

AMERICAN UNIVERSITY OF BEIRUT

FOOD ALLERGY KNOWLEDGE, ATTITUDES AND
PRACTICES (KAPS) OF FOODSERVICE WORKERS AT
RESTAURANTS IN LEBANON:
A CROSS-SECTIONAL STUDY

by
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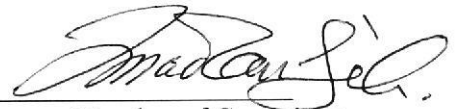
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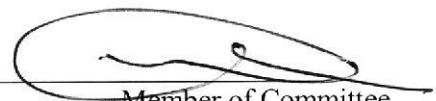
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AN ABSTRACT OF THE THESIS OF

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Title: Food allergy Knowledge, Attitudes and Practices (KAPs) of Foodservice Workers at Restaurants in Lebanon: A Cross-sectional Study.

The epidemiology of food allergies appears to be increasing worldwide. The food allergy prevalence in Lebanon is estimated to be 4.1% in infants and children and 3.2% in adults. Food allergies are caused by immune response against the consumption of allergens. In severe cases allergic reactions can lead to life threatening symptom which is anaphylaxis. However, people suffering from food allergies happen to dine out at restaurants, so this population depends on food service staff to prepare safe and allergen-free meals. Food allergy poses a challenge on food service staff. In order to avoid any dangerous reaction from happening at their premises, restaurant's workers have to be knowledgeable and well trained regarding food allergies issue. Restaurants have to indulge policies and procedures in order to guide their staff. The purpose of our study is to assess food allergy knowledge and practices among all restaurant workers including manages in-charge, servers, and chefs.

The study is implemented on a random sample of foodservice workers and managers (n=137), at the Lebanese restaurants. Restaurants were recruited from all the Lebanese governorates. A structured IRB approved survey including five different sections was administered as a tool of assessment.

Managers at restaurants that have description of menu ingredients, and those who received food allergy training show better knowledge scores respectively; ($\beta=1.339/p=0.016$) and ($\beta=3.062/p=0.007$). The predictors of staff knowledge scores include years of foodservice experience (Very low: $\beta=-2.160/p<0.01$), (Low: $\beta=-1.664/p=0.003$), and previous training received ($\beta=1.736/p=0.003$). Factors that had impact on practices scores include the availability of allergen-free menu ($\beta=1.479/p=0.015$) and receiving food allergy training ($\beta=3.075/p=0.003$), for managers and years of food service experience (very low: $\beta=-1.492/p<0.01$, low: $\beta=-0.730/p=0.038$), educational level (Low: $\beta=-2.12/p<0.01$, moderate: $\beta=-0.680/p=0.033$, high: $\beta=-0.712/p=0.017$) and previous food allergy training received ($\beta=2.472/p<0.01$) for staff. No predictors were associated with attitude scores; however, all respondents had positive attitudes towards serving special customers. According to our study, although the participants had positive attitudes towards serving customers with food allergies, there are major gaps in the food allergy knowledge and practices of restaurant managers and workers. Thus, restaurant personnel food allergy trainings are essential for preparing safe meals.

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*To My
Beloved Family*

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

A. Introduction

Food allergies are a growing public health and food service concern. Food allergy is considered a serious and potentially life-threatening medical condition, which can lead to death. Food allergic reactions incidences are not limited to private homes only, but a significant number of food allergy reactions occur in food service establishments. So it is highly important for restaurants to establish safe dining environment for food allergenic customers, through well-planned food allergy policies and regular employee food allergy training. Unfortunately, there are gaps in food allergy knowledge and convenient practices regarding food allergies at restaurants.

B. Prevalence of Food Allergies

The food allergy prevalence in Lebanon is estimated to be 4.1% in infants and children and 3.2% in adults [1]. The Centers for Disease Control and Prevention (CDC) report that food allergies affect 15 million persons in the United States and, responsible for approximately 30,000 emergency department visits; and cause 150 to 200 deaths every year [2]. A German study among children reported a prevalence of Oral Food Challenge-confirmed food allergy of 4.2% [3], and a study from Turkey reported a rate of 0.15% among adolescents [4]. In Europe the self-reported prevalence is 6% food allergies to common foods. In Australia the overall allergy rate was 3.8%, with a peanut allergy prevalence of 1.9%, egg allergy prevalence of 1.2%, and sesame allergy prevalence of 0.4%. Survey done by the World Allergy Organization observed that rates

of FAs for children were lowest in Thailand and Iceland and highest in Canada, Finland, and Australia. Finally, 2 % of the world adult population shows food hypersensitivity and nearly 1% suffers from food allergies, and 8% children show hypersensitivity and 2.5 % may suffer from food allergies [5].

C. Food Allergies: Definition and Treatment

According to the World Health Organization (WHO), a food allergy reaction occurs when the immune system overreacts to the proteins, known as allergens, in food [6]. The immune response, occurs when the immune system attacks proteins in the food that are normally harmless. Allergic reactions to foods vary greatly from mild gastrointestinal discomfort, to skin rashes and potentially life threatening asthma and anaphylaxis [7].

Until today, there is no cure for food allergy. However, prevention of serious health consequences is possible through strict avoidance of food allergens, early recognition and management of an allergic reaction [6, 8]. The only cure is by complete elimination of foods containing the allergen.

D. Prevalence of Food Allergy Reactions in Restaurants

Deaths due to the consumption of food containing allergens in food services have been reported. In the United States (US), 31% of deaths from food allergens anaphylactic reactions occurred from meals consumed in food services between 1994 and 1999, and 26% took place between 2001 and 2006. In the United Kingdom, half of fatal reactions due to food allergens happened from meals consumed at restaurants [9]. In half of reported cases of allergic reactions to peanuts that occurred in US restaurants, the food allergen was hidden in sauces and dressings; a quarter were caused by cross-

contamination. A significant number of food allergy reactions occur in food service establishments [10]. Furthermore, in USA, 18 out of 48 food allergy related deaths occurred after the consumption of catered meals [11]. Many people with food allergies simply avoid eating outside the home, in which 19 to 25 percent of respondents never consumed food at restaurants [12]. Dining out becomes challenging for food allergic consumers, as these individuals feel insecure and doubtful towards restaurants ability to produce safe meals.

E. Factors Associated with Food Allergies at Restaurants

Food allergy reactions in restaurants and food service establishments may be caused by several factors. Cross contamination, miscommunication between waiters and chefs, and lack of staff training were reported as the common causes of such reactions [12]. Also, incomplete food labels, including hidden allergens in specialty menus or mixed dishes such as casseroles [13], may increase the risk of exposure to food allergens and their accidental ingestion by allergic customers.

Restaurants offer complex foods in their menus and it is difficult for customers to detect the availability of an allergenic ingredient, those foods include: Sauces & dressings, mixed dishes, desserts. Lack of specialized training for food workers on proper food handling, major food allergens, and best practices for avoiding cross-contamination. A key factor in minimizing the risk of food allergy reactions is education. Training food service staff on food allergens and having procedures in place for communication and safe food preparation for food allergic customers is critical for retail food establishments. Other factors are miscommunication between restaurant staff and customers which is considered a major barrier to providing safe meals. Some cases involve customers not notifying

the restaurant staff about their allergies. However, some cases involve that customers experienced food allergies despite warning servers, cooks and chefs about their case which shows the lack of staff knowledge about ingredients present in foods, in addition to the failure of communication between the person placing the order and the employee taking that order, or their inability to inform the chef of the requirements [12].

F. Consequences on Restaurants

Food allergy reactions at restaurants may have negative consequences on both the consumer's health and the restaurant's quality and reputation. In fact, the restaurants could experience loss of revenues, reputation, and relationship with customers if any food allergy reaction occurs on their premises [11, 12].

G. Roles of Managers, Chefs and Servers in Preventing Food Allergies

Managers, food workers, and servers have crucial roles in preventing food allergy reactions in restaurants [10]. First, managers should provide food allergy training for their staff and accommodate ways to serve food allergic customers. Second, food workers should be educated about allergens and preparation methods to ensure allergen-free food. Third, servers should provide an accurate description of menu items to customers and notify the manager and kitchen staff about allergen-free orders [11, 12]. Hence, all food service employees including managers, food workers and servers, have equal responsibilities for providing safe meals when it comes to food allergens. It is essential to improve the practices involved in the preparation and handling of food in a search to reduce the occurrence of food allergies [14]. Some precautionary steps should be implemented in order to decrease the risk of food allergy reactions, such as a

good communication with the customer to inform them about allergens in food and to know if they suffer from any allergies, proper reading of food labels and avoiding cross-contamination during food preparation [15].

A key to preventing food allergy reactions in restaurants is the manager, food worker, and server knowledge, attitudes, and practices towards food allergy. While customers have a responsibility to let staff know if they suffer from allergies or intolerances, staff must be properly trained to understand how to comply with legislation and need to offer up to date and accurate information to customers. Restaurants are required by law to be able to tell diners if meals or drinks contain the top 14 food allergens, even in trace amounts [16].

H. Creating Food Allergy Management Plan in Restaurants

Restaurant staff must keep in mind that food allergies are allergic disorders, not food preferences. The best way to minimize risks is to create a written plan for handling guests with food allergies that all staff members must follow. The plan should mention: the person responsible for answering guests' questions regarding menus, the one responsible for checking the ingredients in menu items, the steps that should be followed by kitchen staff for avoiding cross-contamination incidences. In addition to the steps to be taken in case of allergic reaction at the premises. It has to include folder of modified recipes to be used for preparing special meals [16].

