



AMERICAN UNIVERSITY OF BEIRUT

ASSOCIATION BETWEEN KNOWLEDGE, ATTITUDE AND  
PRACTICES OF FOOD ALLERGIES AMONG LEBANESE  
RESTAURANT MANAGERS AND STAFF

by  
MAYSSAA ISSMAT BOU DARGHAM

A thesis  
submitted in partial fulfillment of the requirements  
for the degree of Master of Science  
to the Department of Nutrition and Food Sciences  
of the Faculty of Agricultural and Food Sciences  
at the American University of Beirut

Beirut, Lebanon  
April 2021

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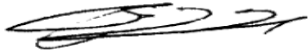
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## ACKNOWLEDGEMENTS

First and foremost, I have to thank my thesis advisor, Dr. Samer Kharroubi of the Department of Nutrition and Food Sciences at the American University of Beirut. Without his assistance and dedicated involvement in every step throughout the process, this paper would have never been accomplished. Throughout COVID-19 pandemic the “Virtual door” to Professor Kharroubi’s office was always open whenever I ran into a trouble spot or needed to steer me the right direction. I would like to thank you very much for your support and understanding over the past year.

I would also like to express sincere gratitude to my committee, including Dr. Imad Toufieli, Dr. Issmat Kassem, and Dr. Ali Chalak. Everyone raised many precious points in our discussion during the comprehensive and I hope that I have managed to address several of them here.

Getting through my masters required more than academic support, and I have people to thank for listening to and, at times, having to tolerate me over the past three years. I would like to extend my sincere thanks to my colleague Mrs. Tsolaire Sourenian for personal and professional support during the time I spent at the American University of Beirut.

Most importantly, none of this could have happened without my family. I must express my very profound gratitude to my parents (particularly my mom) and to my husband, Samer, and my kids for providing me with unwavering support and continuous encouragement throughout my years of study and through the process of writing this thesis. They kept me going on and this work would not have been possible without their input. I achieved all of this while homeschooling a Kindergartener and nursing a baby between classes and meetings. Forever grateful.

Finally, I dedicate this thesis to the my beloved Dad’s soul; I wish he was here to celebrate this milestone with me. Until we meet again.

# ABSTRACT OF THE THESIS OF

Mayssaa Issmat Bou Dargham for

Master of Science

Major: Food Safety

Title: Association Between Knowledge, Attitude and Practices of Food Allergies  
Among Lebanese Restaurant Managers And Staff

*Introduction:* Restaurants are unique and challenging environments that may expose consumers with food allergies to the risk of accidental allergen ingestion. *Objective:* The main objective of our present paper is to study the association between food allergy knowledge, attitudes, and practices in the Lebanese restaurant environment whilst also examining potential determinants of the KAP's outcome. *Methods:* Data for the current study was drawn from a cross-sectional survey that was conducted among restaurants' food service workers and managers in Lebanon. Through face-to-face interviews, food service workers and managers filled in a multicomponent questionnaire containing two sections: (1) sociodemographic characteristics and work experience, and (2) knowledge, attitudes and practices related to food allergy. An additional section related to the restaurant characteristics was completed by managers only. Further details about the sampling framework were presented elsewhere. *Results:* A total of 137 restaurants' food service workers and managers completed the surveys. In light of prior research, as described in more details elsewhere; the surveys indicated that the attitudes of restaurant managers and staff were generally positive regarding food-allergic customers. After employing a pooling strategy, results indicated that the food allergy attitude scores were positively correlated with both the food allergy practice scores ( $r= 0.325$ ,  $p<0.01$ ) and knowledge scores ( $r=0.373$ ,  $p <0.01$ ). Yet, a statistically significant correlation exists between knowledge and practice scores ( $r=0.224$ ,  $p<0.01$ ). Notably, the association between knowledge and attitude and that between knowledge and practice was influenced by previous food allergy training. *Conclusions:* The findings of this study underscore the need for crafting effective food allergy trainings to ensure that workers have the alertness and knowledge essential for adhering to adequate food handling practices. Policymakers, restaurant industry, and food safety educators in Lebanon should develop robust legislations and incorporate risk communication strategies to ensure a safe dining experience for food-allergic patrons.

**Keywords:** Food allergies; Knowledge; Attitude; Training; Food Handler; Restaurants; Lebanon

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# CHAPTER I

## INTRODUCTION

Food allergy can adversely affect an individual's wellbeing and impair the quality of life. This abnormal hypersensitive reaction arises when the immune system attacks food proteins that are normally harmless [1]. Food allergy is a significant public health concern since it may induce life threatening responses and even death. It is estimated that food allergies are on the rise over the last decade, affecting approximately 8% of children [2] and 10% of adults [3] in the United States of America, and 4.1% of infants and children and 3.2% of adults in Lebanon [4]. Yet, one of the major challenges is the accurate determination of food allergies prevalence around the world due to the paucity of robust data [5].

A food allergy can be triggered by many different types of food; still, eight foods (milk, egg, fish, shellfish, soy, wheat, peanut and tree nuts) are known as the major food allergens in the USA [6]. The Food Allergen Labeling and Consumer Protection Act (FALCPA) identifies the "Big Eight" as the most common food types contributing by 90% of food allergic reactions and shall be declared on food labels to protect vulnerable consumers. Beyond the acknowledged allergens, FALCPA has recently identified "Sesame" as a food allergen of growing concern. Sesame, a common food used in middle east, gained considerable attention since any hypersensitive reaction can persist into adulthood and result in severe, including anaphylaxis [7]. In Lebanon, a Mediterranean developing country, prevalence research and data on food allergies is limited and scarce. Yet, previous studies in literature (Irani, C. and Maalouly, G. (2015)), reported cow's milk in infants and young children (30.4% and

17.4%, respectively), hazelnut and wheat in adults (9.9% and 8.5%, 82 respectively), sesame seed (3.8% in infants, 2.7% in children, and 1.9% in adults) and peanut (15.8% in infants, 8.3% in children, and 7.1% in adults) as the most common foods associated with food allergies [4].

While most symptoms from food allergies are mild and limited to the oral cavity, gastrointestinal tract or skin rashes, some may progress to major anaphylactic reactions, possibly leading to mortality [8]. For instance, a total of 8.6% of food-allergic adults have been admitted to the emergency departments due to food anaphylaxis in the US in 2018 [3]. Despite the risk of food induced anaphylaxis and even death, there is no current treatment for food allergy but treating promptly (i.e., within minutes) with epinephrine. Considering the fact that ingestion of a small amount of food allergen can cause a severe food allergy reaction, preventing these episodes would demand high vigilance and strict avoidance of food and food ingredients that elicits adverse allergic reactions [9].

