

Assessing Food Allergen Knowledge in Food Service Workers

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Abstract

Background: Food service workers are responsible to safely handle food that is intended for customer consumption. Many of these workers take FOODSAFE™, which is a food safety certification in British Columbia that equips students with knowledge to prevent foodborne illness. Poor food handling practices are a major factor in the causation of an allergic reaction to a certain food. When patrons with food allergies dine out, they rely on the food service workers' knowledge about allergens and proper technique to prevent allergic reactions. The purpose of this study is to assess food allergen knowledge of food handlers.

Methods: A self-administered online survey was distributed to food service workers of British Columbia to evaluate food allergen knowledge. The survey was created using Survey Monkey and the results were analyzed using NCSS 2023 statistical software. The survey link was distributed through face-to-face interactions, email, and through the website Reddit. Multiple choice and true or false questions were included in the survey that analyzed topics such as worker demographics and food allergen knowledge.

Results: Pearson's chi-square and Mann Whitney U Test results indicate that there are various factors that influence the level of food allergen knowledge in food service workers. The longer a participant has worked in the food service industry, the higher the overall allergen knowledge score was. Food service subsectors influenced the overall allergen knowledge-based score with daycare workers scoring the highest overall, followed by healthcare-related kitchens, and dine-in restaurants. The lowest overall score was from fast-food workers. Participants who have obtained FOODSAFE scored lower than those with expired certification or those who have never taken FOODSAFE. The scores were very low overall for those who participated in the survey.

Conclusion: Based on this study, food allergen knowledge among food service workers is lacking. Increased training and education are needed to ensure food is properly handled with special consideration for food allergens.

Keywords: food allergen, FOODSAFE, food service worker, allergen training

Introduction

FOODSAFE™ is a training program in the province of British Columbia designed to educate food handlers on safe food handling practices such as proper temperature holding, food storage, possible cross-contamination, and food allergen awareness. The goal of this course is to prevent food-borne illnesses through the knowledge provided in this course. While most food handlers know to keep foods at the correct temperatures and away from various hazards, things can still go wrong in a split-second mistake or human error. The objective of this study is to determine whether FOODSAFE certification effectively supports food service workers in managing food allergens.

Literature Review

Severe Food Allergens and Their Health Effects

In Canada, 11 priority food allergies have been identified as the key source of substances associated with food allergies. These allergens include eggs, milk, mustard, peanuts, crustaceans and molluscs, fish, sesame seeds, soy, sulphites, tree nuts as well as wheat and triticale. (1-4) These allergens can also be labelled as other names in recipes and ingredient lists. When

someone comes in contact with a food item that they are allergic to, there is an increased risk for a potentially serious or even fatal reaction called anaphylaxis.

Food Intolerances, Food Sensitivities, and Food Allergies

Symptoms of food intolerances can come in many different forms. Food intolerance does not involve a person's immune system and is more likely to affect a person's gastrointestinal system, such as the inability to digest or absorb certain foods usually due to an absence of required enzymes in the body. (5) These symptoms usually become apparent when the person ingests a normal or full-sized portion of food. (5)

Food sensitivities are less severe than food allergies because they also do involve an immune response. Symptoms of food sensitivities can include rashes, stomach pain or bloating, fatigue and brain fog and can appear either immediately or even days later. (6)

Food allergies are the most severe and are caused by the body's immune system reacting to specific proteins present in food. (3,6) Most severe reactions from food allergies could result in anaphylaxis which

requires immediate medical attention with epinephrine and quick transport to the hospital. (1)

What is FOODSAFE?

FOODSAFE is a food safety course that is geared towards food service operators and handlers in the food service industry. The program was first introduced in 1985 by the province of BC in a collaboration with the industry to train food service workers on safe food handling practices. (7) BC FOODSAFE Level 1 is typically an 8-hour course that requires students to obtain 70 percent or higher on the final exam to pass the course. After successful completion, students are awarded a certificate which is valid for 5 years.