This plan requires managers and food workers in understanding the basics of food allergies. Restaurants should be able to supply a list of ingredients for a menu item. When a guest informs restaurant staff that he or she has a food allergy, staff should activate the restaurant's plan for handling the special order such as providing the diner with special menus free from food allergens [16].

I. Many Studies Assessed Managers and Food Workers KAPs

Several studies were carried out in the purpose of assessing the knowledge, attitudes, and practices of food service employees. Results of one study indicated that less than half of managers had received training on food allergies at their current restaurants and identified some gaps in knowledge such as mistakes in recognizing that eggs are food allergens, and 10% of managers and staff think that someone with food allergy can safely consume small amount of the allergen [10].

Further study in Philadelphia U.S revealed employees' knowledge and practices gaps which renders the restaurants unsafe for food allergic patrons [15].

Similar study was conducted in Penang, Malaysia show that a low percentage of staff 1.79 % were considered to have excellent knowledge, and only 4.27% had positive attitudes towards food allergies. Moreover, the authors ensure that staff were not well informed about food allergies due to lack of specific training [17].

More studies in the same field were directed; in New Zealand a study revealed that 13% of respondents provided correct answers for knowledge items, and only quarter of them reported past food allergy trainings. Most of the managers with previous training have plans for providing safe meals, managing an allergen emergency, and providing training sessions for staff. The author of this study notes that 65 % of managers kept modified recipes details, results demonstrated a serious deficit in knowledge and plans to adapt with food allergy cases. This highlights the need of additional trainings [9].

A study that took place in Leicester, UK, displayed that “Only one in four staff were able to correctly name three common food allergens. Despite alarming gaps in knowledge all staff expressed ‘comfort’ in providing a safe meal to food allergic customers” [18].

In Turkey, the training, knowledge levels on food allergy, and comfort level in providing safe food were assessed and results showed that only 60 (17.1%) respondents had training about food allergy and, the percentage of those who were able to recognize at least 3 allergens was 54.3%. Two out of three respondents knew that a food allergic reaction could cause death. No significant association was found among the responsibility of the personnel in the restaurant, their allergy training, and the reported comfort level in offering a safe meal for allergic diners [20].

Additional study surveyed 110 restaurant managers and staff in the United States, results of this study confirmed that more than 80% (n = 90) of the participants lacked an understanding about listing allergens on a food label. There was no significant difference in a knowledge score based types of the restaurant. The predictors of knowledge scores include years of foodservice experience, years in a current position, and previous training received. Only the education level of the participants predicted their attitude scores. Respondents' identified the lack of commitment and the lack of interest in attending food allergy training was the main barrier in performing training. In addition, to scheduling conflicts of trainings and work flow [11].

Many of these studies highlight the gaps in food allergy knowledge among restaurant employees, including misconceptions about safely handling food allergy requests and emergencies. To date, all the available data in the literature about food allergy knowledge, attitudes and practices is from US, UK, Europe, Asia and Turkey. However, none of the published literature is about Lebanon and MENA region.

J. Study Objectives

The main objectives of this study are to: (i) explore the knowledge, attitudes, and practices scores of restaurant managers and staff towards food allergy; (ii) compare knowledge, attitudes, and practices among managers and staff; and (iii) identify factors associated with food allergy knowledge, attitudes, and practices.

CHAPTER II

METHODOLOGY

A. Study Setting and Population

A descriptive, cross-sectional study was conducted among foodservice workers to assess their knowledge, attitudes and practices regarding food allergies. No data that could identify individuals was collected. The PI secured restaurants' managers approval before approaching their employees, conducting the study at their premises and examining the menu for some parameters. Employees were approached and invited to participate in the study during their break/free time in order not to disrupt the work flow of the restaurant. Data collectors solicited restaurant participation by contacting randomly selected restaurants within a specified geographic location.

The sample population recruited reflected the socio-economic and demographic variability of the population, including but not limited to age, education, gender, socio-economic status. Hence, considering a study power of 80%, a design effect of 1.5 to account for stratified sampling with $\pm 5\%$ precision, and an estimated prevalence of 5% of food allergies in Lebanon [1], a representative sample of 137 participants (managers, workers and servers only two from each foodservice) was recruited from all Lebanese governorates as shown in the table below.

The sample size was determined using the WHO sample size calculator [21], available on the following link: www.who.int/ncds/surveillance/steps/resources/sample_size_calculator.xls

Table 1. Distribution of restaurants over different governments in Lebanon

Governorates	Percentage	Number of Recruiters
Beirut	28.7	40
Mount Lebanon	56	77
Bekaa	3.4	4
North	9	12
South	2.9	4
Total	100	137

B. Recruitment

Foodservice workers (managers, chefs, servers) aged between 18 and 65 years from different restaurants were invited to participate in the study using direct approach at the restaurant premises. Then, interested participants were contacted to schedule for survey administration at a date and time pending their preference and availability. After obtaining permission from the restaurant manager, investigators conducted an on-site survey, in a private setting, with a manager (worker with authority over the kitchen), a food worker (worker who primarily prepares or cooks food), and a server (worker who primarily takes orders or serves food to customers). Participants were asked to complete a self-administered questionnaire after providing their oral consent (Appendix I). A list of restaurants from all over the Lebanese governorates are targeted. Managers or owners of the food establishments are approached for anonymous participation. If the manager was not available three further visits are made before omitting the food establishment from the list, or if the manager did not wish to participate the next listed food establishment was approached. An information sheet with background of food allergies, types of food allergens and what to do in case a customer experiences an allergic reaction, is provided for each manager at the recruited restaurant after survey

completion (Appendix IV). Approval is obtained from the AUB Dean of Students. The completion of the questionnaire took approximately 15-20 minutes (Appendices II & III). Investigators received trainings to conduct effective and efficient data collection during surveys.

C. Data Collection

All students' researchers and other members of the research team have CITI certification for human subjects' research according to AUB IRB regulations prior the initiation of the study or a research ethics training and certificate. Data is collected by self-filled surveys; secure data collection took by letting the employees to fill the surveys in a closed room at the restaurant to avoid any manager-employee clashes. Nothing jeopardized their employability status. In order to avoid any undue influence that could be exerted by managers' presence during data collection, the research team made sure that the manager is not present when food workers are filling the survey. Data collectors asked participants to fill a questionnaire in a private setting away from manager's office in a closed room with a door to be closed. The investigator explained to potential recruits that their participation in the study is voluntarily and refusing to take part of the data collection will not have any negative impact on their jobs. Furthermore, data collection was completely anonymous (nothing indicates the name of the restaurant or participant) and the participants had the right to stop the survey at any point during the process. Filled surveys are collected by research team directly after completion by participants. Noted that Participants will not be contacted after filling the surveys to complete any missing data as they have the right to skip or refrain from answering any question. Noted also that after completion of data collection process at the end of the study, the surveys from various locations are pooled so that there will be

no indication of the location of the restaurant. Data collected will be kept in a locked drawer in the principal investigator's (PI) office where only the PI and co-investigators can have access to it. Also, all collected material will be destroyed 5 years after dissemination of the results, as per the IRB instructions.

D. Study Instruments

Two survey forms were developed to evaluate employees' knowledge, attitudes and practices in the food service sector focusing on the socio-demographic characteristics of foodservice employees (e.g. years of experience in current restaurant, food safety certification, etc.) and the characteristics of the restaurant (only for managers) (e.g. chain versus independent ownership, number of meals served in a typical day, etc.). One survey form will be handled to managers (Appendix II) and another form will be used for servers and chefs (Appendix III).

Investigators asked further questions to assess the food sector employees' knowledge, attitudes and practices towards food allergies, as follows:

- 7 questions about employees' knowledge of food allergy (e.g. identifying major food allergens, handling allergic incidence, etc.),
- 14 questions about employees' attitudes towards food allergies (e.g. meeting customers' requests, servers' knowledge about allergies, etc.),
- 8 questions about employees' practices towards food allergy (e.g. cross contamination, behavior towards doubtful menu items knowledge, etc.).

In addition, researchers observed the restaurant and examined its menu to assess additional characteristics about the restaurant (e.g. items' prices, number of critical violations during last inspection, etc.) and food allergy documentation (e.g. allergens stated on the menu, documentation in the kitchen, etc.).

After each of the manager and the employee are done from filling the surveys, food allergies' information sheet is explained to them by the investigator. A copy of this sheet is kept with the manager to ensure future improvements in food allergy related knowledge practices and attitudes. Please refer to Appendix IV.

E. Data Assessment and Interpretation

We created knowledge, practices and attitude scores for each participant group (i.e. manager, food worker, and server). For the knowledge and practices score, we summed up the number of correct answers (out of 7) and (out of 8) respectively and use each group's mean score to dichotomize the participants as having a higher or lower level of knowledge. For the attitude score, we assigned point values to each response as follows: strongly disagree = 1, disagree = 2, unsure = 3, agree = 4, and strongly agree = 5. Then, we computed each participant's average response to the 14 attitude questions by summing up positive attitudes. Data obtained is statistically analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0. 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 linear regressions were applied to determine which factors (social or work characteristics) are associated with KAP (Knowledge, attitudes and practices) scores. In the regression model, KAP 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.

CHAPTER III

RESULTS

In total, 137 complete self-filled questionnaires were collected.