Dining out while sticking to an allergen-free diet can be highly challenging in real life. Eating outside the house may limit the opportunity for strict dietary control and may expose consumers with food allergies to the risk of accidental allergen ingestion [10]. A systematic review conducted by Versluis et al. (2015) indicated that 31 percent of unexpected accidental allergic reactions to food happened in a restaurant setting. Additionally, fatal allergic reactions linked to dining out at restaurants or food establishment in the US and UK has been reported to be 18 of 63 (28%) and 16 of 48 (31%), respectively [11].

Accommodating customers with food allergies has become a challenge for the restaurant industry, since the ability to prepare allergen free-safe meals is prone to error.

Food allergy incidents are attributed to a number of common risk factors and root causes that lead to allergic reactions in restaurants such as failure to disclose or communicate the allergy between and among restaurant staff and vulnerable customers, unexpected or undeclared food allergens, cross-contact, and incomplete and inconsistent food labeling on menus [10,11,12].

For the restaurants industry, serving allergy free – safe meals to food-allergic individuals has shown to benefit the restaurant by protecting the client’s wellbeing, avoiding legal implications, maintaining sound reputation, and enhancing customers loyalty [13]. However, some foodservice establishments may refrain from accommodating diners with food allergies particularly with the increasing number of individuals with food allergies and the complexity of food.

Managers and staff have an essential and unique responsibilities in preventing and reducing food allergy incidence in their restaurants setting. They also play an active role in understanding and communicating possible risks to their food-allergic patrons as well as employing precautionary steps to mitigate risks of potential anaphylactic reactions. Yet, some vulnerable individuals would rather avoid eating out rather than employing preventative strategies. For instance, a previous survey has shown that 294 food-allergic individuals in which 19 to 25 percent of respondents never ate out at restaurants [12], though dining out is considered one of the most important social activities.

While dining out, the safety and satisfaction of an allergic customer is determined by a high quality, allergen free menu and retained through knowledgeable staff. A study conducted by Tarro et al. (2017) concluded that the information and knowledge communicated between front- and back-of-the-house employees and shared

with customers promoted a better allergy management and reduced safety concerns. Yet, the consumer's experience and satisfaction remain contingent upon the food allergy knowledge, attitudes, and practices of the restaurant's employees [10].

Knowledge, attitude and practices (KAP) surveys related to food allergy would help the researcher assess and understand what is known, believed and done towards food allergens and provide valuable insights into potential risks within a restaurant setting. Due to the collective value of those surveys and assessments, numerous studies have been conducted in Turkey, US, and UK to address the level of food allergy knowledge of restaurant's personnel or their attitude or their work practices [14]. Previous research studies have evaluated the food allergy knowledge among food service worker's and suggested the need for improved training and comprehensive adherence to allergen risk management practices [15, 16]. Furthermore, in their systematic review Young I, Thaivalappil A (2018) emphasized the shortfalls in prior food allergy trainings among restaurant and food service personnel (prevalence of 65% across 12 studies). The same study reported a generally low use of various risk prevention and response practices among the participants. Likewise, a study conducted by Abbot et al. (2007) demonstrated that poor attitudes toward food safety prevented the foodservice employees from adhering to safe preparation and proper handling practices of allergen-free food orders [17]. Another two studies, McAdams, Deng, & MacLaurin, 2018 and Radke et al. (2016), revealed that most restaurant employees were knowledgeable about food allergies and appreciated their role in serving safe food to vulnerable consumers, yet they lacked adequate training and access to resources. Lastly, a recurring finding highlighted high levels of confidence amongst restaurant employees

at reducing food allergy risks and preventing fatal allergic reactions though they demonstrated low level of food allergies related knowledge [12].

Accordingly, the surveys on knowledge, attitudes, and practices among restaurant staff have attracted increasing interest in a search to reduce the occurrence of food allergies within food establishments. However, to date, the published studies in Lebanon aim only to explore and assess the food safety performance, knowledge and practices of the food service sector. For instance, Faour-Klingbeil, Kuri, & Todd (2015) reported substantial gaps in food handler's knowledge and practices associated with temperature control, cross-contamination, and good food preparation procedures [18]. Similarly, Hassan & Dimassi (2018) assessed the level of food safety knowledge and self-reported practices among Lebanese food handlers in Lebanese households [19]. The results also showed gaps in knowledge and reported that food handler's attitudes were not consistent with their work but rather guided by their demographic characteristics or work settings related misperception [20]. With that being said still the current literature is limited in scope. There is still a scarcity of research and paucity of concrete data on food allergies on the knowledge, attitudes and practices of food handlers in Lebanese restaurants in developing countries, such as the Middle East and North Africa region [21]. For example, in Lebanon only a single study conducted by Dimassi, H et al. (2020) tackled diagnosed food allergic individuals to assess their knowledge, practices, and attitudes towards food allergens and allergies. This study revealed that having a health related educational background had a positive statistically significant impact on both knowledge and best practices scores, while age and gender did not have an effect. Further, a new study, currently in submission process addressed and surveyed the Knowledge, attitudes, and practices of food handlers and managers on food allergy at

restaurants in Lebanon (Nasseredine, et.al. 2021). Hitherto, to the best of our knowledge, no studies have addressed the association between knowledge, attitude, and practices of food allergies among Lebanese restaurant managers and staff in Lebanon or even across the MENA region. In order to successfully develop control strategies and policies for food allergy within food establishment, there is a need to fully understand their knowledge, attitude and practice (KAP), and perceptions. Accordingly, the main objectives of our present paper are to i) Study the association between food allergy knowledge, attitudes, and practices in the Lebanese restaurant environment ii) Explore the factors that may affect the association among the KAP's while controlling for other sociodemographic characteristics.

## CHAPTER II

### METHODOLOGY, RESULTS AND DISCUSSION

#### **A. Methodology**

##### ***1. Study Setting and Population***

Data for the current study were drawn from descriptive, cross-sectional survey that was conducted among Lebanese foodservice workers to explore their knowledge, attitudes, and practices regarding food allergies entitled “Food allergy knowledge, attitudes and practices of foodservice workers at 1 restaurants in Lebanon: Findings from a National Cross-sectional study” (Nasseredine et al., 2021). Data collection took place between September 2017 and February 2018. A list of all restaurants; facilities that prepare and serve food or beverages to customers (chain, independent), from an online database from all over the six Lebanese governorates was obtained. Sample size calculations (WHO sample size calculator) indicated that a minimum of 137 participants must be recruited. Further details about the sampling framework were presented elsewhere (Nasseredine et al., 2021).