The FOODSAFE level 1 workbook mentions Canadian priority allergens as well as best practices for preventing allergic reactions in customers while handling foods. Allergen prevention policies include proper communication with the customer and among staff, awareness of alternative names for allergen-containing foods, and the elimination of potential cross-contamination. (1)

Who is Required to Hold FOODSAFE Certification in BC

In BC, there are requirements on who must hold a FOODSAFE certificate when working in the food industry. Division 2, Section 10, of the *Food Premises Regulation* [B.C. Reg. No. 210/99] pursuant to the *Public Health Act* clearly explains that every operator of a food service establishment must have a FOODSAFE Level 1 at minimum or its equivalent in training. (8) Furthermore, when the operator is not present on the premises, then there needs to be at least one person who holds a FOODSAFE level 1 certification or equivalent. (8)

Who is Most at Risk and What is Being Done

Children are the most vulnerable when it comes to eating foods containing allergens and also represent the majority of the population that suffers from food allergies. (5) Canadian schools have formal policies on bringing in certain foods that are on the list of well-known allergens such as peanuts. (2) The Anaphylaxis Protection Order is legislation enforced by the BC Ministry of Education and requires all BC school districts to implement and follow anaphylaxis policies and procedures. (9)

Legal Implications for Food Service Workers

Recently, in 2016, a waiter in Quebec was arrested for criminal negligence after serving a known allergen to a customer. The customer informed the waiter of his fish allergy and ordered a beef tartare dish. The customer was served the salmon tartare by mistake. Due to the dim lighting, the customer ate some of the salmon tartare which led to anaphylactic shock. (10) This waiter was ultimately not charged for the mix-up, but other restaurant workers have faced serious consequences.

In 2014, a restaurant owner in England was found guilty of gross criminal negligence. The owners had swapped out an ingredient that now contained peanuts without informing customers. (11) Another incident happened in 2015 where a waitress in Italy was found guilty of culpable manslaughter for serving a pasta dish containing milk to a boy after reassuring his family that the dish was safe for him to eat. (12) Lastly, in 2017, two workers were arrested on suspicion of gross negligence and involuntary manslaughter in England, when a teenager died from a peanut allergy. (13)

Food Service Worker Demographics

In Canada, the food service industry sector is the fourth-largest private employer generating roughly 4 percent of the national

gross domestic product. (14) In 2021, the industry employed roughly 957,700 Canadians 15 years or older according to Statistics Canada. (15) It is estimated that about 1 in 5 Canadians aged 24 and under are employed in the restaurant industry and 42 percent of restaurant employees are 24 years or younger. (14)

The median salary for food handler jobs in British Columbia in 2023 can vary. Fast-food workers are estimated to make approximately \$32,663 yearly (16) Dine-in restaurant servers is estimated to be \$31,257, which does not include tips. (17) Daycare workers are estimated to make \$39,536 (18) Lastly, the median yearly salary for healthcare-related kitchen workers was estimated at \$37,118. (19)

Knowledge Retention of FOODSAFE Users

Studies have shown a steady decline in retention of food safety knowledge among those who have taken food safety courses within the first 5 years. (7,20) A study looking at food safety knowledge retention by measuring failure rates when taking a food safety questionnaire in Edmonton revealed that people who took a food safety course were less likely to score higher than 70% on the written portion after 10 years from certification. (20) Food handlers who

did not have formal training or expired certification were more likely to fail a food safety knowledge test. (20)

Public Health Significance

It is estimated that up to 2.5 million Canadians have a food allergy. (21) People working in high-risk places such as restaurants, daycares, and schools must be educated on food allergens. In the United States, a study found that eating at a food establishment was the second most common place for a food-related allergic reaction to happen. (22) An allergen registry in the United States also found that 8 of the 31 food allergen fatalities between 2001-2006 experienced an allergic reaction in a restaurant. (23) With increasing trends toward dining out, it is important that measures are being followed to ensure all Canadians have access to safe food.

Gaps in Knowledge

Although there have been several studies examining the retention of food safety knowledge in food handlers, there has been no formal study on allergen knowledge retention among food handlers who have completed FOODSAFE. (7,20) With the increased responsibility put upon the food service worker and establishments, as well as the lifelong implications on the person

suffering from food allergies, the researcher would like to see whether FOODSAFE certification provides adequate knowledge and training for food service workers to prevent allergic reactions in customers

Purpose of This Study

The purpose of this study is to determine if the completion of FOODSAFE Level 1 makes a difference in the knowledge and ability of food service workers to properly handle food allergens in the food service industry. This was achieved by collecting primary data on food handlers in BC using a survey questionnaire.

Methods and Statistics

Materials

The materials utilized in this study include a laptop. Microsoft Word and Excel were used to organize the data and create graphs. (24) The statistical package, NCSS 2023 was utilized to run descriptive and statistical analysis on the data. (25) The self-administered survey was created using the BCIT server of SurveyMonkey (26) The website Reddit.com was used to promote the survey to BC food service workers. (27) A \$100 Visa gift card was also supplied by BCIT.

