



# Food safety knowledge of foodservice workers at a university campus by education level, experience, and food safety training



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## ABSTRACT

Food safety knowledge of university foodservice workers was evaluated and the relationship between food safety knowledge and education level, length of employment, and food safety training was assessed using a 40-item food safety questionnaire. Each knowledge question was scored as “1” for a correct answer and as “0” for an incorrect answer. The relationships between the level of education and food safety knowledge scores and length of employment in the foodservice industry and food safety knowledge scores were determined using bivariate correlation analysis. A total of 63.5% of the respondents had limited knowledge, 79% were well-informed about hygiene practices, while 33.9% of persons knew of correct time-temperature control measures. Kendall's tau = 0.067;  $p = 0.294$  revealed a lack of strength of the relationship between education level and food safety knowledge. The relationship between length of employment and food safety knowledge was Kendall's tau =  $-0.133$ ;  $p = 0.121$ . No mean differences ( $p = 0.426$ ) were observed for mean knowledge scores between groups of food safety trained and untrained persons. Neither education level, nor the length of employment in the foodservice industry had a significant impact on food safety knowledge. The authors recommend that in order to improve food safety knowledge, attention should be given to the planning, implementation, monitoring, and evaluating food safety education programs.

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## 1. Introduction

Food safety is a constant public health concern supported by the fact that in both industrialized and developing countries, the rates of foodborne diseases are increasing and encompass a wide spectrum of illnesses. Numerous devastating foodborne outbreaks of salmonellosis, *Escherichia coli* infections, listeriosis, and other diseases have occurred in these countries. They are the result of ingesting contaminated food items and range from diseases caused by a multitude of microorganisms to those caused by chemical hazards. The World Health Organization (WHO, 2009) highlighted that worldwide, every year, millions of people fall ill and die as a consequence of consuming unsafe food. According to WHO (2011), the global incidence of foodborne disease is difficult to estimate. However, reports have indicated that approximately 15.3% of deaths are caused by infections or parasitic diseases globally, and of these, 4.3% is accounted to diarrheal diseases. The Latin American

and Caribbean region is not immune to this phenomenon. In low- and middle-income countries in this region, 33,000 deaths were attributed to diarrheal diseases, which represent 1% of all deaths and 5.9 deaths per 100,000 population (WHO, 2011). The Caribbean Epidemiological Centre (CAREC, 2011) revealed that human foodborne disease (FBD) pathogens in the Caribbean increased by 26.7%, from 1064 cases in 2005 to 1310 in 2011, with a peak in *Salmonella* in 2010. Human salmonellosis which was the most commonly reported cause of foodborne disease illness and outbreaks in the Caribbean since 1985 continued in 2011, when salmonellosis accounted for 60% of the overall reported FBD pathogens (CAREC, 2011).

Recent global developments are increasingly challenging international health security. Globally, WHO estimates that between 15 and 79% of all cases of diarrhea is due to food contamination. However, for the Latin American and Caribbean region that percentage is approximately 70% (WHO, 2011). Foodborne outbreaks occur frequently when sufficient care is not paid as foods move along the food chain. The challenge is that the food chain is complex and involves production, processing, distribution, and

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preparation to get food to the table. Therefore, contamination can occur at any point along the chain leading to foodborne illnesses. Although many countries have legislation to protect citizens from food related illnesses, frequent outbreaks continue to occur. Food manufacturers have recalled food products from the market due to an outbreak of foodborne illness where consumers became ill or died after consuming contaminated foods (Ingelfinger, 2008). Epidemiological studies (Jones et al., 2004; Olsen, Mackinnon, Goulding, Bean, & Slutsker, 2000) have reported that the majority of foodborne illness outbreaks originate in foodservice entities. Some case control studies (Friedman et al., 2004; Kassenborg et al., 2004; Kimura et al., 2004; Sobel et al., 2000) indicated that “dining-out” is a risk factor for contracting a foodborne illness.