##### ***2. Recruitment and Data Collection***

Participants who were eligible to be part of the study were approached. The following inclusion criteria was considered: participants should be food service workers (managers, chefs, and servers) aged between 18 and 65 years. A multicomponent self-administered questionnaire was used to obtain data on (1) sociodemographic characteristics and work experience (e.g. educational level, years of experience in the present restaurant, food allergy training, etc.), and (2) knowledge, attitudes and



practices related to food allergy along with an additional related to the restaurant characteristics was completed by managers only (type of restaurant, menu specifications, etc.). Face-to-face interviews were conducted with food service workers in a closed room by trained data collectors lasting approximately 15-20 minutes. Moreover, the data collection process was completely anonymous. The original study was ethically approved by the institutional review board at the American University of Beirut. Informed consent and assent were secured from all participants prior to the start of data collection.

### ***3. Study Instrument***

Data on the sociodemographic characteristics and restaurant characteristics, and knowledge, attitudes and practices related to food allergy was collected using two survey forms; one of which was addressed to the managers while another form was presented to the servers and chefs. Questions asked to assess the food allergy Knowledge, attitude and practices include:

- Part 1: 23 questions about the employees' knowledge of food allergy,
- Part 2: 14 questions about the employees' attitudes towards food allergies, and
- Part 3: 8 questions about the employees' practices regarding food allergy

In addition, the investigators observed the restaurant and then checked its menu to explore any extra 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, records in the kitchen, etc.).

#### ***4. Statistical Analysis***

Scores were developed for the knowledge, practices, and attitudes for food service workers. With regards to knowledge and practices scores, the numbers of right responses (out of 23) and (out of 8) were summed up respectively and every group's median score was used to dichotomize the respondents as having a higher or lower level. For example, the knowledge score for each participant was calculated by coding each correct answer as 1, and incorrect answer as 0, and then summing these values such that the highest possible knowledge score was 23. Participants with knowledge scores  $< 12$  were considered to have low knowledge levels, whereas those with scores  $\geq 12$  were considered to have high knowledge level. As for the attitude scores, each response was assigned point values as follows: strongly disagree (SA) = 1, disagree (D) = 2, unsure (UN) = 3, agree (A) = 4, and strongly agree (SA) = 5. Every participant's response was computed to the 14 attitude questions by summing up positive attitudes and every group's median score was used to divide the respondents into those having relatively positive or less positive attitudes.

Data entry and statistical analyses were performed using Statistical Package 220 for the Social Sciences (SPSS) version 24.0 for data analysis. Frequencies and proportions were used to describe categorical variables, medians and standard deviations (SD) for continuous ones. Pearson's correlation was used to evaluate the correlation among the food allergy knowledge, practice and attitude scores. Simple linear regression was applied to investigate potential association between knowledge, attitude and practice and later multiple linear regression were used to confirm the association after adjusting for the potentially confounding variables: age, gender, educational level, marital status, receiving training, and menus description of

ingredients. Findings from the linear regression were expressed in terms of  $\beta$  coefficients and their respective 95% confidence intervals (CI) were obtained. All analyses used in the study were two-tailed, and a p-value  $< 0.05$  was considered statistically significant.

## **B. Results**

### ***1. Restaurant, Managers and Staff Characteristics***

*Restaurants characteristics:* The section related to the restaurant characteristics was completed by managers only (Table 1). The interview data showed that half of the surveyed restaurants were independently owned and located in Mount Lebanon governorate, 60% were classified as full service casual dining and 45% had American menus. More than half of the participating restaurants (52.5%) had 3 or more than managers, 57.5 % had more than 10 workers at the restaurant, and 42.5% received more than one critical violation after the last inspection. Additionally, 40% of managers indicated serving ranges of 1 to 100 meals per day and 30% (n=28) reported a person in duty to handle questions and requests by food allergic customers. The managers reported that menus included a thorough description of the ingredients in each food item (n=37, 92.5 %), and provided separate allergen-free menu (n=10, 25%). As for the documentation, the manager reported that the restaurant provided food allergens information in the kitchen area (n=22, 55%) and provided modified recipes to produce allergen free-meals (n=21, 52.5%).

Table 1 Characteristics of Restaurants

|  | Manager N=40 n (%) |
|--|--------------------|
| <b>Governance</b>  |                    |
| <i>Beirut</i>  | 14 (33.3)          |
| <i>South Lebanon</i>   | 1 (2.6)            |
| <i>Mount Lebanon</i>   | 23 (59.0)          |
| <i>Beqaa</i>   | 2 (5.1)            |
| <b>Restaurant Type</b>   |                    |
| <i>Chain</i>   | 20(50.0)           |
| <i>Independent</i>   | 20 (50.0)          |
| <b>Service Type</b>  |                    |
| <i>Full service</i>  | 28 (70.0)          |
| <i>Quick service</i>   | 12 (30.0)          |
| <b>Menu Type</b>   |                    |
| <i>American</i>  | 18(45.0)           |
| <i>Non-American</i>  | 22 (55.0)          |
| <b>No. of Meals Served Per Day</b>                                       |                    |
| <i>1-100</i>   | 16 (40.0)          |
| <i>101-300</i>   | 13(32.5)           |
| <i>&gt;300</i>   | 11 (27.5)          |
| <b>No. of Managers or Persons in Charge That Work in This Restaurant</b> |                    |
| <i>&lt; 3</i>  | 19 (47.5)          |
| <i>≥ 3</i>   | 21 (57.5)          |
| <b>No. of Workers Other Than Managers That Work in This Restaurant</b>   |                    |
| <i>&lt; 10</i>   | 18 (46.2)          |
| <i>≥ 10</i>  | 22 (53.8)          |
| <b>No. of Critical Violations Received After the Last Inspection</b>     |                    |
| <i>0</i>   | 19 (47.5)          |
| <i>1</i>   | 4 (10.0)           |
| <i>&gt; 1</i>  | 17(42.5)           |
| <b>Person In Duty</b>  |                    |
| <i>No</i>  | 28 (70.0)          |
| <i>Yes</i>   | 12 (30.0)          |
| <b>Description of Menu Ingredients</b>                                   |                    |
| <i>No</i>  | 3 (7.5)            |
| <i>Yes</i>   | 37 (92.5)          |
| <b>Separate Allergen - Free Menu</b>                                     |                    |
| <i>No</i>  | 30 (75.0)          |
| <i>Yes</i>   | 10 (25.0)          |
| <b>Preparing Modified Recipes For Food Allergic Customers</b>            |                    |
| <i>No</i>  | 19 (48.0)          |
| <i>Yes</i>   | 21 (52.5)          |
| <b>Documentation About Food Allergens in Kitchen Area</b>                |                    |
| <i>No</i>  | 18 (50.0)          |
| <i>Yes</i>   | 22 (50.0)          |