Standard Method

The self-administered electronic survey remained open from February 16 to February 27, 2023. A QR code and web link was provided to food service workers via in-house visits and Reddit. The survey consisted of 10 questions that included multiple-choice and true or false type questions to collect information on workers' demographics and food allergen knowledge. Once the survey was completed the researcher analyzed the data using NCSS software.

Inclusion and Exclusion Criteria

This project was conducted to target and only include food service workers in BC who are 14 years of age or older whether or not they had taken FOODSAFE.

Ethical Considerations

All aspects of this research project were reviewed by the BCIT ethics board prior to launch. All participants were made aware that their participation was completely voluntary through the use of a cover letter and consent form. Once the participants started the survey they had no obligation to submit or finish the survey.

Results

At the end of the survey period, a total of 240 participants responded. Out of those

who responded, 211 were found to be eligible to participate in the survey and 197 completed every question.

Descriptive Statistics

When asked if the participants hold a current FOODSAFE Level 1 (taken within the last 5 years), 93% responded yes, 6% responded no, and 1% responded prefer not to answer. The participants reported working in various settings with 35% in fast food, 37% in dine-in restaurants, 7% in daycares, 17% in healthcare facilities, and 4% choosing not to disclose their workplace. The majority of respondents, 44%, had worked in the industry for 1-3 years, followed by 26% for 3-5 years, 13% for 5-10 years, 10% have worked 10+ years, and only 7% have worked in the industry for less than 1 year. For the years since the participant has taken FOODSAFE, 11% indicated that they have taken it less than 1 year ago, 50% answered 1-3 years ago, 24% 3-5 years ago, 8% 5-10 years ago, 3%, and 4% have never taken FOODSAFE.

Results from the Survey respondents' knowledge-based questions are included in Table 1.

Table 1. Survey respondents' answers to knowledge-based questions

| Question | TRUE | FALSE | I don't know |
|--|------|-------|--------------|
| If a person is having a food allergy reaction, you should immediately give them a glass of water to help dilute the allergen | 72% | 23% | 5% |
| If someone has a food allergy, they can handle the food allergen in very small amounts as long as they have a balanced meal to dilute the allergen | 67% | 29% | 4% |
| Dizziness, face rash, confusion, and change in voice are signs of anaphylaxis | 89% | 8% | 3% |

had FOODSAFE certification. The third test was to assess the association between allergen safety knowledge and the type of food service industry the participant works in. Chi-square tests of independence were run at an alpha level of 0.05 (5%). All Chi-square tests show a very low p-value indicating a low probability of type I or type II errors occurring. Pearson's Chi-square test does not provide power. The fourth test was performed using a two-sample t-test on years of working in the food service industry and the mean knowledge score of the participant. Results from inferential analyses are included in Table 2.

Inferential Statistics

A Chi-square test was performed to assess the association between allergen safety knowledge scores and respondents' years of experience working in the food service industry. The second Chi-squared test assessed if allergen safety knowledge is dependent on whether or not participants

Table 2. Hypothesis and results

| # | H ₀ and H _a | Test Used | Result | Conclusion |
|---|---|---------------------------|--------------------------|--|
| 1 | H ₀ : There is no association between allergen safety knowledge and years of experience working in the food service industry. H _a : There is an association between allergen safety knowledge and years of experience working in the food service industry. | Pearson's Chi-square test | P=0.0005 | Reject the null hypothesis and conclude that there is a statistically significant association between allergen safety knowledge and years of experience working in the food service industry. |
| 2 | H ₀ : There is no association between allergen safety knowledge and whether the participant has a valid or invalid FOODSAFE certificate. H _a : There is an association between allergen safety knowledge and whether the participant has a valid or invalid FOODSAFE certificate. | Pearson's Chi-square test | P=0.0015 | Reject the null hypothesis and conclude that there is a statistically significant association between allergen safety knowledge and valid or invalid status of FOODSAFE. |
| 3 | H ₀ : There is no association between allergen safety knowledge and the type of food service industry the participant works in. H _a : There is an association between allergen safety knowledge and the type of food service industry the participant works in. | Pearson's chi-square test | P=0.0000 | Reject the null hypothesis and conclude that there is an association between allergen safety knowledge and the type of food service industry the participant works in. |
| 4 | H ₀ : There is no difference in allergen safety knowledge score between food service workers with < 5 years of experience and those with 5 or more years experience in the food service industry. H _a : There is a difference in allergen safety scores between food service workers with less than 5 years of experience and those who have 5 or more years of experience in the food service industry. | Mann Whitney U test | P=0.0002 Power=92.08% | Reject null hypothesis and conclude that food service workers with 5 or more years of experience are more knowledgeable compared to those who have less than 5 years of experience in the food service industry. |

