

**An- Najah National University**  
**Faculty of Graduate Studies**

# **Evaluation of Palestinian Consumer Awareness to Food Safety and Hygiene**

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**This Thesis is Submitted in Partial Fulfillment of the Requirements for  
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**2020**

## **Evaluation of Palestinian Consumer Awareness to Food Safety and Hygiene**

**By  
Tasneem Zaher Odeh**

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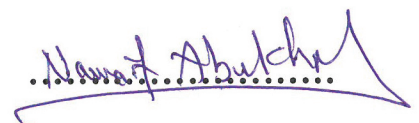
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### III

#### **Acknowledgment**

*To the one who grabbed my hand along the way and never let go... Opened my soul, eyes, and heart to the world... Mohammed, my husband*

*To the one who has started this journey and never hesitate to give his unlimited support... Zaher, my father*

*To my two families and two mothers, Hanan and Ola*

*To the truly inspiring teacher... Dr. Samer Mudalal*

*To the lovely little gone Karma*

## الإقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

### **Evaluation of Palestinian Consumer Awareness to Food Safety and Hygiene**

أقر بأن ما اشتملت عليه هذه الرسالة انما هي نتاج جهدي الخاص، باستثناء ما تمت الإشارة اليه  
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The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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## List of abbreviations

ANOVA	Analysis of variance	39
CCPs	critical control points	25
DALYs	Disability Adjusted Life Years	14
e.g.	Example	13
etc	et cetera	39
FDA	Food and Drug Administration	23
FERG	The Foodborne Disease Burden Epidemiology Reference Group	14
FSA	Food Standards Agency	27
FSIS	Food Safety and Inspection Service	24
FSMS	The food safety management system	22
FSSC	Food Safety System Certificate	22
GLM	Generalized linear Model	39
GMPs	Good Manufacturing Practices	20
HACCP	Hazard Analysis and Critical Control Point	22
i.e.	for example	35
ISO	International Standardization Organization	22
No.	Number	13
P	Probability	39
PCBS	Palestinian Central Bureau of Statistics	36
pH	Power of Hydrogen	19
PRPs	prerequisite programs	29
SD	Standard Deviation	42
SEM	Standard Error of the Mean	39
SFBB	Safer Food Better Business	28
SLDBs	Small and less Developed Businesses	27
SPSS	Statistical Package for Social Sciences	39
SQF	Safe Quality Food	22
TV	Television	35
UK	United Kingdom	27
USA	United States Of America	13
WHO	The World Health Organization	14

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**Abstract**

Improper handling, storage, preparation, and processing of foods have adverse effect on consumers. Therefore, consumer awareness towards food safety is an important issue. Food borne diseases can be minimized by increase the consumer awareness towards food safety. There are several interrelated factors that can affect consumer awareness toward food safety. Consumers in Palestine still have low level of awareness toward food safety. This study was conducted to evaluate the awareness of Palestinian consumers towards food practices and safety and their relation with some demographic characteristics. Around 300 Palestinian (32.1% males and 67.9% females) consumers were selected randomly from three different Palestinian governorates (Nablus, Tulkarm and Qalqilya). Consumers were subjected to face to face interview to fill validated questionnaire related to food safety information and practices. Data from questionnaire were analyzed by descriptive statistics (mean, SEM, minimum and maximum values). Results were evaluated using the ANOVA test of SPSS software (IBM SPSS statistics 21). This study showed that there was no gender effect on most parameters of consumer's knowledge in food safety. Palestinian consumers trust health professionals, family, consumer reports,

and scientists as sources of food safety information more than other sources. Lower age consumers exhibited higher confidence in the safety of food products in Palestinian market than consumers with higher age. On another hand, educational level was one of the most important factors in building the consumer knowledge in food safety. The confidence of consumers in Palestinian governmental food safety authorities is still low. So, more attention must be given to food safety issue from policymakers, food safety authorities and the food industrial sectors.

**Keywords:** Food safety; consumers, awareness; demographic characteristics.

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# Chapter One

## Literature Review

### 1.1 Introduction

The consumer is one of the main parts of the food chain. Consumers should have enough knowledge to deal safely with food during preparation, storage, and consumption. In other words, the informed consumer would reduce food contamination during food production chain. In contrast, the ignorant consumer in the food chain could affect the work of others badly., using the same plate for raw and cooked meat, or using warm water to defrost frozen food (Krause *et al.*, 2007). According to the previous study, food contamination generated an economic and social burden on governments, as it affected mainly the health sector, which was an important issue in most communities. About 30% of populations in industrialized countries suffered from foodborne illness annually, while the accurate records about foodborne diseases were still undetermined due to lack of improper documentation (Krause *et al.*, 2007). In this context, Foodborne diseases caused about 3000 deaths and 48 million illnesses in the USA, which cost the government more than \$152 billion – \$1.4 trillion per year (Scharff, 2012). The distribution of foodborne diseases in Ohio State was shown in Table.1 (Scharff, 2012).