*Managers Data:* A total of 40 surveys were filled by foodservice managers (Table 2). Among which 36 were males (90 %) and 4 were females (10 %). The food service

managers' ages ranged between 21 and 55 years (median = 34, SD= 7.858). As for the marital status 22 out of the 40 were married (55 %). The majority reported having a university education (n= 31, 77.5 %). In addition, 72.5 % (n=29) of the managers had 2 or more years of experience at current restaurant. More than half the employees, 62.5% (n=25), reported receiving training on food allergies while working at their present restaurant. In regards to the number of meals prepared for food allergic customers per month, 37.5% (n= 15) and 20 % (n=8) of the managers reported preparing 1- 10 meals and more than 10 meals at the restaurant establishment respectively.

*Staff Data:* A total of 97 staff participated in the study with an age range 18 - 46 years (median= 23, SD = 5.429), of which 64.9 % were males, 79.4 % are single, 57.7% had a university degree, 35.1 % had less than 2 years' experience in the food industry and 79.4% were full-time workers (Table 1). When asked about the number of meals prepared for food allergic customers, 32 out of the 97 staff participants reported preparing and serving zero meals for food allergic customers. More than half of the participants (62%) reported receiving training on food allergies while working at present restaurant.

Table 2 Characteristics of Managers and Staff

|                                      | Manager N=40 n (%) | Staff N=97 n (%) |
|--------------------------------------|--------------------|------------------|
| Age, median, standard deviation (SD) | 34; SD= 7.858      | 23; SD = 5.429   |
| Gender                               |                    |                  |
| <i>Male</i>                          | 36 (90.0)          | 63 ( 63.9)       |
| <i>Female</i>                        | 4(10.0)            | 34 (35.1)        |
| Marital status                       |                    |                  |
| <i>Married</i>                       | 22 (55.0)          | 19(19.6)         |
| <i>Single</i>                        | 18 (45.0)          | 77 (79.4)        |
| Highest Educational Level            |                    |                  |
| <i>None/Low/intermediate/High</i>    | 9 (22.5)           | 40 (41.1)        |
| <i>University Degree</i>             | 31 (77.5)          | 57 (58.9)        |
| Experience in food service industry  |                    |                  |
| <2 years                             | 4(10.0)            | 34 (35.1)        |
| 2-4 years                            | 4(10.0)            | 26 (26.8)        |
| 5-7 years                            | 13 (32.5)          | 20 (20.6)        |
| 7-9 years                            | 13 (32.5)          | 13 (13.4)        |
| >10 years                            | 6 (15.0)           | 2 (2.1)          |
| Received trainings in food allergies |                    |                  |
| <i>Yes</i>                           | 25 (62.5)          | 60 (61.9)        |
| <i>No</i>                            | 15 (37.5)          | 37( 38.1)        |

## 2. Food Allergy Knowledge Score

*Managers:* The median score of food allergy knowledge was calculated to be 14 (mean =  $13.6 \pm 4.835$ , n=40), ranging from the lowest score of 2 to the highest score of 22 ( Table 3) . In the knowledge section, 23 questions were asked to the managers The majority of managers (77.5%, n=31) failed to identify soy as one of the major food allergens. More than half of them (52.5%) reported potatoes and tomatoes (57.5 %) as food allergens. In addition, around 70% (n=19) falsely identified chocolate as one of the top food allergens. The majority of the participants were able to identify milk (90%), Eggs (85%), Tree Nuts (80 %), Fish and Wheat (72.5%), and Peanuts as the top food allergens. Of the polled managers, only 15% (n=6) and 5 % (n=2) reported that fever

and vomiting are not considered ones of the food allergy reactions symptoms, respectively. Only 42.5 % of the participants knew that they have to call the emergency in case a food allergy reaction occurred at the restaurant. Half of surveyed managers (n=20, 50%) reported that someone who consumes foods they are allergic to might die, while 75% (n= 30) of them correctly indicated that removing a food allergen from a meal after it has been prepared does not make it safe for a food-allergic consumer. As for the cooking methods, 62.5 % of the employees reported that high temperature does not destroy the food allergens (Table 4).

*Staff:* Regarding the 23 knowledge questions, the median score of food allergy knowledge was 13 (mean =  $13.15 \pm 4.355$ ) out of a maximum score of 21 (Table 4). For major food allergen identification, around half of the staff failed to identify soy (56.6%) and wheat (46%) as top food allergens. The majority of them (69%) falsely reported chocolate and tomatoes (52.6 %) as food allergens. The majority of the participants were able to identify eggs (86.6%), milk (85.6%), peanuts (65%), fish (64%), and tree nuts (60 %) as the top food allergens. Of the polled 97 staff, only 13.4% (n=13) reported that fever is not considered ones of the food allergy reactions symptoms, whereas none were able report vomiting as non-symptom well. Only 42.5 % of the participants knew that they have to call the emergency in case a food allergy reaction occurred at the restaurant. Only 36 (37.1%) of the staff knew that when allergic reactions occur at their premises they must contact the emergency immediately while 51.5 % reported asking a customer if they have a medication to take in case of an allergic food related reaction. Half of the staff failed to correctly indicate that a food-allergy person might die from consuming the allergen-containing food. As for taking a food allergen out of a ready-to-eat meal, only 58.8% reported that this action will ensure

a safe meal being served. Lastly, 38 out of 97 polled staff (39.2%) believed that high temperature would destroy the food allergen (Table 4).