Discussion

There is an association between allergen knowledge scores and how long the participant has worked in the field (Table 3). The longer a person works in the food service industry correlates with higher scoring on the knowledge-based questions. Another similar study by McIntyre et al, (2013) found that the average safety knowledge score for food handlers also increases with more years of experience working in the food service industry. (7)

Table 3. Average scores for knowledge-based questions 5, 6, and 8.

| Years working in the food service industry | Average allergen knowledge score out of 3 |
|---|--|
| 10+ | 2.21 |
| 5-10 years | 1.40 |
| 3-5 years | 1.39 |
| 1-3 years | 1.22 |
| 1 or less | 1.13 |
| FOODSAFE certification status | |
| Current and valid FOODSAFE | 1.28 |
| Expired or no FOODSAFE | 2.20 |
| Area of food service employment | |
| Fast food | 1.15 |
| Dine-in restaurant | 1.18 |
| Healthcare-related kitchen | 1.83 |
| Daycare center | 2.57 |
| Prefer not to answer | 2 |

There was an association between allergen safety knowledge and whether the participant has a valid or invalid FOODSAFE certificate (Table 2 and 3). Average scores for people who do not have current FOODSAFE certification were higher than participants with current and valid FOODSAFE certification. This is contradictory to the findings of McIntyre et al, (2103) study where the food handlers with valid FOODSAFE certification scored higher on knowledge-based questions in comparison to the food handlers without FOODSAFE training. (7)

Average knowledge-based scores varied with the work area the participant works in. Daycare centers and healthcare-related facilities scored the highest which could be due to stricter allergen policies within the workplace. Dine-in restaurants scored the third highest, followed by fast-food establishments. A higher income in daycare centers and health care kitchens may persuade staff to be more diligent, as well as retain the food handler to work for a longer period at that establishment. Decreased staff turnarounds may improve allergen knowledge and awareness by allowing employees more years of employment at

their establishment to gain experience and knowledge in the field.

Limitations

Some limitations were noted within the survey. The survey was shared on Reddit which limited the sample size to only people who visit that website. Having the survey anonymous and online left no way to verify if the respondents fit the study criteria. The \$100 visa gift card may have been a limitation if people only participated in the survey for a prize, rather than a food service worker participating. Leaving the survey open for longer may have garnered more responses which could have increased internal and external validity.

One of the knowledge-based questions asked respondents to identify priority Canadian food allergens from a list. The list included all but one Canadian Priority food allergen. Having every Canadian priority allergen listed would have been more accurate in determining whether participants could identify all allergens. Furthermore, some respondents did not answer this question. Ensuring that the participant answered every question by requiring an answer before moving on to the next question would have increased the accuracy validity of the results

Knowledge Translation

The findings from this study could be used to update the FOODSAFE course curriculum to include a more comprehensive approach to handling food allergens. It is important for food service workers to understand the severity of food allergies and the appropriate precautions to follow to prevent cross-contamination when preparing food items containing allergens. Servers and food handlers should receive formal training on food allergens in addition to the FOODSAFE certification. With more food service workers being held accountable for accidentally serving an allergen to customers with known allergies, this study could also prove to food service workers just how vital FOODSAFE and food allergen safety training is for both the public and the worker.

Future Research

The following are recommended ideas for future research projects:

- Yearly allergen knowledge testing or survey to gauge how quickly food allergen knowledge should be refreshed

- Survey food service clients on their concerns with food service workers with regard to food allergen handling
- Survey FOODSAFE students before and after taking the FOODSAFE course to compare results
- Compare results from participants with FOODSAFE to another equivalent food safety certification.

Conclusion

The findings of this study suggest that obtaining FOODSAFE does not necessarily increase the knowledge of food allergens in food service workers. The level of knowledge of food allergens in food service workers is evidently lacking. This lack of knowledge is concerning for food service workers who serve customers with food allergens as well as the customers who receive the food. While the results do show a lack in food allergen knowledge, this creates an opportunity for restaurant owners and operators, public health inspectors, as well as FOODSAFE educators to reiterate the importance of food allergen awareness. Food service workers should also take into consideration their vital role in preventing an allergic reaction in customers as well as the legal implications that could follow.

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Competing Interest

The authors declare that they have no competing interests in this study.

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