**Table 1. The burden of foodborne illness expressed as an annual number of cases (Scharff, 2012).**

Disease or agent	No. of illnesses	No. of hospitalizations	No. of deaths
Bacteria			
Bacillus cereus	63,400	20	0
Clostridium botulinum	55	42	9
Listeria monocytogenes	1,591	1,455	255
Parasite Cryptosporidium spp.	57,616	210	4
Cyclospora cayetanensis	11,407	11	0
Virus Hepatitis A	1,566	99	7
Rotavirus	15,433	384	0

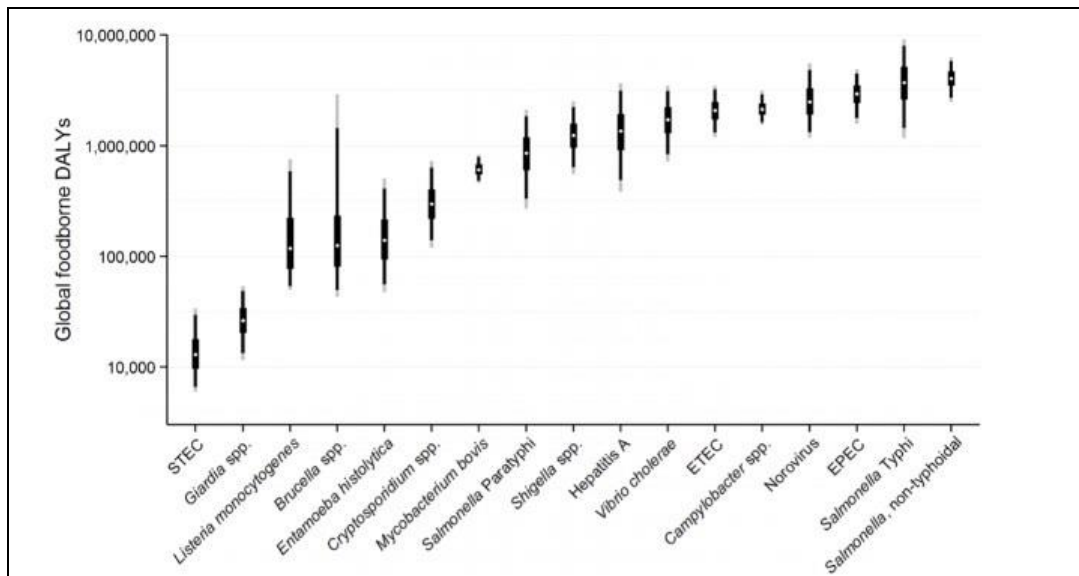
## 1.2 Foodborne illnesses

Foodborne illness is a globally important issue due to its morbid consequences and economic implications. In 2007, The World Health Organization (WHO) established the Foodborne Disease Burden Epidemiology Reference Group (FERG). This group aimed to estimate and measure the global burden of diseases caused by food consumption (Kuchenmüller *et al.*, 2009). The FERG consists of a group of tasks that force to estimate the health burden of human:

1. Parasitic infections.
2. Illnesses because of toxins and chemicals.
3. Viral and bacterial infections.

In this context, Kirk *et al* (2015) estimated the global health burden of foodborne diseases such as viral, bacterial, and protozoal diseases. Data were collected on the number of deaths, Disability- Adjusted Life Years

(DALYs), and foodborne illnesses from 1990 to 2012. It was estimated that 22 diseases included in the study resulted in 2 billion illness cases, 78.7 million DALYs, and over one million deaths in 2010. It was found that diarrheal disease had the highest health burden, causing 4.07 million DALYs. In other words, DALYs were highest per 100,000 populations in the African region then the South East Asian region (Kirk *et al.*, 2015).



**Figure 1.** Global Disability Adjusted Life Years (DALY) for each pathogen acquired from contaminated food ranked from lowest to highest with 95% Uncertainty Intervals in 2010 (Kirk *et al.*, 2015).

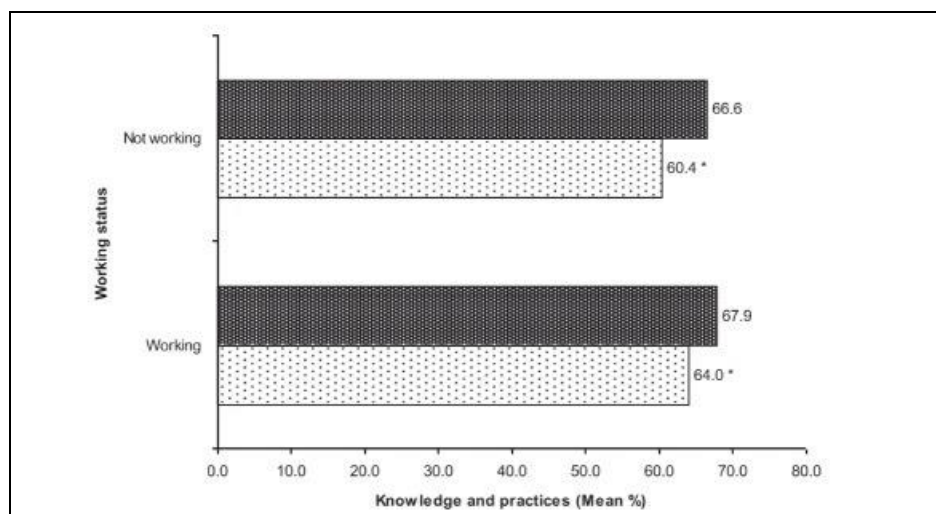
In Australia, there were about 4.1 million cases of foodborne illness annually. One of the most causes of foodborne illness was salmonellosis (Whiley *et al.*, 2017). In 2017, it was found that there was a significant increase in the salmonellosis incidence among consumers with high egg intake. Moreover, it was found that there were inaccurate “risky behaviors” related to raw eggs consumption at home. In which 84% of consumers indicated that they did not consume raw egg, but 86% of them indicated

that they consumed raw eggs within a mixture. The sharp incidence in the salmonellosis was related to poor safe handling of raw eggs at home. The study showed no significant differences between males and females in their food safety practices (Whiley. *et al*, 2017).