Several factors contribute to the spread of foodborne outbreaks by foodservice workers. Among these factors are improper practices and low level of knowledge (Sharif, Obaidat, & Al-Dalalah, 2013). Mederios, Hillers, Kendall, and Mason (2001) revealed that common food handling mistakes include, serving contaminated raw food, inadequate cooking, or reheating of foods consumption of food from unsafe sources, cooling food inappropriately, and allowing too much of a time lapse. Other contributors to the spread of foodborne outbreaks involve human foodborne pathogens, such as hepatitis A, noroviruses, *Staphylococcus aureus*, *Shigella* sp, and typhoidal *Salmonella* that can be carried by foodservice workers in cuts, sores, mouth, and skin (Sharif et al., 2013). In order to minimize foodborne outbreaks, education must be an integral component of all interventions. Therefore, to plan a successful food safety intervention, obtaining information pertaining to food safety knowledge is of utmost importance. Additionally, making prudent decisions to uproot the problems as early as possible lessens the risk of major foodborne outbreaks. Several studies have reported strong emphasis for educational programs as a way to improve knowledge and control foodborne diseases (Angeliillo, Viggiani, Rizzo, & Bianco, 2000; Baş, Ersun, & Kivanç, 2006; Martins, Hogg, & Otero, 2012; Osaili et al., 2013). Baş et al. (2006) and Nel, Lues, Buys, and Venter (2004) pointed out that food handlers need training and education as a result of their low level of knowledge on microbiological food hazards, temperature control of refrigerators, cross contamination, and personal hygiene. Mortlock, Peters, and Griffith (1999) reported that there is a consensus among authors that knowledge towards food safety as it relates to food handlers and the effective practices of such knowledge in food handling were important in ensuring the safe production of food in any catering operation.

Roberts et al. (2008) postulated that restaurant employees who underwent training were better able to respond to questions on food safety knowledge and behavior than untrained employees. Brannon, York, Roberts, Shanklin, and Howells (2009) suggested that it may be beneficial if employees underwent training as it heightens awareness and serves as a stimulus for behavior modification. Johnson, Shin, Feinstein, and Mayer (2003) cited a direct causal relationship between education level and experience on food safety knowledge in a comparison between “fine-dining” and “quick service” restaurant. In contrast, other studies (Chukwuocha et al., 2009; Hertzman & Barrash, 2007) took the position that food safety practices were substandard although employees received food safety training and were experienced. Foote (2004) reported that due to the high turnover among employees in foodservice establishments, many companies consider them less valuable and therefore not worth the investment in training. As a result, many employees handling food at foodservice entities lack food safety knowledge and skills.

Limited research has been conducted in Trinidad and Tobago to evaluate food safety knowledge of foodservice workers. In this study, food safety knowledge of foodservice workers was carried

out to examine the distribution and relationship of food safety knowledge and education level (i.e., primary, secondary, tertiary), as well as length of employment.

## 2. Methods

This study was conducted using a cross-sectional descriptive survey. The inclusion criteria were full-time and part-time employees who were actively involved in the preparation of food at 14 food establishments located on a university campus in Trinidad and Tobago. The food establishments prepared and served both hot and cold items. The number of businesses was reduced from the initial 15 because one of the fast food chain outlets declined to allow employees to participate in the study. A total of 84 questionnaires were distributed; however, only 57 were returned completed, 14 were returned incomplete, and 13 were never returned, giving a response rate of 68%. The questionnaire consisted of a modified version of a validated food safety diagnostic test, developed and established in 2010 by the National Restaurant Association Educational Foundation, USA (2002). The modified version consisted of 33 questions, which examined hygiene, contamination, time-temperature control, and cleaning and sanitizing practices suitable to the study location and population. The questionnaire also collected general/demographic information. The questionnaire was pre-tested to identify the wording and sequencing of the questions, administration, and time to complete. A senior Public Health Officer of the Public Health Inspectorate of Trinidad and Tobago examined the questionnaire to ensure that questions assessed knowledge based on information presented at the 1-h food safety seminars, which is one of the requirements for a “food badge”. A food badge is a certificate that indicated that the food handler is registered with the Ministry of Health to handle food.

Data were analyzed using SPSS<sup>®</sup> version 19 (SPSS, Inc., Chicago, IL, USA, 2011). Descriptive statistics were used to compile the data. The knowledge questions were worth a total of 33 points, each question was scored as “1” for a correct answer and as “0” for an incorrect answer. Cross tabulation was carried out to examine the distribution and relationship of the variables. Bivariate correlation analyses were conducted to determine the relationships between level of education and food safety knowledge scores and length of employment in the foodservice industry and food safety knowledge scores. The effect of basic food safety training on knowledge was measured by conducting an independent sample *t*-test which compared the mean scores of persons who received basic food safety training with those who did not. The level of significance was set at <0.05.

## 3. Results

### 3.1. Socio-demographic data

Table 1 presents a summary profile of participants in the study. Of the 57 participants, 19 (33.3%) were from fast food chain outlets and 38 (66.7%) were employed at independently owned food establishments. Among the participants, there were 13 (22.8%) males and 42 (73.7%) females. The majority of respondents were full-time employees 46 (80.7%) of which were females. The greatest number of employees (61.3%) had  $\leq 3$  years experience working in the foodservice industry and 6 participants acquired >10 years service. Approximately, 91.3% of the participants received secondary (i.e., persons between 11 and 18 years that were exposed to standard school curriculum) or higher level education. Two-thirds of the participants self-reported that they have received basic training in food safety.

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