in restaurants.

The food authority in Jordan must activate the training program which was provided for the shawerma food handlers and stated in the JFDA code of practice (JFDA, 2007b)(JFDA, 2007a). Furthermore, it should perform periodic evaluations for their knowledge and practices in a comprehensive food safety program by qualified trainers.

The media and newspapers must also participate in providing knowledge to the consumer on food safety.

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Conflicts of Interest

All the authors declare that they have no conflicts of interest.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available because of the confidentiality principle of the research project.

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