### **1.3 Food safety knowledge and handling practices**

Several studies revealed that food safety knowledge did not mean or lead to safe food handling practices. Misdiagnosis of foodborne illness might lead consumers to ignore the main reason and did not practice safe food handling practices. Accordingly, consumers in Kentucky were asked about their confidence in food and the possibility of having diseases because of food products. Overall findings showed differences in food safety behaviors with differences in age, gender, educational level, and race. There was a relationship between food safety behaviors and perceptions. Results showed that Kentucky consumers who had higher awareness of food safety exhibited safer food practices (Roseman *et al.*, 2006). In this context, Stein *et al* (2010) found that students had a high level of confidence in the ability to follow safe food handling practices, and know food safety importance. In the same study, it was found that the consumer behaviors indicated that they didn't actually engage in safe food handling practices. Students didn't do safe food practices including the knowledge about the temperature of cooking, refrigerating, and reheating food. The differences in results were attributed due to differences in gender, race, and parents' jobs. In the developing countries, more than 2.2

million deaths are annually caused by foodborne illness, of which 1.9 million are children (Stein *et al.*, 2010). Moreover, about 40% of foodborne illness occurred at home. In Saudi Arabia, Farahat *et al* (2014) conducted a study to assess food safety knowledge and handing practices among Saudi women and to estimate factors affecting them. The results showed that their practices were better than knowledge. However figure 2 showed poor safe cooking practices (49.8%), high personal hygiene practices were recorded (63.6%). Working Saudi women showed higher practice and knowledge than non-working ones except in personal hygiene (Farahat *et al.*, 2014).



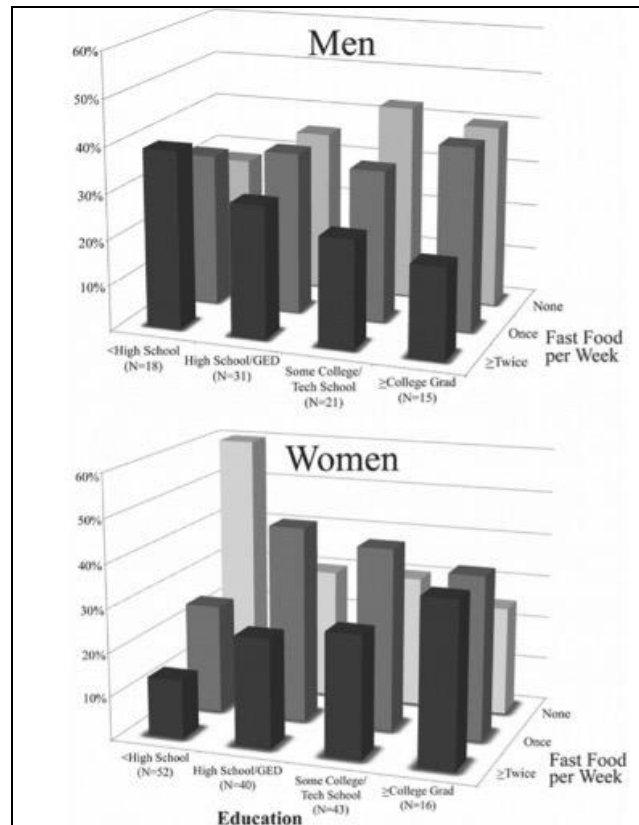
**Figure 2.** Overall food safety knowledge and practices (Mean %) among working and non-working Saudi women (Farahat *et al.*, 2014).

#### 1.4 Safety of Street Foods

In the period between 2001 and 2005, Krause *et al* (2007) analyzed the main causes of 30,578 cases of infectious diseases in Germany. It was found that around 90% of these cases were caused by pathogens (*Escherichia coli*, *Salmonella* and *Campylobacter*) of the gastrointestinal

tract that came from food. In other words, food was considered as the main vehicle for these pathogens leading to foodborne illnesses. Street food is one of the most consumed foods all over the world. It was the main cause of different foodborne illnesses due to unsafe storage, transportation, and preparing conditions (Muyanja *et al.*, 2011). Mendez *et al* (2005) defined street food as any ready-to-eat food or beverage that is prepared by vendors and sold in shops and stalls.; In this context, it was found that only 1.8% of proprietors of stalls for street foods in Ghana followed food safety requirements (King *et al.*, 2000). Moreover, consumers in Kuala Lumpur spent around 25% of their expenditures on street foods (Dawson *et al.*, 1991). In the same study, it was found that street food affected the economy adversely because it arrived at consumers by semi-skilled or unskilled persons, which affected their health badly. For the fruits and vegetable side, Amoah *et al* (2005) found that pesticide residue on fruits and vegetables poses a threat to consumer's lives. It was found that washing vegetables could reduce pesticide residues but not eliminate them at all. Fast street food was usually associated with poor health than other foods. A related study was conducted to assess the relationship between fast food consumption and some demographic characteristics. By considering marital status, age, employment, and race-ethnicity, the relationship between educational level and fast food consumption was affected by sex. In which higher educated women were associated with greater consumption of fast food. Moreover, female consumers with low-

income and high educational level were more associated with more fast food consumption than males (Hidaka *et al.*, 2018).