A. Restaurants, Managers and Staff Characteristics

Restaurant's Data: To understand the size of the restaurants, managers were asked to indicate the total numbers of managers and employees, as well as the approximate number of meals served per day. For this study and as referred by Table 2, 52.5 % (n=21) of the managers reported having more than 3 managers at the restaurant as for the workers, 57.5 % (n=23) of restaurants have more than 10 workers. Regarding the number of meals served per day, 40% of managers indicated serving range of 1 to 100 meals (n=16). Majority of managers reported not preparing any special meals for food allergic customers (n=29, 72.5%). Data related to strategies that should be adopted by restaurants to control food allergies shows that some restaurants have menus which include thorough description of the ingredients in each food item (n = 37, 92.5%), provide separate allergen-free menu (n=14, 35%) and provide food allergens information in kitchen area (n = 13, 32.5%).

Managers Data: 40 out of 137 surveys were filled by managers. In managers' participants as shown in (Table 3) there is 36 males (90%) and only 4 females (10%). Ages of the managers ranged between 23 and 55 (mean= 33.18±7.795). Majority of the managers reported that they had university education (n = 32, 80%). Years of food service experience are categorized accordingly; 19 out of 40 managers had 2 to 4 years of experience in the field (47.5%) and only 3 managers had >10 years of food

service experience (7.5%). Low number of managers had received food allergy training (n=13, 32.5%).

Table 2. Restaurant's Characteristics Filled by Managers

Parameters (N=40)	N	%
Restaurant type		
<i>Chain</i>	20	50
<i>Independent</i>	20	50
Service type		
<i>Full Service</i>	27	67.5
<i>Quick Service</i>	13	32.5
Menu type		
<i>American</i>	18	45
<i>Non-American</i>	22	55
Number of meals served per day		
1-100	16	40
101-300	13	32.5
>300	11	27.5
Number of managers in charge		
<3	19	47.5
≥3	21	52.5
Number of staff		
≤10	17	42.5
>10	23	57.5
Highest priced food item in menu		
< L.L 15,000	7	17.5
L.L 15,000 - 30,000	15	37.5
> L.L 30,000	18	45
No. of meals served to food allergic customers		
0	29	72.5
1-10	9	22.5
>10	2	5

Half of Managers, 50% (n = 20), worked in independent restaurants and the remainder worked for chain restaurants. Approximately 67.5% (n =27) of the participants indicated full-service dining as their restaurant type, followed by quick service (n = 13, 32.5%).

Table 3. Characteristics of Managers and Staff Recruited in the Study

Parameters	Managers N=40 n (%)	Staff N=97 n (%)
Gender		
<i>Male</i>	36 (90)	63(64.9)
<i>Female</i>	4 (11)	34 (35.1)
Highest educational level		
<i>Elementary</i>	0	5(5.2)
<i>Intermediate School</i>	0	19(19.6)
<i>Technical diploma</i>	8 (20)	37(38.1)
<i>University</i>	32(80)	36(37.1)
Experience in food service		
<2 years	9 (22.5)	34 (35.1)
2-4 years	19 (47.5)	29(29.9)
5-7 years	2 (5)	20(20.6)
7-9 years	7 (17.5)	14(14.4)
>10	3 (7.5)	0
Job type		
<i>Full time</i>	-	77(79.4)
<i>Part time</i>	-	20 (20.6)
Received training in food allergies		
<i>Yes</i>	13(32.5)	27 (27.8)
<i>No</i>	27 (67.5)	70 (72.2)

Staff Data: Survey data from the 97 staff indicated in (Table 3) show that 64.9 % staff are males, 37.1% had university education, and 77% are full time workers. Majority of the staff have less than 2 years' experience at restaurants (n=34, 35.1%). Only 27.8% (n=27) had received training on food allergies while working at their current restaurant.

B. Food Allergy Knowledge Score

Managers: Out of 7 knowledge questions, the mean food allergy knowledge score was 4.20 ± 1.951 , ranging from lowest score = 0 to highest score equal to 7. For major allergen identification (n=29, 72.5%) of managers failed to identify at least 6 major food allergens. However, in case food allergy reaction occur at the restaurant

about half of the managers (n=17, 42.5%) knew that they have to call the emergency.

As provided by Table 4, about 47.5% (n = 19) of the managers believed that a person suffering from food allergy can die from eating the allergen. Nearly half of managers (n=19, 47.5%) knew that a person who eats food they are allergic to can die, and 60% of managers (n=24) correctly said that taking a food allergen out of a meal after the meal had been prepared is not a way to make it safe for a food allergic customer.

Table 4. Descriptive Data on restaurant's managers and staff Food Allergy Knowledge

Question	Managers N=40 n (%)	Staff N=97 n (%)	Managers vs Staff chi-square (χ^2)/ P- value
Participants Identified at least 6 correct food allergens <i>Yes</i> <i>No</i>	11 (27.5) 29 (72.5)	25 (25.8) 72 (74.2)	$\chi^2 = 100.048/p < 0.01^*$
Which of the following should you do if a customer is having a bad food allergic reaction? <i>Suggest that customer drinks water</i> <i>Call the emergency (Correct)</i> <i>Ask the customer to take their medicine</i> <i>Suggest that the customer throw up</i>	4 (10.0) 17 (42.5) 16 (40.0) 3 (7.5)	24 (24.7) 33 (34.0) 32 (33.0) 8 (8.2)	$\chi^2 = 3.987/p=0.263$
Someone with food allergy can die from eating the food they are allergic to: <i>Yes (Correct)</i> <i>No</i> <i>Unsure</i>	19 (47.5) 14 (35.0) 7 (17.5)	31 (32.0) 49 (50.5) 17 (17.5)	$\chi^2 = 50.837/p < 0.01^*$
Taking a food allergen out of a meal after it has been made is one way to make it safe for food allergic customer: <i>Yes</i> <i>No (correct)</i> <i>Unsure</i>	9 (22.5) 24 (60.0) 7 (17.5)	41 (42.3) 39 (40.2) 17 (17.5)	$\chi^2 = 5.445/p = 0.06$

Linear Regression Results of Managers Knowledge Scores

A single linear regression identified 10 predictors that were significantly

associated with managers' knowledge scores. All the predictors are described in (Table 5). Some of them are: first restaurant characteristics including restaurant type ($\beta=-1.3/p=0.003$), description of menu ingredients ($\beta=2.739/p=0.017$), availability of modified recipe ($\beta=2.659/p < 0.01$) and others reported in the same table. Second, managers' characteristics and background such as; their food service experience (very low: $\beta= -4.556/ p < 0.01$), (low: $\beta=-3.088, p < 0.01$), if they received food allergy training ($\beta=3.692/ p < 0.01$) and others.

The overall mean knowledge score did not show any significant differences based on managers' salaries or social status.

All significant predictors obtained from single regression are analyzed by multiple linear regression. Two predictors were found to be significantly associated with manager's knowledge scores. Managers at restaurants that have description of menu ingredients, and those who received food allergy training show better knowledge scores respectively; ($\beta=1.339/p=0.016$) and ($\beta=3.062/p=0.007$). The coefficient of determination (R^2) value is equal to 0.930 this means that the notion that knowledge scores of managers is influenced by 93 % by availability of menu description and previous training received while the rest 7 % is explained by other factors that were not counted for.

Staff: Regarding the 7 knowledge questions, the mean food allergy knowledge score was 4.21 ± 1.756 , ranging from lowest score = 1 to highest score equal to 7. For major food allergen identification only minority of the staff ($n=25, 25.8\%$) were able to identify at least 6 major food allergens. Half of the staff ($n=49, 50.5\%$) failed to answer correctly that someone with food allergy can die from consuming the allergen, 17.5% were unsure and only 32 answered correctly.

Only 33 (34%) of the staff knew that when any allergic reaction occurs at their

premises they have to call the emergency directly. As for taking a food allergen out of a ready to eat meal, only 40.2 % knew that we won't get a safe meal following this action.

Linear Regression Results of Staff Knowledge Scores

Single Linear regression analysis shows 8 significant predictors of staff knowledge scores shown in (Table 5). The 8 significant predictors are analyzed by Multiple linear regression which identified that the predictors of knowledge scores include years of foodservice experience (Very low: $\beta=-2.160/p<0.01$), (Low: $\beta=-1.664/p=0.003$), and previous training received ($\beta=1.736/p=0.003$). Multiple linear regression provides us with R^2 value equals to 0.577, this means that the notion that staff knowledge score is affected by 57.7% by 2 factors (experience and training), while the rest 42.3% is explained by other factors.

Comparison of Manager and Staff Knowledge Scores and Responses

All 2 groups had equivalent median knowledge scores: 4 for managers (mean=4.20, SD= 1.951, n=40), and for staff (mean=4.21, SD=1.756, n=97).

Knowledge scores were not significantly different between the 2 respondent groups: $p=0.986$.

Regarding responses to knowledge questions, as reference to the cross-tabulations results, significant difference is obtained between managers and staff answers to the first question (Participants Identified at least 6 correct food allergens) ($\chi^2=100.048/p<0.01$) and third question (Someone with food allergy can die from eating the food they are allergic to) ($\chi^2=50.837/p<0.01$) as shown in (Table 4).

From previous results above, multiple linear regression shows similar predictor for both managers and staff, where both groups' knowledge scores are affected by food allergy training.