Table 3 Scores Obtained in The Evaluation of The Knowledge, Attitudes and Practices of The Fooservice Workers

| Dimension        | Manager N=40    |        | Staff N=97      |       |
|------------------|-----------------|--------|-----------------|-------|
|                  | Median, SD      | Range  | Median, SD      | Range |
| <i>Knowledge</i> | 14 (SD=4.835)   | 2 - 22 | 13 (SD= 4.355)  | 3-21  |
| <i>Attitudes</i> | 60 (SD= 6.849)  | 43 -70 | 60 ( SD=7.150)  | 36-70 |
| <i>Practices</i> | 6.0 (SD= 1.152) | 3 - 7  | 6.0 ( SD=1.548) | 1 - 8 |



Table 4 Correct Response to Statements Assessing General Food Allergy Knowledge Item

|  | Manager N=40<br>n (%) | Staff N=97 n<br>(%) |
|--|-----------------------|---------------------|
| <b>Identified At Least Correct Food Allergens</b>  |                       |                     |
| <i>Peanuts</i>   | 27 (67.5)             | 63 (64.9)           |
| <i>Tomato</i>  | 17 (42.5)             | 46 (47.4)           |
| <i>Milk</i>  | 36 (90.0)             | 83 (85.6)           |
| <i>Eggs</i>  | 34 (85.0)             | 84 (86.6)           |
| <i>Chocolate</i>   | 12 (30.0)             | 30 (30.9)           |
| <i>Corn</i>  | 9 (22.5)              | 43 (44.3)           |
| <i>Soy</i>   | 5 (12.5)              | 42 (43.3)           |
| <i>Fish</i>  | 29 (72.5)             | 62 (63.9)           |
| <i>Apples</i>  | 24 (60.0)             | 64 (66.0)           |
| <i>Potatoes</i>  | 19 (47.5)             | 52 (53.6)           |
| <i>Tree Nuts</i>   | 32 (80.0)             | 53 (54.6)           |
| <i>Wheat</i>   | 29 (72.5)             | 59 (60.8)           |
| <b>Identified Symptoms of An Allergic Reaction</b>   |                       |                     |
| <i>Trouble breathing</i>   | 26 (65.0)             | 66 (68.0)           |
| <i>Hives and rashes</i>  | 33 (82.5)             | 85 (87.6)           |
| <i>Swelling of tongue</i>  | 26 (65.0)             | 60 (61.9)           |
| <i>Vomiting</i>  | 2 (5.0)               | 1 (1.0)             |
| <i>Headache</i>  | 19 (47.5)             | 40 (41.2)           |
| <i>Fever</i>   | 6 (15.0)              | 13 (13.4)           |
| <b>Which of the following should you do if a customer is having a bad food allergic reaction?</b>                        |                       |                     |
| <i>Call the emergency (correct)</i>  | 17 (42.5)             | 36(37.1)            |
| <i>Ask the customer if they have medicine to take (correct)</i>  | 17 (42.5)             | 50 (51.5)           |
| <b>High temperature cooking method destroy food allergen</b>   |                       |                     |
| <i>No (correct)</i>  | 25 (62.5)             | 57 (58.8)           |
| <i>Yes</i>   | 4 (10.0)              | 21 (21.6)           |
| <i>Unsure</i>  | 11 (27.5)             | 19 (19.6)           |
| <b>Someone with Food Allergy Can Die from Eating the Food They Are Allergic To</b>                                       |                       |                     |
| <i>No</i>  | 20 (50.0)             | 27 (27.8)           |
| <i>Yes (correct)</i>   | 10 (25.0)             | 54 (55.7)           |
| <i>Unsure</i>  | 10 (25.0)             | 16 (16.5)           |
| <b>Taking A Food Allergen Out of a Meal After It Has Been Made Is One Way To Make It Safe For Food Allergic Customer</b> |                       |                     |
| <i>No (correct)</i>  | 30 (75.0)             | 57 (58.8)           |
| <i>Yes</i>   | 6 (15.0)              | 29 (29.9)           |
| <i>Unsure</i>  | 4 (10.0)              | 11 (11.3)           |

n (%) with correct answer

### 3. Attitude Towards Serving Customers with Food Allergy

*Managers:* The majority of managers (95%) strongly agreed or agreed that restaurants ought to attempt to meet the food- allergic consumers’ special orders. In addition, nearly all the restaurant employees (93.75%) strongly agreed or agreed that servers and kitchen staff ought to be educated about food allergies. Most food service managers (85 %, n=34) feel confident in their abilities to provide safe and special meals for the food-allergic customers’. However, only 22.5% (n=9) agreed and 15 % (n=6) strongly agreed that a person with a food allergy should be able to bring their meals when eating out at the restaurant premises (Table 5).

*Staff:* The majority of staff strongly agreed or agreed that servers and kitchen staff ought to be educated about food allergies (90.6% vs. 92.7% respectively). In addition, most food workers (83.5%) strongly agreed or agreed that restaurants must attempt to meet the special requests of the food-allergic customers’. Most food service staff (89.7 %, n=87) feel confident in their abilities to provide safe and special meals for the food-allergic customers’. However, only 39.1% of food workers strongly agree and agreed that a person with a food allergy should be able to get their meals or snacks when eating out (Table 5).

Table 5 Responses To Statements Measuring Attitudes Towards Food Allergy

|  | Manager N=40 n (%) | Staff N=97 n (%) |
|--|--------------------|------------------|
| Kitchen Staff Should Be Knowledgeable About Food Allergies         |                    |                  |
| <i>Strongly Agree</i>  | 26 (65.0)          | 66 (68.0)        |
| <i>Agree</i>   | 12 (30.0)          | 24 (24.7)        |
| Appropriate for FA Customer to Request More Info About Ingredients |                    |                  |
| <i>Strongly Agree</i>  | 29 (72.5)          | 65 (67.0)        |
| <i>Agree</i>   | 10 (25.0)          | 21 (21.6)        |

|   |                                  |           |
|---|----------------------------------|-----------|
| Restaurant Should Try to Meet Food Allergic Customers' Special Requests             |                                  |           |
| <i>Strongly Agree</i>   | 15 (37.5)                        | 54 (55.7) |
| <i>Agree</i>  | 21 (52.5)                        | 27 (27.8) |
| Someone with Food Allergy Should Be Able to Bring his/her Own Meals When Dining Out |                                  |           |
| <i>Strongly Agree</i>   | 6 (15.0)                         | 17 (17.5) |
| <i>Agree</i>  | 9 (22.5)                         | 21 (21.6) |
| Employee Feel Confident About the Ability Handle FA Concern Safely                  |                                  |           |
| <i>Strongly Agree</i>   | 17 (42.5)                        | 54 (55.7) |
| <i>Agree</i>  | 17 (42.5)                        | 25 (25.8) |
|   |                                  |           |
|   | <i>n (%) with correct answer</i> |           |

#### 4. Food Allergy Practice Score

*Managers:* The median score of food allergy practice was calculated to be 6 (Mean =  $5.58 \pm 1.152$ , n=40) (Table 3). The total score of this section which addresses 8 questions, ranged from 3 to 7 and higher scores were correlated with better protective actions being taken 70 % of managers (n=28) answered correctly that the service staff should be able to recognize the ingredients in the menu and indicate whether it contains any known allergen to preempt possible allergic reactions. The majority of managers (n=32, 80%) reported that if they are unsure about the ingredients in a menu they never persuade the customer that the meal is free from allergens. When asked if a prepared meal for a food allergic customers should be remade in case a mistake has been done, 28 out of 40 participants answered correctly (72.5%). As for communicating the food allergen information to the cook to ensure a safe-allergen free meal is prepare, 90% (n=36) of the managers agreed that it should always be the best practice to be followed (Table 6).