**Figure 3.** Fast-food consumption and education level by sex (Hidaka *et al.*, 2018).

The consumer's new lifestyle changed their behavior towards food. The spent time in food preparation at home was sharply reduced leading to a massive increase in consumption of fast food. As a result, this change made dramatic growth of the food service industry (Taha *et al.*, 2010). Therefore, there was a growing interest in the role of food handlers in food safety. In this context, Taha *et al* (2010) found that about 70% of food handlers in the United Arab Emirates had good knowledge in food safety. Moreover, half of the food handlers knew the correct sanitizing and cleaning procedures and about half of them showed poor knowledge in

food poisoning symptoms. Besides, there was an association between knowledge of food safety and food handlers' age, education, training and experience. Enhancing training efficiency and effectiveness was suggested.

## **1.5 Food hazards**

### **1.5.1 Biological hazards**

Several biological hazards (such as viral, bacterial and parasitic hazards), could be destroyed or at least eliminated by thermal processing, drying and freezing. Moreover, conditions of food packaging (anaerobic or aerobic) and the storage temperatures like freezing or refrigeration could also be used to reduce and inhibit the growth. Bacterial hazards could be either as foodborne intoxications or infections. The foodborne infection could be caused by ingesting a several of pathogenic microorganisms, while foodborne intoxication could be caused by the ingestion of preformed toxins by certain bacteria during their multiplication in foods. Some biological agents could produce chemical hazards including marine biotoxins and affecting people badly with different symptoms ranging from discomfort to a fatal outcome. Marine biotoxins are produced by harmful algal blooms (Visciano *et al.*, 2016). The presence of biogenic amines in food products could be caused by microorganisms (bacteria) by decarboxylases action and their formation could be affected by environmental factors including pH, temperature and salt concentrations (Gardini *et al.*, 2016).

### **1.5.2 Physical hazards**

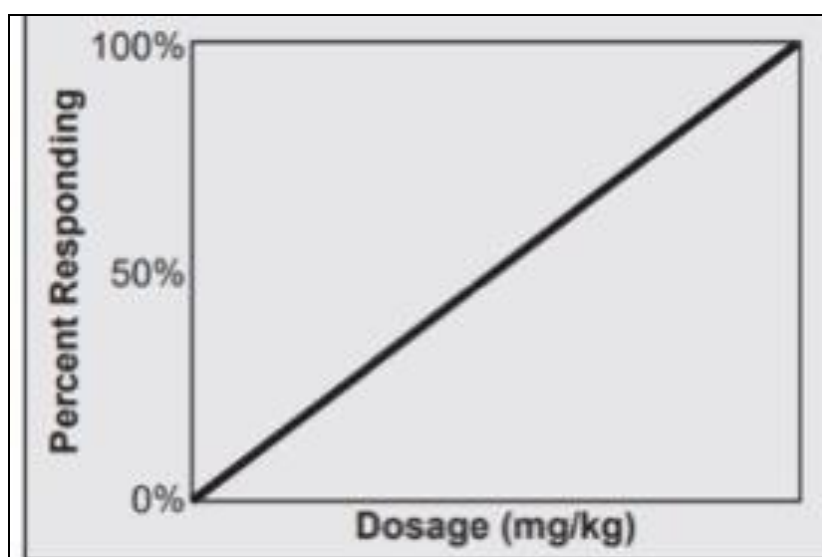
Rhodehamel (1992) defined physical hazards as any foreign object that presents in food and causes injury or illness to humans like stones and metals. Almost anything that could be introduced into food could be considered a physical hazard. Hair, wood, dirt, grease, paint, rust, bones, dust, plastics and paper could be classified as physical hazards. There are several sources of physical hazards sources such as water, raw materials, equipment, building materials, facility grounds, and personal effects. The contamination of food by physical hazards might occur during storage or distribution, or could be a result from the inclusion of toxic materials in the final product. Most of the reported incidents of injury or illness related to physical contaminants included oral injury, dental problems, esophagus trauma and abdomen problems. Fortunately, most of these incidents are not life-threatening. The applied strategies for controlling foreign materials (physical hazards) included in-line detection of metals, magnets usage, visual inspection (on-line), X-ray technology, systems of automated vision (on-line), filters, screens, and sieves. Good Manufacturing Practices (GMPs) were also used as a hazard control system (Smith, 1996). Proper personnel training was considered as the most effective approach to prevent physical contamination. Moreover, the proper and continuous maintenance of facilities, processing equipment, buildings, and grounds would help in the reduction of physical hazards.

### 1.5.3 Chemical hazards

Chemical hazards were defined as any substance that could be produced by the chemical processes and cause illness to humans including added and natural chemicals (Smith, 1996). Food products were made from chemicals, and all chemicals could sometimes be toxic according to the dosage level. Chemicals contaminants could be introduced to food during growing, harvesting, processing, storage, and distribution. Generally, these chemicals would not be considered hazardous if proper conditions were followed. Agricultural chemicals including fungicides, pesticides, fertilizers, herbicides, growth hormones and antibiotics were considered as added chemicals. Reports showed that chemical contamination of food was less than either physical or microbiological (Smith, 1996). Unlike physical hazards, chemical hazards were more insidious so more difficult to exclude from the manufacturing food process. Actually, additives, ingredients, flavors and colors, sanitizers, adhesives and lubricants that were used in food production were dangerous and able to cause illness to humans (Smith, 1996). In the previous study it was found that when evaluating chemical hazards, it was important to consider the substance toxicology and the likelihood of who it would be harmful to consumers. Each chemical had an inherent toxicity degree, and to estimate the chemical potential hazard of any substance, the degree or toxicity level must be known, in addition to the estimation of exposure:

$$(\text{Hazard} = \text{Toxicity} \times \text{Exposure})$$

A theoretical relationship between dose and response is presented in Figure 4, the response was defined as the individuals' number expressed as a percentage over a low-to-high dosages range. For instance, when individuals were exposed to Vitamins A or D at very high doses, the result was a toxic effect was observed (about 100% of the population). However, at a arrange of low dose, there could be only a very small percentage of the exposed population.