Table 5. Predictors of Managers and Staff Knowledge Scores

Predictors	Managers				Staff			
	Simple Linear B coefficient , P- value		Multiple Linear B coefficient, P- value		Simple Linear B coefficient, P- value		Multiple Linear B coefficient, P- value	
Gender	-0.5	0.366	-		-0.816	0.028*	-0.225	0.440
Restaurant Type	-1.3	0.003*	-0.310	0.309	N/A ^d			
Menu Type	-0.040	0.949	-		N/A ^d			
Highest Price					N/A ^d			
<i>Low</i>	-1.429	0.092	0.23	0.586				
<i>Moderate</i>	-1.467	0.03*	0.318	0.397				
<i>High</i>	Reference		Reference					
Total meals prepared at the restaurant			-		N/A ^d			
<i>Very low</i>	-0.364	0.644						
<i>Low</i>	-0.056	0.946						
<i>High</i>	Reference							
Person on duty	2.989	0.0*	0.591	0.172	N/A ^d			
Description of menu	2.739	0.017*	1.339	0.016*	N/A ^d			
Allergen free menu	2.286	0.012*	-0.072	0.908	N/A ^d			
Number of violations			-0.698	0.203	N/A ^d			
<i>Low</i>	-0.706	0.28						
<i>Moderate</i>	-1.706	0.12						
<i>High</i>	Reference							
Documentation in dining	2.286	0.012*	-0.661	0.262	N/A ^d			
Documentation in kitchen	3.236	0.0*	-0.661	0.262	N/A ^d			
Modified recipes	2.659	0.0*	-0.314	0.487	N/A ^d			
Educational level	1.188 ^a	0.125 ^a	-		Reference		Reference	
<i>No school</i>								
<i>Low</i>					-2.250,	0.03*	-0.014	0.984
<i>Moderate</i>					-1.250	0.06*	-0.646	0.179
<i>High</i>					-1.791	0.0*	-0.286	0.523
Job Type	N/A ^b		-		-0.890,	0.043*	-0.149	0.657
Social Status			-				-	
<i>Married</i>	Reference				2.938	0.103		
<i>Good</i>	0.087	0.892			2.115	0.228		
<i>Not good</i>	-1.190	0.563			1	0.638		
<i>Widowed</i>					Widowed	Reference		
Salary	0.235 ^c	0.789 ^c	-					
<i>Low</i>					-0.719	0.421	0.118	0.870
<i>Moderate</i>					1.383	0.01*	-0.184	0.620
<i>High</i>					-0.719	0.136	0.166	0.686
<i>Very high</i>					Reference		Reference	
Experience								
<i>Very low</i>	-4.556	0.0*	-0.314	0.487	-2.908	0.0*	-2.160	0.0*
<i>Low</i>	-3.088	0.0*	0.123	0.923	-2.488	0.0*	-1.664	0.02*
<i>Moderate</i>	-0.667	0.365	-0.240	0.777	-0.843	0.084	-0.839	0.09
<i>High</i>	0.33	0.607	1.156	0.186	Reference		Reference	
<i>Very high</i>	Reference							
Experience at this Rest.	2.234	0.0*	0.228	0.640	0.836	0.026*	-0.394	0.234
Training	3.692	0.0*	3.062	0.007*	2.573	0.0*	1.736	0.003*

“Table 5 – Continued”

Predictors	Managers				Staff			
	Simple Linear B coefficient, P- value		Multiple Linear B coefficient, P- value		Simple Linear B coefficient, P- value		Multiple Linear B coefficient, P- value	
Special Meals								
<i>Low</i>	-3.655	0.001*	-0.617	0.467	1.707	0.0*	0.332	0.332
<i>Moderate</i>	-0.667	0.541	-0.495	0.480	2.033	0.007*	0.768	0.768
<i>High</i>	Reference				Reference		Reference	

^a Educational level is categorized into two groups (Technical, university) in Managers data set.

^b Data were obtained from Staff questionnaires only.

^c Salary is categorized into two groups (High, very high) in Managers data set.

^d Data were obtained from Managers questionnaires only

*Significant results $p < 0.05$

C. Attitudes toward Serving Customers with Food Allergies

Managers: Managers (95%) agreed or strongly agreed that servers should be knowledgeable about food allergies (Table 6). Nearly all managers (95%) agreed or strongly agreed that kitchen staff should be knowledgeable about food allergies. Managers (87.5%) agreed or strongly agreed that restaurants should try to meet food allergic customers’ special requests. However, only few managers (15%) agreed or strongly agreed that someone with food allergy should be able to bring his/her own meals when dining out at the restaurant premises.

Demographic variables, knowledge, and previous training status were entered into the regression model, with attitudes as the dependent variable. Few predictors were associated with attitude score because nearly all the managers scored high attitude points. Managers in restaurants that served more than 300 meals per day had greater odds of having a higher food allergy attitude score than did managers in restaurants that served 100 meals or fewer ($B=0.531, p < 0.05$).

Table 6. Descriptive Data on Managers and Staff Food Allergy Attitude

Attitude	Managers N=40 n (%)	Staff Managers vs. Staff N=97 n (%)	chi-square (χ^2)/P-value
Servers should be knowledgeable about food allergies <i>Strongly Agree</i> <i>Agree</i> <i>Neutral</i> <i>Disagree</i> <i>Strongly Disagree</i>	17 (42.5) 21 (52.5) 1 (2.5) 1 (2.5) 0	32 (33) 56 (57.5) 8 (8.2) 1 (1) 0	$\chi^2 = 2.697/0.441$
Kitchen staff should be knowledgeable about food allergies <i>Strongly Agree</i> <i>Agree</i> <i>Neutral</i> <i>Disagree</i> <i>Strongly Disagree</i>	17 (42.5) 21 (52.5) 1 (5) 0 0	26 (26.8) 65 (67) 4 (4.1) 2 (2.1) 0	$\chi^2 = 4.047/0.256$
Restaurant should try to meet food allergic customers' special requests <i>Strongly Agree</i> <i>Agree</i> <i>Neutral</i> <i>Disagree</i> <i>Strongly disagree</i>	10 (25) 25 (62.5) 5 (12.5) 0 0	15 (15.5) 62 (63.9) 14 (14.4) 5 (5.2) 1 (1)	$\chi^2 = 3.971/0.410$
Someone with food allergy should be able to bring his/her own meals when dining out: <i>Strongly Agree</i> <i>Agree</i> <i>Neutral</i> <i>Disagree</i> <i>Strongly Disagree</i>	2 (5) 4 (10) 15 (37.5) 17 (42.5) 2 (5)	0 (0) 8 (8.2) 43 (44.3) 41 (42.3) 5 (5.2)	$\chi^2 = 5.263/0.261$

Linear Regression Results of Managers Attitude Scores

Single linear regression analysis for manager's attitude scores show only one significant predictor which is number of total meals prepared at the restaurant where low number decreases the attitude score ($\beta = -1.114/p = 0.017$).

Staff: Majority of staff (90.5%) agreed or strongly agreed that servers should be knowledgeable about food allergies and 93.8% agreed or strongly agreed that kitchen staff should be knowledgeable about food allergies (Table 6). 79.4 % food workers also

agreed or strongly agreed that restaurants should try to meet food allergic customers' special requests. However, 42.3% of food workers disagreed that someone with food allergy should be able to bring his/her own meals when dining out. However, no significant predictors were obtained.

Linear Regression Results of Staff Knowledge Scores

Single linear regression analysis shows that high monthly income of staff is associated by lower attitude scores (High: $\beta = -1.094/p=0.03$). However, no significant results are identified by multiple linear regression analysis.

Comparison of Manager and Staff Attitudes Scores and Responses

All 2 groups had similar median attitude scores: 10 for managers (mean=10.7, SD= 1.203, n=40), and for staff (mean=10.57, SD=1.767, n=97). T-tests suggested that attitude scores were significantly correlated between the 2 respondent groups: $p = 0.257$.

Regarding attitude feedbacks of both groups, as reference to the cross-tabulations results, significant correlation is obtained between managers and staff. (Table 6).

Based on previous analysis, multiple linear regression shows that no significant predictors are associated with both managers and staff attitude scores (Table 7).

Table 7. Predictors of Managers and Staff Attitude Scores

Predictors	Managers		Staff	
	Single Linear B coefficient	P-value	Single Linear B coefficient	P-value
Salary	-0.157 ^c	0.773 ^c		
Low			-0.844	0.365
Moderate			-0.630	0.129
High			-1.094	0.030*
Very high			reference	
Restaurant type	-0.100	0.796	N/A ^d	
Service type	-0.239	0.562	N/A ^d	
Menu type	0.465	0.229	N/A ^d	
Total meals			N/A ^d	
Low	-1.114	0.017*		
Moderate	-0.671	0.160		
High	reference			
Number of managers	0.431	0.263	N/A ^d	
Number of staff	0.501	0.196	N/A ^d	
Highest price			N/A ^d	
Low	0.365	0.500		
Moderate	-0.378	0.375		
High	reference			
Person on duty	-0.418	0.301	N/A ^d	
Description of menu	1.117	0.123	N/A ^d	
Modified recipes	-0.198	0.626	N/A ^d	
Gender	0.889	0.164	-0.511	0.176
Training	-0.125	0.762	0.241	0.550
Experience				
Very low	-0.220	0.789	-0.529	0.349
Low	0.281	0.716	-0.241	0.677
Moderate	0.330	0.769	-0.850	0.172
High	reference		reference	
Educational level	0.406 ^a	0.400 ^a		
No school			reference	
Low			-0.617	0.469
Moderate			0.478	0.345
High			0.232	0.578
Current experience	0.125	0.762	0.105	0.276
Special meals				
Low	-0.172	0.846	0.417	0.360
Moderate	-0.778	0.414	1.175	0.152
High	reference		reference	

^a: Educational level is categorized into two groups (Technical, university) in Managers data set.