*Staff:* In the practices section, 8 questions were asked to the staff and the median practice score was 6 ( Mean =  $5.56 \pm 1.548$ , n=95) out of a maximum score of 8. When asked what can they do to avoid an allergic reaction from occurring, 57 staff out of 97

answered correctly, specifically that the service staff should be able to recognize the ingredients in the menu and indicate whether it contains any known allergen. A relatively high proportion of the staff (67%, n=65) stated that if unsure about the ingredients in a menu they never guarantee the customer that the meal is free from allergens. As for communicating the food allergen information to the cook to ensure a safe-allergen free meal is prepared, 91% (n=89) of the staff agreed that it should always be the best practice to be followed (Table 6).

Table 6 Responses of Employees to Practices Related To Food Allergy

|   | Manager<br>N=40 n (%) | Staff N=97 n<br>(%)              |
|---|-----------------------|----------------------------------|
| <b>Which of the following should service staff do in order to prevent allergic reaction</b>                             |                       |                                  |
| <i>Cook food to right temperature</i>   | 3 (7.5)               | 18 (18.6)                        |
| <i>Be able to identify ingredient in meal and determine if it contains an allergen (Correct)</i>                        | 28 (70.0)             | 57 (58.8)                        |
| <i>Use dishwasher</i>   | 6(15.0)               | 8 (8.2)                          |
| <i>Keep food safe from bacterial growth</i>   | 3(7.5)                | 14 (14.4)                        |
| <b>If Unsure about the ingredients in a menu item, I still assure to the customer that the allergen is not present.</b> |                       |                                  |
| <i>Never</i>  | 32 (80.0)             | 65 (67.0)                        |
| <i>Sometimes</i>  | 6 (15.0)              | 12 (12.4)                        |
| <i>Always</i>   | 2 (5.0)               | 20 (20.6)                        |
| <b>Communicate the allergy information to the cook</b>  |                       |                                  |
| <i>Never</i>  | 0                     | 0                                |
| <i>Sometimes</i>  | 4 (10.0)              | 8 (8.2)                          |
| <i>Always</i>   | 36 (90.0)             | 89 (91.8)                        |
| <b>If a mistake is done upon preparation, food should be remade</b>   |                       |                                  |
| <i>Never</i>  | 10 (25.0)             | 10 (10.3)                        |
| <i>Sometimes</i>  | 2 (5.0)               | 16 (16.5)                        |
| <i>Always</i>   | 28 (70.0)             | 71 (73.2)                        |
|   |                       | <i>n (%) with correct answer</i> |

### ***5. Comparison of Manager and Staff Knowledge, Attitude and Practice scores***

Out of a maximum score of 23, both groups had nearly equivalent median knowledge scores at 14 (SD=4.835, n=40) for managers and 13 for staff (SD=4.355, n=97). Both managers and staff had similar median attitude scores for managers the median score=60 (SD=6.849, n=40) and staff median score=60 (SD=7.150, n=97) out of a maximum score of 14. The median practice score for the 2 groups was 6 for both managers and staff. The median practice score for managers and staff were 6 (SD=1.152, n=40) and 6 (SD=1.548, n=97), respectively, out of a maximum score of 8. These results are in line with the study conducted by Nasserredine et al., 2021, which revealed that knowledge, attitude, and practice scores did not differ significantly between the 2 respondent groups ( $p=0.986$ ,  $p=0.257$ , and  $p=0.575$ ).

### ***6. Relationship Between Food Allergy Knowledge, Attitude, & Practice Scores***

A pooling strategy was employed where managers and staff were combined into one dataset. Pearson correlation analysis was used to study the association between food allergy knowledge, attitudes, and practices in the restaurant environment (Table 7). The data analyzed indicated that the food allergy attitude scores were positively and moderately correlated with both the food allergy practice scores ( $r=0.325$ ,  $p<0.01$ ) and knowledge scores ( $r=0.373$ ,  $p<0.01$ ). However, a statistically significant positive weak correlation ( $r<0.3$ ) exists between knowledge and practice scores ( $r=0.224$ ,  $p<0.01$ ) for the pooled sample data.

Table 7 Pearson's Correlation (R) Among the Scores Obtained in The Evaluation of KAP of Restaurant Employees

| Correlation                  | R-Value | p-Value |
|------------------------------|---------|---------|
| <i>Knowledge- Attitudes</i>  | 0.373   | 0.000   |
| <i>Knowledge- Practices</i>  | 0.224   | 0.008   |
| <i>Practices - Attitudes</i> | 0.325   | 0.000   |

*N = 137; Correlation is significant at the 0.01 level (2-tailed) (p <0.01)*

### 7. *Linear and Multiple Regression Analysis of Attitude Score Against Knowledge Score*

*Simple linear regression analysis*, showed that the attitude score was a statistically significant predictor of knowledge score ( $P < 0.01$ , = 0.000). The interpretation was for every one unit increase in attitude score, there will be 0.238 increases in knowledge score on Food allergy among foodservice personnel (Table 10A).

*Multiple linear regression analysis*: The food allergy attitude scores, being statistically significant indicator of knowledge, was incorporated into the multiple regression model to be analyzed. The following variables: age, gender, educational level, marital status, receiving training, and menus description of ingredients, were all included in the final multiple regression model. The impact of every variable on the model was examined and consequently was maintained in the model if it contributed significantly to a better fit. Subjecting the first 4-identified predictors (age, gender, educational level, and marital status) to multiple linear regression analysis indicated that education level of foodservice employees ( $\beta = 1.716$ ,  $p = 0.032$ ) was a determinant of knowledge score included. After incorporating additional potential predictor (receiving training, and menus description of ingredients) to the regression model; the restaurant

employees who received training on food allergies while working at this restaurant had impact on the knowledge score (Low:  $\beta = 4.471$ ,  $p = 0.008$ ) (Table 8).