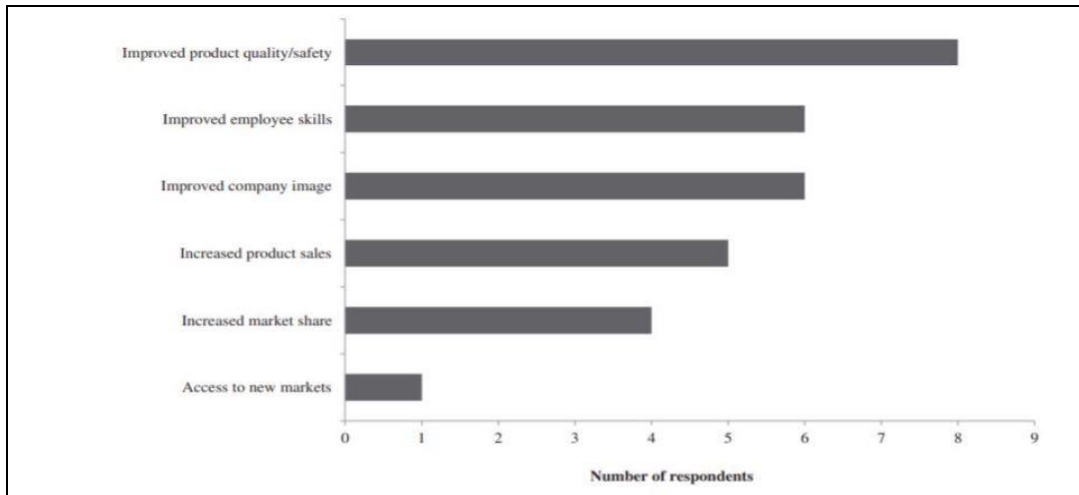
**Figure 4.** Typical and theoretical dose-response relationship. The dose is expressed as the number of individuals, as a percentage, responding over a range of low-to-high dosages (Smith, 1996).

In this context, many programs including hazard analysis and critical control point (HACCP) programs were made about biological hazards. In South Africa, Asiegbu *et al* (2016) found that 70% of consumers had no knowledge about Salmonella. Moreover, Badrie *et al* (2006) found that gender had no effect on consumer's awareness towards food hazards in India.

## 1.6 Food safety management system

The food safety management system (FSMS) included a broad spectrum of activities for effective quality assurance and control. In addition, FSMS regulates activities that aim to avoid microbial contamination or at least reduce its level (Schirone *et al.*, 2017). Different national systems were used to guarantee food safety in food manufacturing companies. These systems included Hazard Analysis and Critical Control Point (HACCP), Safe Quality Food (SQF), and recently (International Standardization Organization) ISO 22000 as well as Food Safety System Certificate (FSSC 2200). There is a growing concern about food safety from the food industry, public health sector, and consumers all over the world, due to the significant increase in the incidence of foodborne diseases in several countries (Wilcock *et al.*, 2011).

Accordingly, a study was carried out in Zimbabwe showed that companies tried to apply FSMS in their systems, and some barriers were found. The major barrier for FSMS implementation included inadequate financial resources 26.7%, no enough facilities and infrastructure 20%, small companies that did not need FSMS 13.3%, lack of commitment from the management 16.7% and weakness of the food safety policy 13.3%. These results were attributed due to that there was no legal requirement for food companies to apply FSMS in Zimbabwe. Therefore there was lack of motivation for companies to apply FSMS mainly for companies that were selling locally, taking in consideration financial cost of applying and adhering the system (Macheka *et al.*, 2013).



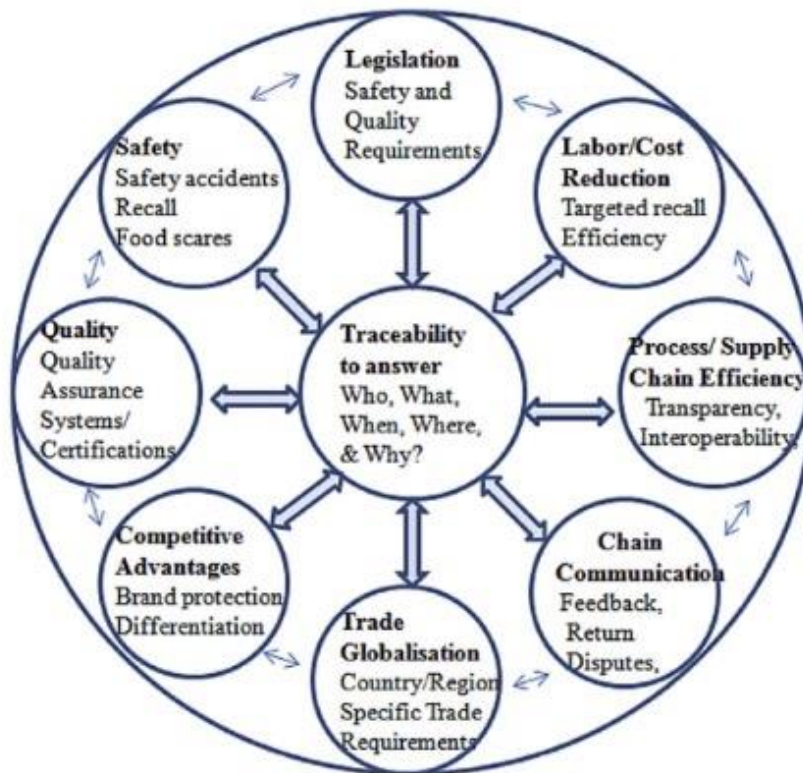
**Figure 5.** Major benefits for implementing FSMS cited by companies in Zimbabwe (Macheka *et al.*, 2013).

