



## Food safety knowledge among food workers in restaurants in Jordan

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### ABSTRACT

Food handlers working at restaurants play a major role in transmission of foodborne diseases. This study aimed to measure food safety knowledge of food handlers working at fast food restaurants in Jordan. A total of 1084 food handlers in 297 fast food restaurants were participated in this question survey study. The overall knowledge of food handlers on food safety concepts is fair. The overall score of correct answers for the food safety tested aspects was 46.47 out of 67 points (69.4%). Correspondents had poor knowledge regarding foodborne pathogens and safe storage, thawing, cooking and reheating of the foods but had good knowledge on personal hygiene and symptoms of foodborne illnesses. Food workers who enrolled in food safety training course had significantly ( $P < 0.05$ ) higher total food safety knowledge score compared with the score of those who did not enroll in a training course. There was no association between the experience of food workers and total food safety knowledge score. Also, there were no association between the other characteristics of food workers and the total food safety knowledge score. This study suggests adopting proper food safety education training courses to food handlers, periodic evaluation of food handlers' knowledge and food safety training course materials and better pay for food handlers would improve the food safety status in foodservice institutions.

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### 1. Introduction

Eating a safe food continues to be one of the major concerns of the societies. Every year, millions of people worldwide are hospitalized or die as a result of eating contaminated foods (WHO, 2000). The burden of foodborne diseases in Jordan is unknown as there is no available estimate of foodborne illnesses. In the United States of America, new estimates of foodborne disease have shown that major pathogens cause 9.4 million incidents of foodborne illness, 55,961 hospitalizations and 1351 deaths each year (Scallan et al., 2011).

Nationally and worldwide, it is evident that life-style and food consumption behaviors have changed. The commitment to food preparation at homes decreased and number of meals eaten out of the home increased. Consumers favor convenience and saving time than proper handling and preparation of food (Collins, 1997; Osaili, Obeidat, Abu Jamous, & Bawadi, 2011). Eating at restaurants has been involved in about 50% foodborne outbreaks in USA and UK

and 22% in Europe (Coleman & Griffith, 1998; Olsen et al., 2001; Tirado & Schmidt, 2001). In Jordan, foodborne outbreaks from eating at restaurants resulted in 1600 hospitalization and one death in 2006 and 2007 (Personal communication).

World Health Organization (WHO, 2006) identified factors associated with foodborne illnesses including poor personal hygiene and sanitation; cross-contamination from other foods; inadequate cooking; temperature abuse (time/temperature) during storage; and purchasing food from unsafe sources. Food workers in restaurants may contribute in foodborne illnesses. They may contaminate food by poor personal hygiene, cross-contaminating raw and processed food, and inadequately cooking and improperly storing foods (Walker, Pritchard, & Forsythe, 2003).

Previous survey studies have revealed that food handlers in catering establishments have lack of knowledge about the basics of food hygiene including critical cooking and storage temperatures of food, cross-contamination, and personal hygiene (Baş, Ersun, & Kıvanç, 2006; Jianu & Chiş, 2012; Martins, Hogg, & Otero, 2012; Walker et al., 2003). These studies have reported mean score of hygiene knowledge in the range of 56–63% (Garayoa, Vitas, Díez-Leturia, & García-Jalón, 2011; Jianu & Chiş, 2012; Martins et al., 2012).

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According to our knowledge, no studies on food handlers' knowledge on major aspects of food safety were conducted in Jordan. Therefore, the objective of this study was to measure the level of food safety knowledge of food handlers working at fast food restaurants in Amman and Irbid cities (the biggest two cities in Jordan).

## 2. Materials and methods

### 2.1. Research design

A cross-sectional study was conducted from February to November 2009 to assess food safety knowledge level among food handlers at fast food restaurants in Amman and Irbid cities.

### 2.2. Participants

A total of 1084 food handlers in 297 fast food restaurants were participated in the study. Based on the writing and reading abilities of the respondents, questionnaires were filled in either by the respondents or by face to face interview. The interviewers have educational backgrounds in food science and were trained by the researchers to conduct the survey.