Table 8 Linear Regression Analysis Between Scores Obtained for Knowledge, Attitudes and Sociodemographic Characteristics

| Model <sup>a</sup>   | Crude Analysis <sup>b</sup> |       | Adjusted Analysis <sup>c</sup> |       |
|--|-----------------------------|-------|--------------------------------|-------|
|  | $\beta$                     | p     | $\beta$                        | p     |
| Predictor  |                             |       |                                |       |
| <i>Attitude</i>  | 0.238                       | 0.000 | 0.234                          | 0.047 |
| <i>Age</i>   |                             |       | -0.172                         | 0.138 |
| <i>Gender</i>  |                             |       | -0.137                         | 0.957 |
| <i>Education Level</i>   |                             |       | -0.192                         | 0.917 |
| <i>Marital Status</i>  |                             |       | -0.160                         | 0.993 |
| <i>Received previous training on food allergies</i>                        |                             |       | 4.471                          | 0.008 |
| <i>Menus has thorough description of the ingredients in each food item</i> |                             |       | -3.695                         | 0.123 |

<sup>a</sup> | Dependent Variable: Knowledge score ; p-value <0.05  
<sup>b</sup> | R-squared = 0.139  
<sup>c</sup> | R-squared =0.336

### 8. Linear Regression Analysis of Practice Score Against Knowledge Score

Simple linear regression analysis indicated that the practice score (independent variable) had a significant impact on the knowledge score ( $P < 0.01$ ,  $= 0.008$ ). The interpretation was for every one unit increase in practice score, there will be 0.7 increase in knowledge score on food allergy among food service employees (Table 9).

*Multiple linear regression analysis:* The food allergy practice scores, being statistically significant indicator of knowledge, were incorporated into the multiple regression model to be analyzed. The following variables: age, gender, educational level, marital status, receiving training, and menus description of ingredients, were controlled for in the final multiple regression model. Subjecting the 6-identified predictors to multiple linear regression analysis indicated that receiving training on food

allergies while working at this restaurant (Low:  $\beta = 4.133$ ,  $p = 0.019$ ) had an impact on knowledge scores (Table 9).

Table 9 Linear Regression Analysis Between Scores Obtained for Knowledge, Practice and Sociodemographic Characteristics

| Model <sup>a</sup>   | Crude Analysis <sup>b</sup> |       | Adjusted Analysis <sup>c</sup> |       |
|--|-----------------------------|-------|--------------------------------|-------|
|  | $\beta$                     | p     | $\beta$                        | p     |
| Predictor  |                             |       |                                |       |
| <i>Practice</i>  | 0.700                       | 0.008 | 0.473                          | 0.050 |
| <i>Age</i>   |                             |       | -0.172                         | 0.251 |
| <i>Gender</i>  |                             |       | -0.137                         | 0.796 |
| <i>Education Level</i>   |                             |       | -0.192                         | 0.865 |
| <i>Marital Status</i>  |                             |       | -0.160                         | 0.700 |
| <i>Received previous training on food allergies</i>                        |                             |       | 4.471                          | 0.019 |
| <i>Menus has thorough description of the ingredients in each food item</i> |                             |       | -3.695                         | 0.097 |

<sup>a</sup> / Dependent Variable: Knowledge score ; p-value <0.05  
<sup>b</sup> / R-squared = 0.05  
<sup>c</sup> / R-squared =0.225

### 9. Linear Regression Analysis of Results of Practice Scores Against Attitude Score

Simple linear regression analysis showed that the practice score (independent variable) had a significant impact on the attitude score ( $P < 0.01$ ,  $= 0.000$ ). The interpretation was for every one unit increase in practice score, there will be 1.63 increase in attitude score on food allergy among food service employees (Table 10).

Multiple linear regression analysis: The food allergy practice scores, being statistically significant indicator of attitude, were incorporated into the multiple regression model to be analyzed. Upon controlling for the following variables: age, gender, educational level, marital status, receiving training, and menus description of ingredients, none of the determinants had impact on the knowledge scores (Table 10).



Table 10 Linear Regression Analysis Between Scores Obtained for Attitude, Practice and Sociodemographic Characteristics

| Model <sup>a</sup>   | Crude Analysis <sup>b</sup> |       | Adjusted Analysis <sup>c</sup> |       |
|--|-----------------------------|-------|--------------------------------|-------|
|  | $\beta$                     | p     | $\beta$                        | p     |
| Predictor  |                             |       |                                |       |
| <i>Practice</i>  | 1.639                       | 0.000 | 2.770                          | 0.006 |
| <i>Age</i>   |                             |       | 0.144                          | 0.365 |
| <i>Gender</i>  |                             |       | 3.613                          | 0.311 |
| <i>Education Level</i>   |                             |       | -1.183                         | 0.658 |
| <i>Marital Status</i>  |                             |       | 3.591                          | 0.178 |
| <i>Received previous training on food allergies</i>                        |                             |       | -1.139                         | 0.609 |
| <i>Menus has thorough description of the ingredients in each food item</i> |                             |       | -2.189                         | 0.505 |

<sup>a</sup> | Dependent Variable: Attitude Score ; p-value <0.05  
<sup>b</sup> | R-squared = 0.105  
<sup>c</sup> | R-squared =0.331

### C. Discussion

A thorough search of the relevant literature revealed that no previous studies have addressed the association between knowledge, attitude, and practices of food allergies within Lebanese restaurant environments. The present study examined this association and explored the factors that may affect the correlation among the KAP's while controlling for other sociodemographic characteristics. Overall, this study found that there was a statistically significant positive correlation between food allergy knowledge, attitude, and practices among the food service employees across adverse Lebanese governorates. Results also showed that adjusting for confounding variables i.e. sociodemographic characteristics did not reduce the strength of the association except for one determinant, Training.

In light of prior research on the current dataset, as described in more details elsewhere; the surveys indicated that the attitudes of restaurant managers and staff were generally positive regarding food-allergic customers. However, important and substantial gaps in their knowledge and practices scores were identified. They also

revealed that the knowledge, attitudes, and practices' scores did not differ significantly between managers and staff. As a follow on, our present study indicates that knowledge's level of restaurant employees influences their attitudes in food allergy related fields. This finding conforms to the outcomes reported in previous research [16, 22, 23] indicating a statistically significant positive relationship between food allergy knowledge and attitude among restaurant employees. These results indicate that providing employees with strong foundational information and knowledge may have enhanced their positive attitude and improved their awareness and confidence in coping with food allergy requests [12]. The correlation between attitude and knowledge may also be explained by the employee's personal willingness and readiness to accommodate vulnerable customers. Such a positive attitude may have stimulated independent learning among food service workers on allergen handling and serving customers with food allergies. Thus, adopting positive attitude in favour of food allergy within the restaurants, could arise from the accumulation of the requisite knowledge on food allergy management. In this context, knowledge (i.e. Food allergy training and description of menu items) would equip the food handlers with essential information on food allergies and strengthen the employee's self-confidence and self-efficacy in reducing food allergy risks and preventing fatal allergic reactions among their customers.