### 1.7 Food safety and quality

Improper handling, storage, preparation, and processing of foods have an adverse effect on consumers. Therefore, food quality and safety have social, environmental and economic consequences. For the social side, food safety is an essential issue for consumer's health. Tourism and trade could be damaged by foodborne illnesses, and the unemployment rate would be increased (Aung and Chang, 2014). The Food and Drug Administration (FDA) economist Scharff showed that the economic burden of foodborne diseases was about \$150 billion yearly (Scharff., 2012). Food spoilage had an adverse effect on the confidence of food safety. Moreover, food industries have a great contribution to global warming and environmental pollution, so there is a need for environmentally friendly solutions (Aung and Chang, 2014).

In last years, the growing consumers concerns toward food safety and the increased incidence risk of food borne illnesses increased the need for

accurate information about food production chain (Beulens *et al.*, 2005). For instance, genetically modified food, H<sub>1</sub>N<sub>1</sub> and cow mad diseases caused reduction in consumers' confidence towards food industry. Because of this growing food safety concerns, many technologies and programs were found to support traceability systems "from farm to fork" (Tian, 2017). The need for the traceability system came from the continuous change of food quality and safety with time. Some food products including meat and milk could be damaged before reaching the consumer. So the turn of the traceability system was to trace each product and production unit, to increase consumer's confidence and reduce their concern (Folinas *et al.*, 2006).



**Figure 6.** Drivers for traceability of the food supply chain (Aung and Chang, 2014).

## **Hazard Analysis and Critical Control Points (HACCP)**

The Food Safety and Inspection Service (FSIS) developed the Hazard Analysis and Critical Control Points (HACCP) system to reduce foodborne illnesses. HACCP system can ensure the safe production of food, identify critical points and determine the hazards that may occur. In other words, HACCP could control the production process. It was first developed by Pillsbury Company (Hulebak *et al.*, 2002). HACCAP system monitors the production process to quantify and identify the magnitude of probable risks. In most countries, food quality assurance systems became more stringent to improve and enhance food safety problems (Henson and Caswell., 1999). HACCP implementation does not mean the complete elimination of hazards, but reduces pathogenic contamination and minimizes the risk of foodborne illnesses to the possible degree. The central aim of the HACCP system was to achieve food-safety improvement by public and general standards that all must meet. FSIS regulated different systems and guidelines to set several goals to reduce pathogens according to technology and science (Hulebak *et al.*, 2002). According to the previous study, HACCP principles were classified as follow:

1. Performing the hazard analyses.
2. Identifying the critical control points (CCPs) in the process.
3. Establishing a critical limit for each point.

4. Establishing CCPs procedures and requirements for results monitoring.
5. Establishing corrective actions that must be taken for the deviations.
6. Establishing a record-keeping procedure.
7. Establishing a verification procedure to be sure that HACCP system is working correctly.

In addition to the seven principles of HACCP systems that have been previously mentioned, five steps were recommended before hazard analyses:

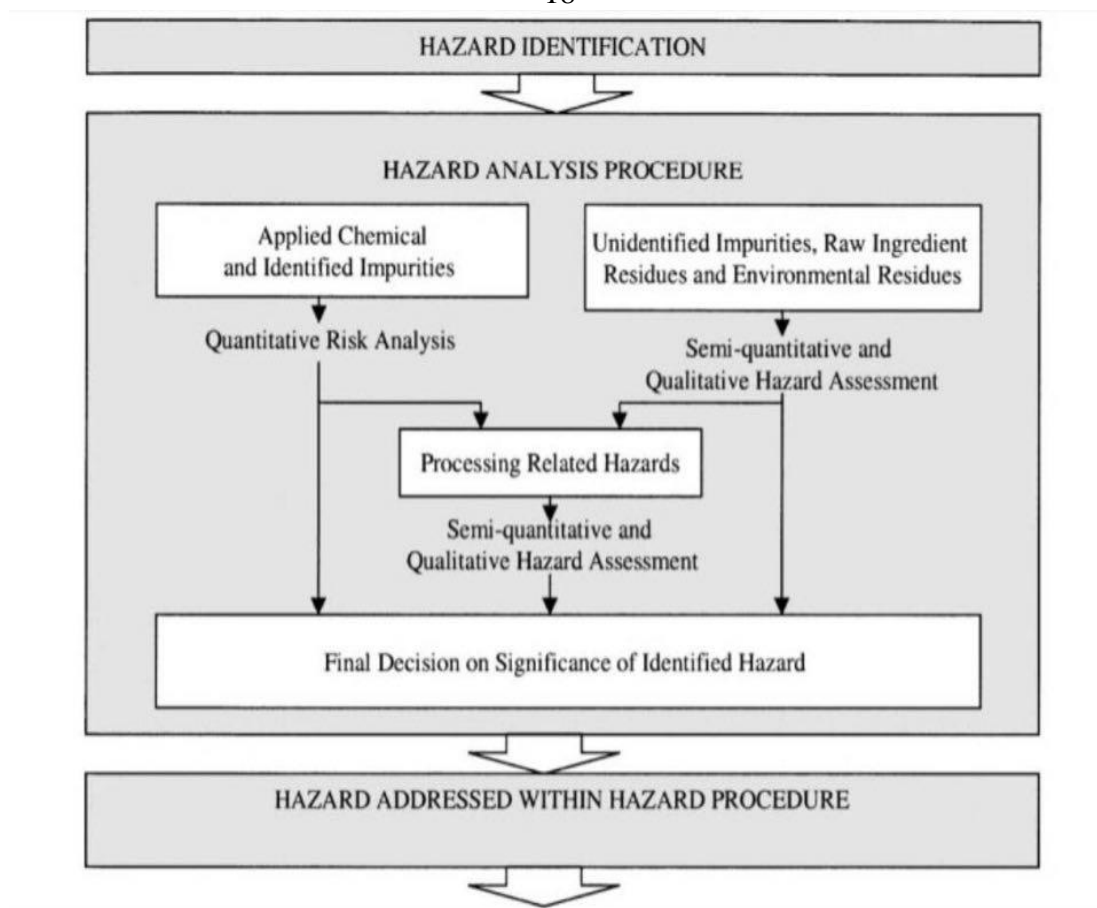
1. Choosing the HACCP team to develop the process.
2. Foodstuff description.
3. Identifying the foodstuff end-point
4. Constructing a flow diagram of the production process.
5. Verifying the flow diagram on-site.