### 2.3. Food safety knowledge questionnaire

The questionnaire consisted of two parts: the first part focused on workers' socio-demographic information and the second part of the questionnaire covered major food safety knowledge concepts including: personal hygiene (14 questions), cross contamination prevention and sanitation (20 questions), safe storage, thawing, cooking and reheating of the foods (14 questions), knowledge of health problems that would affect food safety (10 questions), knowledge of symptoms of foodborne illnesses (9 questions) and knowledge of important foodborne pathogens (9 questions). All questions were True/False or Multiple Choices Questions that were adapted from published questionnaires (Bolton, Meally, Blair, McDowell, & Cowan, 2008; Kennedy et al., 2005; Omemu & Aderoju, 2008). To reduce the possibility of selecting the correct answer by chance, all questions have the option "not sure". The questionnaire took about 15 min to complete. The questionnaire was pretested on 30 food workers from 10 randomly selected restaurants for clarity, understanding, and timing. No revisions were performed based on the pilot testing as no problems or comments were identified.

### 2.4. Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences, Version 16.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were calculated for all variables. One-way analysis of variance (ANOVA) was carried out to identify the relationship of food workers' characteristics (age, educational level, monthly income level, food workers' experience, and enrollment in food safety training course) with food safety knowledge score. Knowledge scores were calculated by counting of items answered correctly. Findings with a *P*-value <0.05 were considered to be statistically significant.

## 3. Results

### 3.1. General characteristics of the study population

A total of 1084 male food handlers had participated in the study with a mean age of 30.12 years (range = 14–68 years) and their

average years of experience was 7.24 years (range = 1–58 years). More than half of the workers had an educational level  $\geq 12$  years (56.9%,  $n = 590$ ) and had a monthly income level less than 200 Jordanian Dinar (\$282) (57.6%,  $n = 603$ ). About 14.5% ( $n = 156$ ) of the workers reported that they were previously enrolled in food safety training program.

### 3.2. Overall food safety knowledge

The mean knowledge score of the tested food safety aspects are shown in Table 1. The overall score of correct answers for the food safety tested aspects: personal hygiene; cross contamination prevention and sanitation; safe storage, thawing, cooking and reheating of the foods; knowledge of health problems that would affect food safety; and knowledge of symptoms of foodborne illnesses was 47.11 ( $\pm 4.49$ ) out of 67 points, corresponding to 69.4% of questions answered correctly. The "knowledge of important foodborne pathogen" aspect (9 questions) was not included in the overall score to minimize the effect of the "true/false" answers on the overall food safety knowledge score. The food safety aspect with the highest percentage of correct answers was "knowledge of symptoms of foodborne illnesses" (81.7%) while the aspect with the lowest percentage of correct answers was "safe storage, thawing, cooking and reheating of the foods" (52.4%).

### 3.3. Personal hygiene

Ninety percent or more of the correspondents were able to identify the occasions at which they need to wash their hands and knew that gloves should be worn before touching ready to eat foods (Table 2). However, approximately 82% believed that touching a clean counter requires cleaning of the hands. Less than the third of the correspondents (32%) knew the duration that should be spent during washing the hands. More than the third believed that the duration of hand washing depends on the last task.

### 3.4. Cross contamination prevention and sanitation

About half of the correspondents wash cutting board and knife that were used to cut meat or poultry with hot water or hot water and soap before they use them to chop vegetables (Table 3). Similar rate of the correspondents knew the correct procedure for cleaning and sanitizing cutting board and knife and about three fourth of the correspondents knew that the same cutting board and knife must not be used to chop vegetables after were used to cut meat and poultry. About 75% of the correspondents knew the food contact surface should be washed with water and soap then sanitized with a sanitizer. About 14% of the correspondents would store ready to

**Table 1**  
Mean knowledge scores ( $\pm$ SD) of food safety aspects for food handlers at fast food restaurants in Jordan.

Food safety aspect	Mean knowledge scores	Possible range of scores	Percentage of correct responses (n)
Personal hygiene	11.2 $\pm$ 1.0	0–14	79.9 (866)
Cross contamination prevention and sanitation	14.6 $\pm$ 2.7	0–20	72.9 (790)
Safe storage, thawing, cooking and reheating of the foods	7.3 $\pm$ 2.3	0–14	52.4 (568)
Knowledge of health problems that would affect food safety	6.0 $\pm$ 1.2	0–10	60.4 (655)
Knowledge of symptoms of foodborne illnesses	7.4 $\pm$ 1.9	0–9	81.7 (886)
<b>Total knowledge score of food safety</b>	<b>47.1 <math>\pm</math> 4.5</b>	<b>0–67</b>	<b>69.4 (752)</b>

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