^b: Data were obtained from Staff questionnaires only.

^c: Salary is categorized into two groups (High, very high) in Managers data set.

^d: Data were obtained from Managers questionnaires only

*Significant results $p < 0.05$

D. Food Allergy Practices Scores

The practices responses of managers and staff toward food allergies are displayed in (Table 8).

Managers: Out of 8 practices questions, the mean practices score was 4.58 ± 2.049 , ranging from lowest score = 1 to highest score equal to 8. One of the practices inquiries is what can the service staff do in order to prevent an allergic reaction from occurring, 24 managers out of 40 answered correctly which is that the service staff should be able to identify the ingredients in menu and determine if it contains any known allergen. Majority of managers (n=32, 85%) stated that if unsure about the ingredients in a menu they never assure to the customer that the meal is free from allergens.

Table 8. Descriptive data of Managers and Staff Food Allergy Practices Questions

Practice	Managers N=40 n(%)	Staff N=97 n(%)	Managers vs Staff chi-square (χ^2)/P-value
Which of the following should service staff do in order to prevent allergic reaction			
<i>Cook food to right temperature</i>	7 (17.5)	29 (29.9)	$\chi^2 = 0.625 /$ $p = 0.453$
<i>Be able to identify ingredient in menu and determine if it contains any allergen (Correct)</i>	24 (60)	51 (52.6)	
<i>Use Dishwasher</i>	6 (15)	13 (13.4)	
<i>Keep food safe from bacterial growth</i>	3 (7.5)	4 (4.1)	
If Unsure about the ingredients in a menu item, I still assure to the customer that the allergen is not present.			
<i>Never</i>	34 (85)	11 (11.3)	$\chi^2 = 114.103 /$ $p < 0.01$
<i>Sometimes</i>	4 (10)	18 (18.6)	
<i>Always</i>	2 (5)	68 (70.1)	

Linear Regression Results of Managers Practices Scores

Predictors of manager's practice score established from single linear regression

analysis include: Some restaurant characteristics: person on duty ($\beta=3.291/p<0.01$), description of menu ingredients ($\beta=2.423/p=0.047$) and the availability of allergen free menu ($\beta=3.0/p<0.01$) and others reported in (Table 9).

Also some manager's characteristics are considered predictors of practice scores such as; their food service experience (Very low: $\beta= -5.111/p<0.01$), (Low: $\beta= -3.877/p<0.01$), current experience at this restaurant ($\beta=2.33/p<0.01$) and food allergy training ($\beta=3.934/ p<0.01$).

Based on multiple linear regression performed, the predictors of practices scores are the availability of allergen-free menu ($\beta=1.479/p=0.015$) and receiving food allergy training ($\beta=3.075/p= 0.003$). R^2 value is equal to 0.971, this means that the notion that practice scores of managers is influenced by 97.1% by availability of allergen-free menu at the restaurant and previous training received, however the rest 2.9% is explained by other factors.

Staff: In the practices section 8 questions were asked to the staff, the mean practices score was 5.31 ± 1.761 , ranging from lowest score =2 to highest score equal to 8. Staff were asked what can they do in order to prevent an allergic reaction from occurring, 51 staff out of 97 answered correctly which is that the service staff should be able to identify the ingredients in menu and determine if it contains any known allergen. Mainly 70.1 % of the staff (n=68) stated that if unsure about the ingredients in a menu they never assure to the customer that the meal is free from allergens.

Linear Regression Results of Staff Practices Scores

Predictors of staff practice score obtained from single linear regression analysis include: social status (very good: $\beta= 4.063/p=0.043$), Experience (very low: $\beta=-3.092/p=0.0$), (low: $\beta=-2.323/p=0.021$), education (low: $\beta=-4.844/p= 0.0$), (moderate: $\beta=-2.865/p= 0.0$), (high: $\beta= -2.850/p< 0.01$), training ($\beta=3.657/p<0.01$) and others

reported in (Table 9).

Based on multiple linear regression performed, factors that had impact on staff practices scores include years of food service experience (very low: $\beta=-1.492/p <0.01$, low: $\beta= -0.730/p=0.038$), educational level (Low: $\beta=-2.12/p <0.01$, moderate: $\beta= -0.680/p= 0.033$, high: $\beta= -0.712/p=0.017$) and previous food allergy training received ($\beta=2.472/p<0.01$).

On the other hand, job type whether the staff is full-time or part time had no impact on practice score. In reference to the multiple linear regression R^2 value= 0.858 shows that the 3 factor (experience, training and educational level) have 85.8% influence on staff practices scores.

Comparison of Manager and Staff Practices Scores and Responses

Median practices' scores for the 2 groups is: 4 for both managers (mean=4.58, SD= 2.049, n=40), and for staff (mean=4.55, SD=1.942, n=97). Practices scores of the 2 respondent groups were significantly correlated: $p= 0.575$.

There is significant difference in the responses of the two groups for the following practice question: if Unsure about the ingredients in a menu item; I still assure that the allergen is not present. Table 8 shows ($\chi_c^2=114.103/ p<0.01$).

One common factor influencing both groups' practices scores is food allergy training.

Table 9. Predictors of Managers and Staff Practices Scores

Predictors	Managers				Staff			
	Single Regression		Multiple Regression		Single Regression		Multiple Regression	
	B coefficient	P-value	B coefficient	P-value	B coefficient	P-value	B coefficient	P-value
Gender	-0.361	0.743	-	-	-0.524	0.206	-	
Restaurant type	-1.25	0.052	-	-	N/A ^d		-	
Menu type	-0.268	0.687	-	-	N/A ^d		-	
Highest Price	-1.96	0.029*	0.408	0.238	N/A ^d		-	
Total number of meals prepared					N/A ^d		-	
<i>Low</i>	-0.045	0.956						
<i>Moderate</i>	0.147	0.866	-	-				
<i>High</i>	Reference							
Person on duty	3.291	0.0*	0.772	0.058	N/A ^d		-	
Description of Menu	2.423	0.047*	0.861	0.069	N/A ^d		-	
Allergen free Menu	3.0	0.0*	1.479	0.015*	N/A ^d		-	
Number of violations					N/A ^d		-	
<i>Low</i>	-1.559	0.318	-	-				
<i>Moderate</i>	-0.690	0.178						
<i>High</i>	reference							
Documentation in dining	2.086	0.031*	-0.049	0.919	N/A ^d		-	
Documentation in kitchen	3.479	0.0*	-0.131	0.807	N/A ^d		-	
Modified recipes	3.071	0.0*	0.381	0.359	N/A ^d		-	
Social Status								
<i>Married</i>	Reference	-	-	-	4.063	0.043*	1.128	0.235
<i>Good</i>	0.095	0.888			3.513	0.072	1.465	0.120
<i>Not Good</i>	-1.571	0.467			2.5	0.291	0.807	0.469
<i>Widowed</i>					Reference			
Experience								
<i>Very low</i>	-5.111	0.0*	-0.613	0.651	-3.092	0.0*	-1.492	0.0*
<i>Low</i>	-3.877	0.0*	-0.011	0.992	-2.323	0.021*	-0.730	0.038*
<i>Moderate</i>	-0.667	0.379	-0.868	0.262	-0.157	0.758	-0.206	0.528
<i>High</i>	Reference		-0.543	0.496	reference			
Educational level	0.875 ^a	0.286 ^a						
<i>No school</i>					reference			
<i>Low</i>					-4.844	0.0*	-2.128	0.0*
<i>Moderate</i>					-2.865	0.0*	-0.680	0.033*
<i>High</i>					-2.850	0.0*	-0.712	0.017*
Job type	N/A ^b				-0.688	0.159	-	
Salary	0.873 ^c	0.343 ^c						
<i>Low</i>					-1.594,	0.112	-0.375	0.424
<i>Moderate</i>					-1.368,	0.003*	-0.051	0.834
<i>High</i>					-0.744	0.167	0.039	0.884
<i>Very high</i>					reference			
Special Meals								
<i>Low</i>	-3.914	0.0*	-0.297	0.702	2.158	0.0*	-0.023	0.935
<i>Moderate</i>	-0.389	0.699	-0.668	0.297	2.4	0.003*	-0.220	0.605
<i>High</i>	reference				reference			
Experience at this rest.	2.33	0.0*	0.305	0.484	1.285	0.002*	-0.257	0.243
Training	3.934	0.0*	3.075	0.003	3.657	0.0*	2.472	0.0*

^a: Educational level is categorized into two groups (Technical, university) in Managers data set.

^b: Data were obtained from Staff questionnaires only.

^c: Salary is categorized into two groups (High, very high) in Managers data set.

^d: Data were obtained from Managers questionnaires only

* Significant results p<0.05

CHAPTER IV

DISCUSSION

To the best of our knowledge, this study is the first comprehensive report that evaluated the knowledge, practices and attitudes of restaurant personnel about food allergy in Lebanon. The results showed that there are gaps in the knowledge and training. The main goal of this study was to identify food allergy knowledge, attitudes, and practices in the Lebanese restaurants distributed in all the governorates. The study sought to identify how the restaurant industry has responded to food allergies. Which revealed that both managers and staff lack the basic food allergy knowledge and only low percentage of the sample received training regarding food allergies.