A multidisciplinary team should be formed to manage effectively the HACCP system. The HACCP team must consist of an engineer, a chemist, microbiologist, production manager, quality assurance manager, food technologist and others with relevant experience. The HACCP team must receive and access all information to identify hazards, CCPs and limits that are associated with the process, and considered them (Ropkins & Beck,

2000). Ropkins & Beck (2000) showed that the HACCP team had a main role in the program. The team had to collect the food-stuff description, identify ingredients and processing steps, monitoring the procedure and other tasks. After that, the HACCP flow diagram had to be compared with the actual production process to make sure of the accuracy of each stage. Hazard analysis included: identifying the hazard characteristics, the risk associated with this hazard and the hazard assessment (Bovee *et al.*, 1997)

After the hazard was selected, CCPs should be identified. The CCPs assessment should be accurate to develop the process economically, effectively and efficiently (Untermann, 1999). So, the central criterion for CCPs identification and selection was in asking the following two questions:

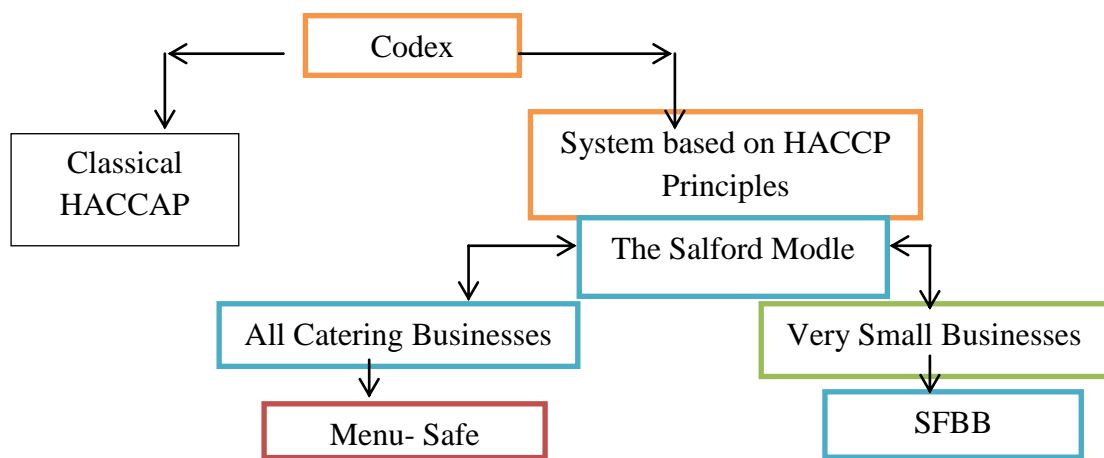
1. At which point did the hazard occur?
2. What preventive events could be taken for the hazard and at what point?



**Figure 7.** Example of quantitative, semi-quantitative and qualitative approaches with hazard analysis (Untermann, 1999).

About 60% of the food business in the UK was from food industry sector. It includes cafes, restaurants, street vendors, schools and hotels. As evidenced in a review by Taylor (2008), there were clear targets in UK to reduce foodborne diseases and increase HACCP uptake. Therefore, the Food Standards Agency put the plans that aimed at food safety management problems within food industry. The project started with a general HACCP training review that showed that there was a real need for better accessibility, quality and more training within food industry sectors. The project aimed to support the needs of small and less developed businesses (SLDBs). The method was tried, evaluated and then validated

by the FSA in the UK and agreed HACCP requirements. The original model (Salford Model) was published as a Menu-safe, which was a system that could be used by all types and sizes of food industry businesses. A new version of Safer Food Better Business (SFBB) has been developed into a ready-to-use package for all types of the food industry (Taylor, 2008) (figure 9).



**Figure 8.** HACCP methods based on Codex principles (Taylor, 2008).

In another study, Karaman *et al* (2012) showed that the most important barriers for applying FSMS in the Turkish industry especially the dairy industry were the lack of funds, knowledge about HACCP practices and plant conditions. Food safety was not considered as a business priority by managers because the cost was much more than benefits. Companies' managers believed that quality controls on the final product, basic hygiene practices, and lists of control checks were more important than FSMS based on HACCP application. Results showed that there was a need for clarifications programs that could help managers to understand the food safety regulations' goals. Moreover, there was a need to train them to

understand basic food safety principles. Furthermore, the government must support FSMS long-term maintenance and provide financial support to increase the chance of applying FSMS in plants (Karaman *et al.*, 2012).