Our finding also revealed that the restaurant employees attitude levels enhance good practices in handling and serving patrons with food allergies. This result is consistent with previous research [24], who found that attitudes toward food allergies had a significant influence on food allergy practices to minimize any potential food allergy reaction within the restaurant setting. This finding suggests that if a positive

attitude towards food allergy is adopted and confidence in providing “safe” meals is exhibited by employees, this would lead to increased food allergy awareness when preparing and serving allergy free food at the restaurants. Besides, food allergy embeds together with food safety. Hence, the studies that have demonstrated that attitude towards concepts like food safety could be translated into good and safe practices, would contribute to fill the gaps of limited studies within the food allergy scope [25]. As such, a study that was conducted to assess the food handler’s knowledge, attitude, and practice in the state of Penang, Malaysia pointed a moderate significant correlation between practices and attitudes [16]. In this case, the alertness and confidence of the restaurant employees can motivate and improve their behavioral changes in the field of food allergen- management. Accordingly, these studies suggest that it is crucial for the foodservice management to foster an environment that encourage effective allergen competence and awareness of food allergy issues in order stimulate good food handling practices and meet the needs of vulnerable customers.

Regarding the relationship between knowledge and practices, our findings indicate that inadequate knowledge level can culminate to poor hygienic practices by foodservice workers. Of particular importance, the self-reported practices were significantly associated with the food allergy knowledge of the respondents in crucial areas of food allergy. This is in line with findings from previous research conducted to assess the level of food safety knowledge and self-reported practices among Lebanese food handlers in small-medium sized enterprises (SME’s) [18] and Lebanese households [19]. However, contradictory results are described in preceding studies which found that improved food allergy related knowledge does not necessarily translate into good hygienic practices when handling and serving food allergy related

products [ 26,27]. It is noteworthy that in spite observing the restaurant personnel in the current study, the self-reported data may not be essentially coherent with practices performed during their accommodation of food allergic patron. Our data underlines the need for well oriented food allergy education interventions and technical guidance to generate positive practices and reduce the risk of potential allergic reactions.

In addition to the restaurant employees' level of food allergy knowledge, practices and the nature of their attitude, another point observed in this study was the significant difference in knowledge score upon controlling for the sociodemographic characteristics of foodservice workers. Notably, the association between knowledge and attitude and that between knowledge and practices was influenced by whether the respondents received training on food allergies while working at this restaurant or not. In this context, insights into examining possible independent determinates of knowledge and attitude are limited due to lacking mutual statistical adjustment for determinants/ confounders in the vast majority of prior studies [10, 13]. The findings of this study confirm that the positive association between attitude and knowledge towards food allergen management, can be explained by effective and ongoing food allergy training for foodservice workers. Yet, continuous training resources need to be adequately crafted to contribute to better food allergy knowledge, improve the employee's confidence in their ability to accommodate food allergic customers and enhance customer loyalty [12,13,16]. It is worth mentioning, that the opportunities for comparisons of food allergy-related attitude with previous research are limited, because the evidence remains scant and measurement instruments largely differed between studies [10].

Finally, it is worth mentioning that important gaps in knowledge among food service staff and managers were identified in the study population. Specifically, restaurant personnel were less likely to identify at least 6 additional major food allergens. In general, many respondents in both samples were unable to identify soy as major allergens. Though, soy is one of the major food allergens that can cause severe food allergy reaction. Restaurant employee must be aware of the menu ingredients since soy could be hidden in many foods in the form of soy sauce or textured vegetable protein, and result in an allergic reaction [9]. Most of the respondents from both groups identified vomiting as a major common food allergy symptom [13]. This misperception should be rectified because food allergens are different from foodborne diseases that may cause vomiting, nausea and diarrhea. It is noteworthy that despite the many companies/organizations that offer food safety-related certifications, in Lebanon, no dedicated training and certification on food-allergy training and management. Trainings addressing food allergen management should be required for restaurant staff and food workers before one starts to work with food and followed by regular reinforcements.

The present study was subject to limitations. We have relied on a previously existing data to assess food allergy knowledge, attitude and practices among restaurant personnel. Taking this into account, the validity of our assessment was further supported by the fact that our questions in the surveys were adapted to fit our requirements and concept of interest. Another potential limitation is related to the self-reported answers for knowledge, attitudes, and practices, all of which could be liable to errors because of memory recall and/or social desirability bias. A limitation would be the cross-sectional type of study which represents a snapshot of the status of food allergy in Lebanon at a single point in time which rules out the change in human

behavior and attitudes over time during uncertain times (i.e. COVID-19 pandemic and economic crisis in Lebanon). Lastly, the study might be prone to selection bias people who are more aware of their food allergy might be among the interested participants in our survey. Further research is required to evaluate the status of knowledge, attitude, and self-reported practices of trained and newly appointed untrained workers; along with thorough evaluation and identification of effective food allergy trainings, resources and education interventions for restaurant employees that should be disseminated to restaurateurs and hospitality management educators. Further research may include audited practices, adverse organizational departments and levels of management within the restaurants.

## CHAPTER III

### CONCLUSION

#### **Concluding Remarks**

The restaurant employees are the first line of defense in ensuring a safe dining experience for food-allergic patrons. They must possess ample knowledge on the food allergen management, bear a positive attitude towards accommodating customers with food allergies and translate it into safe practices. Our study indicates that knowledge about food allergy and improved self-efficacy toward managing food allergy have positive impact on food service practices in Lebanon. We identified food allergy training as the confounding factor that interfered in the correlation among the KAP's while controlling for other sociodemographic characteristics. However, attitude is the main precursor of the behavioral changes among restaurant personnel. These insights underline the need for crafting effective and well-oriented food allergy education and technical strategies to ensure that workers have the alertness and knowledge essential for adhering to adequate food handling practices. Our study underlines that as long as food allergy knowledge levels and some behaviors elements reflect apparent gaps, customers with food allergies will not be able to dine out safely. In the light of this view, policy makers in Lebanon should develop robust food-allergen management trainings and incorporate risk communication strategies in line with the demands of food allergy in the food industry. Simultaneously, the foodservice industries should seek continuous improvement through the development of appropriate food allergy interventions and fostering a positive and effective food safety culture.

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