Employees of the Lebanese restaurants show positive attitudes toward food allergies, however they are not well prepared and knowledgeable in order to accommodate requests from their food allergic customers. This finding is consistent with the study of Wham and Sharma (2014) the authors reported that most of manager's interview responses were positive regarding preparing safe meals and managing emergencies but the survey results demonstrated a serious deficit in knowledge and plans to adapt with food allergy cases. This highlights the need of additional trainings [9].

This study indicates that attitudes of restaurant managers and staff are hopeful and constructive regarding food allergic customers, but they got low knowledge and practices scores. This finding suggests that restaurant staff should be well trained about food allergies in order to achieve the target of handling food allergic customers' requests. This finding is supported by previous studies of the same topic where Lee and

Xu (2015) mentioned that many knowledge gaps were identified, suggesting a need for increased education and training of restaurant and food service personnel and low levels of participant knowledge, practices, and self-efficacy of responding to food allergy emergencies were observed [11]. Therefore, we can confirm that food allergy related training can be beneficial to restaurants, employees and their customers.

One positive finding was that nearly more than half of restaurant staff and managers were knowledgeable that taking a food allergen out a of meal after it has been made is one way to make it safe for a food allergic and if unsure about the ingredients in a menu item they would still assure that the allergen is not present. However, we identified important gaps in knowledge. For example, restaurant staff members were less likely to recognize at least 6 correct major food allergens. Another troubling finding was that only 10% of managers and 24.7% of staff knew the most convention corrective action when an allergic reaction occurs at their premises which is calling the emergency. Similar finding was established in other studies where one third of respondents answered the true-false knowledge questions correctly. Only one in four staff was able to correctly name three common food allergens [18]. Supportive evidence from similar studies confirm that accurate knowledge is critical to preventing an allergic reaction because the incidence of food allergies continues to increase, it is important for restaurants to be prepared for potential anaphylaxis emergencies [10].

Some individual characteristics were significantly associated with food allergy knowledge and practices such as highest level of education and years of work experience. Higher levels of education and more years of experience were associated with higher scores of knowledge and practices, therefore it is important for restaurants to hire more experienced and educated workers. Regarding the attitudes both managers' and staff characteristics had no impact on positive perspective about food allergies.

Regarding practices questions, 60% of managers (n=24) and 52.6% of staff (n=52) mentioned that servers staff should be able to identify the ingredients in menu and determine if it contains any allergen. Nearly all managers (85%, n=34) would never assure to the customer that allergen is not present if unsure about menu ingredients, on the contrary 70 % of staff (n=68) would always assure even if they are not sure about ingredients. This indicates that there is no coordination between managers and staff and managers do not provide the essential training related to food allergies.

Restaurant characteristics also had an impact on knowledge and practices scores; where the availability of allergen-free menu and ingredients description of menus are predictors for knowledge and practices scores. Food allergy training was significantly associated with higher manager and staff knowledge and practices scores. Thus food allergy trainings are essential resources for controlling food allergic incidence at restaurants. Information sheet was distributed at each restaurant as a resource for improving food allergy knowledge and practices and as a way to make the restaurants aware about the importance of implementing staff trainings. This sheet includes definition, prevalence, causes, symptoms, and treatment of food allergies. Also it gives a brief information about major food allergens, and food allergy preventive actions that should be implemented at restaurants.

Multiple linear regression ensures that restaurants with menu description have 1.339 higher points of knowledge scores, and availability of allergen-free menu increases the manager's practices scores by 1.479 points. Managers who received food allergy training have 3.062 higher knowledge scores and 3.934 greater practices scores than those who were not exposed to any trainings.

Staff with very low experience (< 2 years) and low experience (2-4 years), recorded decreased knowledge scores by -2.160 points and -1.664 points respectively.

Regarding practices scores, staff with low experience have decreased scores by -5.575 points. Educational level of staff also impacted the practices scores where staff with intermediate school level have lower practices scores by -2.128 points compared to lower -0.680 points of those who have technical diploma. Staff who received food allergy training have 1.736 higher knowledge scores and 2.472 greater practices scores than those who were not exposed to any trainings.

Results multiple regressions shows that no predictors of attitude scores were detected as all the respondents had positive responses for serving customers with food allergies. The only factor which had an impact on manager's attitude score was the number of total meals prepared at the restaurant, lower number of meals was associated with -1.114 lower attitude scores. Staff with higher salaries have -1.094 lower attitude scores.

In this study knowledge, attitudes and practices scores did not differ between managers and staff All 2 groups had equivalent median knowledge scores equal to 4 and around 4.21 mean, both scores were not significantly different between the 2 respondent groups: $p= 0.986$. This indicates that gaps in knowledge are corresponding between managers and staff. And multiple linear regression shows similar predictor for both managers and staff, where both groups' knowledge and practices scores are affected by food allergy training.

However; some differences are spotted in the responses of some knowledge questions, as reference to the cross-tabulations results, significant difference is obtained between managers and staff answers to the first question which is the ability of a participant to correctly identify at least 6 correct food allergens. Likewise; practices' scores for respondent both groups were significantly correlated: $p= 0.575$. But a significant difference in the responses of the two groups for the practice question (if

unsure about the ingredients in a menu item I still assure that the allergen is not present) was observed. So this might tell that even when managers are knowledgeable about certain information they do not educate their staff on it. This finding supports the idea of gap in communication between restaurants' food workers. Unfortunately, this is one barrier for producing safe meals in terms of food allergens.

This issue can be solved by preparing restaurant staff with food allergen management resources such as: ingredient lists, dedicated kitchen equipment, written plans and food allergy training for achieving essential knowledge and convenient practices toward accommodating food allergies. "The availability of organizational resources, including training and technology, was positively associated with employee motivation and engagement" [12]. Additional support from more studies ensures that "the provision of a safe meal for food allergic patients is a team activity dependent on everyone having sufficient level of awareness and knowledge to ensure safe delivery of the food. The waiters and servers are in direct communication with diners and they must be relied upon to ascertain the customer's needs" [18].

Additional barriers interrupting the success of food allergies training in restaurants reported by indistinguishable study are the following: employees' lack of commitment and interest, as well as time constraints and schedule conflicts between work flow and training timing [11].

Some drawbacks of our study include that no real-time monitoring or observation was done to know the real practices of staff and to check if any trainings are implemented to improve knowledge about food allergies. Another drawback is that we were not able to have access for the food allergen-free modified recipes at the restaurants that mentioned having modified recipes. Also, the study might have a selection bias as participants who agreed to join our study might already have more

awareness in this topic which is associated with higher food allergy knowledge scores than non- respondents.

It is highly recommended for restaurants in Lebanon to implement concentrated training session related to food allergies in order to enhance staff and managers' knowledge and practices scores. This is confirmed by a study that evaluated the importance of conducting food allergy related educational training and evaluated the staff KAPs before and after the intervention [19]. In USA, according to Illinois department of public health, in 2018 a new allergen awareness training program that is accredited by the American National Standards Institute (ANSI) was incorporated and it is required to the food protection managers working at restaurants to get this certification [22]. In Lebanon we have a lot of ISO and food safety related certification buddies such as Bureau Veritas, ISO Liban, SGS Academy, and International Quality Services. But until now none of those academies provide specific certificates related to Food allergy trainings.

A final note regarding the food regulations and laws: According to Food Standards Agency, Allergen ingredients information should be recorded and should contain: product specification sheets, ingredients, labels and recipes [23]. Under the “Food Safety Modernization Act (21 CFR Part 117)”, restaurants must have a risk assessment and plans in place for handling allergens [24]. Also restaurant industry is addressed by “The Food Code” which states that restaurants should have a person in charge during all hours of operation who has knowledge about major food allergens [25, 26]. In the United Arab Emirates, serving customers with allergies is covered under the municipality Food Code 2013 states: “food service establishments must declare the most common ingredients known to cause allergenic reactions” [24]. On the other hand, there are no food regulations and laws in Lebanon that drive the food industries to

mention all the possible food allergens on their food labels. Or that necessitate restaurants to implement food allergies management plans and modified recipes.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

Overall, these findings suggest that managers, food workers, and servers at the Lebanese restaurants are not well-knowledgeable towards food allergies, and only very low percentage of staff received food allergy specific trainings. However, they have positive attitudes about serving customers with special requests in order to avoid any food allergic reaction of occurring at their premises. Finally, we encourage restaurants to implement enough resources and preventive practices to be able to handle food allergy requests. We encourage the certification buddies in Lebanon to incorporate trainings specific to food allergies. Finally, we encourage the Lebanese ministry of health to oblige the restaurants in implementing food allergies management plans. A future study should be done for implementation of training strategies and resources that effectively improve managers' and workers' knowledge, practices and attitudes in order to ensure a safe dining environment for customers with food allergies. Moreover, further investigations about the results to be established by logistic regression analysis.

APPENDIX I

ORAL CONSENT FORM

Title of Research Study: Food allergy Knowledge, Attitudes and Practices (KAPs) of foodservice workers at restaurants in Lebanon: A Cross-sectional study

Principal Investigator: Dr. Samer Kharroubi-Department of Nutrition and Food Sciences, American University of Beirut, Lebanon

Hello, my name is Sara Nasserredine. I am a graduate student pursuing a Master's in Food Technology at the American University of Beirut (AUB). I would like to invite you to participate in a research study about the knowledge, attitudes and practices (KAPs) of foodservice workers towards Food allergy in Lebanon. It is important that you read the information below carefully before agreeing to participate in the study, to understand the purpose, actions, benefits and risks related to your participation in the project. Please feel free to ask any question if you need any clarification about what is stated in this form or if you need any additional information. You will be provided with this consent form which includes the project information as well as contact information of those carrying out the study for your future reference.

Before we begin, I would like to take a few minutes to explain to you briefly why we are doing this study and why we would like you to participate. The main purpose of this research study is to: (i) explore the restaurant manager and staff food allergy knowledge, attitudes, and practices; (ii) to compare knowledge, attitudes, and practices among managers and staff; and (iii) to identify factors associated with food allergy knowledge, attitudes, and practices.

Our research study will include on-site surveys with a manager (worker with authority over the kitchen), food worker (worker who primarily prepares or cooks food), and server (worker who primarily takes orders or serves food to customers) recruited from a total of 137 randomly selected restaurants across Lebanon. The inclusion criteria of the participants include: Lebanese and aged between 18 and 65 years.

After obtaining permission from the restaurant manager, data collectors will ask you to fill a questionnaire in a private setting to maintain your privacy and confidentiality of the information collected. If you agree to participate in the study, you will be asked to fill a questionnaire described below. Note that your participation will take approximately 15-20 minutes. Filled surveys will be collected by research team directly after completion by participants. Please note that Participants won't be contacted after filling the surveys to complete any missing data as they have the right to skip or refrain from answering any question.

Manager Questionnaire:

First, we will ask you to complete a questionnaire which includes questions on your socio-demographic background (e.g., years of experience in current restaurant and whether you had been food safety certified) and characteristics of the restaurant (e.g., chain versus independent ownership and number of meals served in a typical day).

Food Worker and Server Questionnaire:

First, we will ask you to complete a questionnaire which includes questions on your socio-demographic background (e.g., years of experience in current restaurant and whether they had been food safety certified).

Then, the rest of the questionnaire will include similar questions for both managers and staff. So, you will be asked 7 questions to assess your food allergy knowledge (e.g., identifying major food allergens and knowing what to do when a customer has a bad food allergic reaction), 14 questions to assess your food allergy attitudes (e.g., should servers be knowledgeable about food allergies and should restaurants try to meet food allergic customers' special requests), and 8 questions to assess food allergy practices (e.g., Which of the following should service staff do in order to prevent an allergic reaction?).

In addition, data collectors will examine the menu to assess additional restaurant characteristics (e.g., highest priced food item and number of critical violations on the restaurant's last inspection) and food allergy documentation (e.g., whether the menu mentioned anything about allergens and whether documentation about allergens was available in the kitchen area).

Overall, the PI is responsible to secure restaurants managers' approval to approach their employees, conduct the study at their premises and examine the menu for the parameters

Risks, Discomforts and Benefits

Please be sure that your participation is completely voluntary; refusal for participation will not put you at any risk. You are free to skip any question not feeling comfortable for answering. We deny asking for any personal information; the only personal questions include gender, level of education, marital status and job description at the restaurant. Our procedure doesn't include any invasive tool. We deny any health, psychological or social risk accounted with our intended survey. The questions included in our survey do not influence worker's job or put them at risk of losing their jobs. It is the right of each participant to Contact IRB for questions related to the research or in case of any injury. There is no promise that you will receive any benefit from taking part in this study.

However, your participation in this study will contribute for new findings related to food allergies. Refusal or withdrawal from the study will involve no loss of benefits nor will it affect your relationship with AUB or with your workplace. There are no foreseeable risks or discomfort beyond those encountered every day.

Confidentiality:

Your records will be kept confidential and will not be released without your consent except as required by law. Your identity will be kept private. If the results of this study are published in a scientific journal your name will not be shown. We deny recording your name, telephone number, or any other data that can relate the questionnaire to your personal ID. We will only assign a number for each participant for coding our data. Your records will be monitored and audited without violating your confidentiality. The data will be kept strictly confidential and stored in a locked cabinet in the principal investigator's office at AUB. The data will be destroyed 5 years from the end of the project to meet AUB archive requirements.

Your individual privacy and confidentiality of the information you provide will be maintained in all data analysis and reports resulting from the study. Findings from this study will be used for research purposes only. The data will only be accessed by the advisor, the research team and IRB.

Please Note that data will be published in aggregate with no reference to the participants' and restaurants' names or any other identifying information.

CONTACT INFORMATION AND QUESTIONS

A copy of this consent form will be left with you and if you have any questions or concerns about the research, you may contact:

Dr. Samer Kharroubi, Faculty of Agricultural & Food Sciences-AUB

Address: American University of Beirut; Riad El Solh, Beirut 1107 2020, Lebanon

Tel: 961-1-350000 (Ext 4541) **E-mail:** sk157@aub.edu.lb

If you have any questions, concerns or complaints about your rights as a participant in this research, you can contact the following office at AUB:

Social & Behavioral Sciences Institutional Review Board Address: American University of Beirut Medical Center (AUBMC) Halim and Aida Daniel Academic and Clinical Center (ACC) Building, 3rd Floor **Tel:** 961-1-350000 (Ext 5445) **Email:** irb@aub.edu.lb

Participant Rights: Participation in this study is voluntary. Your decision not to participate in the study does not influence your relationship with AUB. Do you have any questions about the above information? Do you wish to participate in this study?

Participant Consent:

I have read and understand the above information. I agree to participate in the research study.

Researcher name: _____

Date & time: _____

Researcher Signature: _____

APPENDIX II

MANAGER'S QUESTIONNAIRE

- This survey assesses the food allergy knowledge, attitudes and practice of foodservice managers and staff at a sample of restaurants in Lebanon.
- Please read every question carefully and complete the survey to the best of your knowledge.
- Please do not hesitate to ask questions if needed.
- Completing the survey is completely voluntary and anonymous. Please DO NOT write your name on this survey. The answers you provide will be kept confidential.
- When you are done with the survey, kindly return it back to the surveyor who handed it to you.

Thank you for your valuable time and input

ID number: _____ **Interview Start time:** _____

Interviewer's name: _____ **Date:** _____

Day of the week: _____ **Governorate:** _____

I. Restaurant Characteristics: (14)

1. Restaurant type
 - a. Chain
 - b. Independent
2. Service type
 - a. Full service casual or fine dining
 - b. Quick service, fast casual service, or takeout only
3. Menu type
 - a. American
 - b. Non-American
4. Number of meals served in a typical day
 - a. 1-100
 - b. 101-300
 - c. >300

5. Number of managers or persons in charge who work in this restaurant
 - a. <3
 - b. ≥ 3

6. Number of workers, other than managers in charge, who work in this restaurant
 - a. ≤ 10
 - b. > 10

7. Highest price on the menu
 - a. < L.L 15,000
 - b. L.L 15,000 - 30,000
 - c. > L.L 30,000

8. Number of critical violations received after the last inspection
 - a. 0
 - b. 1
 - c. > 1

9. There is an assigned person on duty to handle questions and requests about food allergies
 - a. Yes
 - b. No

10. Menu has a thorough description of the ingredients in each food item
 - a. Yes
 - b. No

11. Separate allergen-free menu is provided
 - a. Yes
 - b. No

12. Documentation in front of the house (areas accessible to customers) or dining area about allergens
 - a. Yes
 - b. No

13. Documentation about allergens in the kitchen area
 - a. Yes
 - b. No

14. Modified recipes exist to produce allergen-free meals
 - a. Yes
 - b. No

II. Manager Characteristics

A. Socio-Demographic Background (7)

1. What is your age? _____
2. What is your gender?
 - a. Male
 - b. Female
3. What is the highest educational level that you have attained?
 - a. No schooling
 - b. Primary school
 - c. Intermediate school
 - d. High school
 - e. Technical diploma
 - f. University degree
4. What is your marital status?
 - a. Married
 - b. Single
 - c. Divorced
 - d. Widowed
5. What is your employment?
 - a. Employee, full time
 - b. Employee, part time
6. What is the type of housing you live in?
 - a. Rental Housing
 - b. Private Housing
 - c. Living with parents
 - d. Live with friends/roommates
 - e. Others _____
7. What is your monthly income (L.L.)
 - a. Less than 500,000
 - b. 500,000-799,000
 - c. 800,000-999,000
 - d. Greater than 1,000,000

B. Work Experience (4)

1. Years of experience in the food service industry
 - a. <2 years
 - b. 2-4 years
 - c. 5-7 years
 - d. 7-9 years
 - e. More than 10 years

2. Years of experience in the current restaurant
 - a. 2 years
 - b. ≥ 2 years

3. Have you received training on food allergies while working at this restaurant?
 - a. Yes
 - b. No

4. Number of meals prepared for food allergic customers per month
 - a. 0
 - b. 1-10
 - c. >10

III. Food Allergy Knowledge, Attitudes and Practices

A. Knowledge Questions (7)

1. Of the following foods, which do you think are major allergens

Food	True	False	I don't know
Peanuts			
Tomatoes			
Milk or Dairy			
Eggs			
Chocolate			
Corn			
Soy			
Fish			
Apples			
Potato			
Tree nuts (almonds, walnuts, pecans)			
Wheat			

2. Which of the following are symptoms of an allergic reaction to food?

Symptoms	True	False	I don't know
Trouble breathing			
Vomiting			
Hives or rash			
Headache			
Swelling of tongue and throat			
Fever			

3. Which of the following should you do if a customer is having a bad food allergic reaction, such as breathing difficulties?
 - a. Suggest that the customer drink water

- b. Call the emergency
 - c. Ask the customer if they have medicine they could take
 - d. Suggest that the customer throw up
4. High-temperature cooking methods (baking, deep-frying, etc.) could destroy the food allergens
 - a. Yes
 - b. No
 - c. Unsure
 5. Someone with a food allergy can safely eat small amounts of the food they are allergic to
 - a. Yes
 - b. No
 - c. Unsure
 6. Someone with a food allergy can die from eating the food they are allergic to
 - Yes
 - No
 - Unsure
 7. Taking a food allergen out of a meal after it has been made is one way to make it safe for a food allergic customer
 - a. Yes
 - b. No
 - c. Unsure

B. Attitude Questions (14)

Attitude	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Servers should be knowledgeable about food allergies					
2. Kitchen staff should be knowledgeable about food allergies					
3. Restaurants should try to meet food allergic customers' special requests					
4. The staff in this restaurant know what to do if a customer has a bad food allergic reaction					
5. Special attention to safe food-handling practices should be made when preparing and serving dishes to customers with food allergies					

6. It is appropriate for customers with food allergies to request more information about ingredients and preparation methods					
7. Basic food allergy training and education should be a requirement for all foodservice employees					
8. Our restaurant welcomes handling food allergy requests. I feel confident in my ability to provide safe meals to customers suffering from food allergy					
9. I personally find it meaningful being able to accommodate and protect food-allergic customers					
10. I feel confident about my restaurant's ability to handle food allergy concerns safely					
11. I think that it is compulsory for restaurants to adjust and customize dishes to meet food allergy requests					
12. Attending food allergy training workshops would help me serve food-allergic customers with greater confidence					
13. I believe I can adequately handle a food allergy emergency at the restaurant where I work					
14. Someone with food allergies should be able to bring his/her own food or snacks when dining out with others					

C. Practice Questions (8)

1. Which of the following should service staff do in order to prevent an allergic reaction?
 - Cook food to the right temperature
 - Be able to identify ingredients in the menu item and determine if it contains any commonly known allergens
 - Use dishwasher for cleaning dishes
 - Keep foods safe from bacterial growth

2. Which of the following practices could cause cross contamination?
 - Using the same utensils for preparing general meals and allergen-free meals

- Preparing allergen-free food on a countertop that has not been well cleaned and sanitized
 - Not washing your hands thoroughly with soap and water and wearing new gloves
 - Not handling the allergen-free plates separately
 - All of the above
3. If a mistake is made when preparing a meal for a food allergic customer, the food should be remake
- Never
 - Sometimes
 - Always
4. I try to listen carefully, and understand customers' questions about food allergens presence in any menu item
- Never
 - Sometimes
 - Always
5. When preparing fried food for customers with food allergy, I make sure to change the oil in the fryer to prevent cross-contamination
- Never
 - Sometimes
 - Always
6. If I am unsure about the ingredients in a menu item, I still assure to the customer that the food does not contain any allergens
- Never
 - Sometimes
 - Always
7. I wash my hands thoroughly with soap and water and wear a fresh pair of gloves before preparing an allergen-free meal
- Never
 - Sometimes
 - Always
8. If one of my customers has a food allergy, I communicate the allergen information to the cook to ensure that the food is prepared safely and is allergen-free
- Never
 - Sometimes
 - Always
-

APPENDIX III

STAFF QUESTIONNAIRE

Same as Manager's questionnaire without section 1 (restaurant characteristics)



Faculty of Agricultural and Food Sciences
Department of Nutrition and Food Sciences

**Food allergy Knowledge, Attitudes and Practices (KAPs) of foodservice workers at
restaurants in Lebanon: a Cross-sectional study**

Questionnaire for food worker and sever

Appendix 3

2019

1

APPENDIX IV

PARTICIPANTS FOOD ALLERGIES INFORMATION SHEET



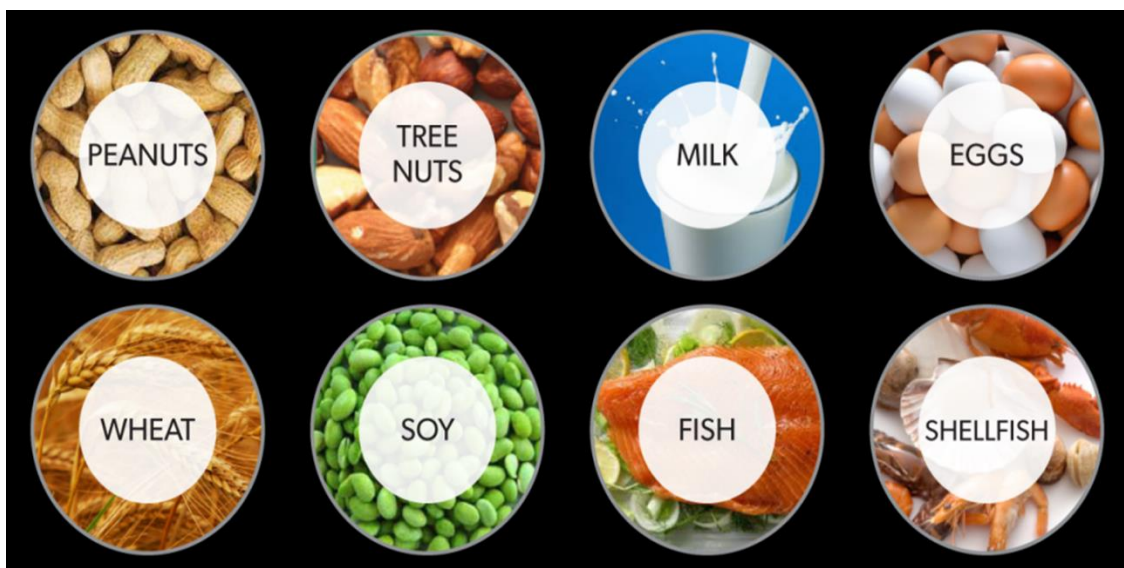
A. Definition of Food Allergies:

Food allergy is an immune mediated response to the consumption of an allergen. Food allergens are typically naturally-occurring proteins in foods that cause abnormal immune responses.

B. Prevalence of Food Allergies in Lebanon:

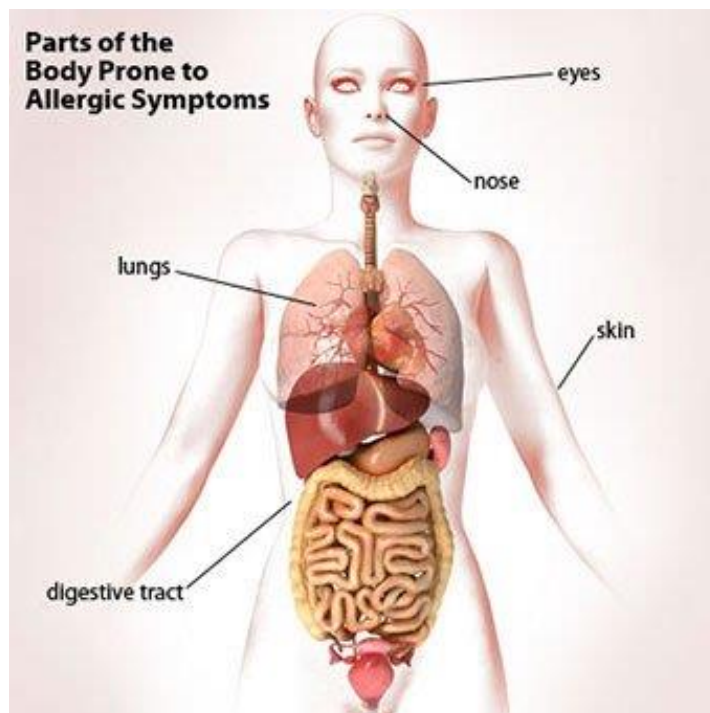
The food allergy prevalence in Lebanon is estimated to be 4.1% in infants and children and 3.2% in adults.

C. Types of Allergens in Foods:



D. Symptoms:

- **Skin:** Hives, eczema, swelling of the lips and **face**, itching
- **Eyes:** Swelling, watering, itching
- **Respiratory Tract:** Swelling of the throat or mouth, difficulty breathing, runny nose, wheezing, and repetitive coughing
- **Gastrointestinal Tract:** Abdominal cramps, vomiting, diarrhea (GI manifestations are often associated with a more serious reaction)



E. Severity:

Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death. It typically causes more than one of the following:

- itchy rash
- throat or tongue swelling
- shortness of breath
- Vomiting
- lightheadedness
- low blood pressure
- Death

F. Cure:

There is currently no cure for food allergies but effective care and emergency treatments are available. The only successful method to manage a food allergy is avoidance of all foods containing the allergen.

G. Corrective Actions in Food Services:

In Case any Food allergic reaction occurs at your premises. Call the Emergency Directly. (Red Cross, or Doctor on call if available)

H. Prevention:

- 1) Identify Allergens
- 2) Know the Ingredients of all the meals served at the restaurant
- 3) Be Aware of food allergens in mixed dishes such as: sauces, desserts, peanut butter, fried foods
- 4) Provide food allergens Friendly-Menus or Recipes.
- 5) Use Safe cooking oil; If an oil has previously been used to fry food that contains an allergen, other foods cooked in that oil will contain protein and may cause an allergic reaction.
- 6) Avoid Cross Contact. Such as: Using cooking utensils, trays, or prep stations, for both allergen-containing and non-allergen-containing products without washing them in between uses. Improper Hand washing Practices.
- 7) Place Food Allergy Awareness posters in the dining and preparation areas.



Thank you.

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