### **International Organization of Standardization (ISO 22000)**

HACCP approach was necessary to enhance food safety. HACCP system was considered as the basic part of ISO 22000 (Psomas *et al.*, 2015). The federation of national bodies worldwide works within a framework of the management system and associated with all activities in the organization; establishing, monitoring, implementing and updating effective systems in food safety. The ISO 22000 approach integrated the HACCP approach and its steps were developed by the commission of Codex Alimentarius. Moreover, ISO 22000 combines HACCP program and the prerequisite programs (PRPs). To perform hazard analysis, accurate planning must be done to determine and measure hazards that need to be controlled. ISO would make a great combination among HACCP, PRPs and operational PRPs. All expect hazards (biological, physical and chemical) must be recorded according to the product type (Soman & Raman, 2016). In addition to recording the process type and identifying the processing facilities, this recording and identification should be based on:

1. Data and information that was collected according to raw materials, product- contact materials ingredients, end products, intended use, process steps, flow diagrams and control measures.

2. Data and information that was collected according to product and producer histories (experience)
3. External information like epidemiological and historical data.
4. Food chain information including hazards that could affect the end product or food at consumption.

The “acceptable level” means the level of a specific hazard in the end product that is required for the next step in the food production chain to ensure food safety. The main function of hazard assessment was to measure and assess the reasonably expected hazards that were identified for the end products, so they could be controlled. Hazard term should not be confused with ‘risk’ term in food safety, in which the last means the probability of an adverse effect on human health, and its severity (absence from work, death and hospitalization). Risk assessment was defined as measuring the potential adverse effects on human or animal health arising from contaminants and additives presence and disease-causing organisms that were present in food (Soman & Raman, 2016).

When applying ISO 22000, and conducting hazard assessment, the following points must be taken into consideration:

1. The hazard source.
2. The probability of hazard occurrence (quantitative or qualitative prevalence)

3. The hazard nature (its ability to deteriorate, produce toxins and multiply)
4. The severity adverse effect on the health that could be caused by the hazard.

More information should be available when applying ISO 22000 from databases, scientific literature, external competences and regulatory authorities. Evaluating the hazard occurrence probability must take into consideration preceding steps and following operation within the same system, service, equipment, surroundings and activities (Mendez *et al.*, 2005).

The probability of hazard occurring could be measured by these parameters:

1. Frequent (Daily)
2. Likely (Weekly)
3. Occasional (Monthly)
4. Unlikely (Yearly)
5. Very Unlikely (Not yet observed)

While the severity of the hazard or its impact on human health could be measured by the following parameters:

1. Critical (Death)
2. High (Hospitalization)
3. Medium (Absence from work)
4. Low (Complaint)
5. Negligible (no effect)

Exposure level (Hazard Acceptance Level):

When the hazard consequence was accepted, there were two acceptance types, Passive Acceptance (Rating 1-9) and active Acceptance (Rating  $\geq 10$ ).

Generally, proper and safe food handling within the food chain was essential to ensure food safety. Hazard analysis as shown in ISO 22000 required evaluations of all food safety control measures in the organization in a scientific procedure. After hazard analysis, some new PRPs could be added to the system. The organization should have full responsibility to document the changes, approve them and prepare implementation in a proper manner to ensure food safety (Worsfold, 2006).

**Table 2. Two dimensional matrixes to assess the significance of hazard (Worsfold, 2006).**

Worward, 2000).

Quantifying Hazards								Significance Rating: (Exposure)	
Hazard Impact/Severity	Critical	5	5	10	15	20	25	≥ 10	Significant Hazards
	High	4	4	8	12	16	20		
	Medium	3	3	6	9	12	15		
	Low	2	2	4	6	8	10	< 10	Non-Significant Hazards
	Negligible	1	1	2	3	4	5		
			1	2	3	4	5		
			Very Unlikely	Unlikely	Occasional	Likely	Frequent		
Hazard Occurrence Probability									

### Control measures categorization

Any organization aimed to have as much as possible of control measures managed by PRPs and the HACCP plan. Control measure's

categorization and selection should be done using a logical approach which included assessments according to the following criteria as given in Table 3.

**Table 3. Guidance on Scoring Parameters (Worsfold, 2006).**

Assessment Criteria for Control Measures	Parameters
a) Control measure effect on identified food safety hazards relative to the strictness applied	1. Not eliminate completely 2. Reduce or control to meet an acceptable level 3. Reduce to within acceptable level or eliminate the hazard completely
b) Control measure feasibility for monitoring (e.g. ability to be monitored in a promptly to enable immediate corrections)	1. No feasibility 2. Has limitation 3. Feasible
c) Control measure place within the system relative to other control measures	1. First 2. Middle 3. Final measure
d) The likelihood of failure in the functioning of a control measure or significant processing variability	1. Low 2. Medium 3. High
e) The severity of the consequence (s) in the case of failure in its functioning	1. Negligible effect 2. Complaint 3. Health implications
f) whether the control measure is specifically established and applied to eliminate or significantly reduce the level of hazards (s)	1. No 2. Somewhat 3. Definitely
g) Synergistic effects (i.e. interaction that occurs between two	1. No

## **1.8 General factors that affect consumer's awareness towards food safety**

Stratev *et al.* (2016) had carried out a study on medical students from Trakia University (Bulgaria). It was found that a high level of food safety knowledge between students (85.06%), but the practice of food safety was 65.28% (above the average). The study revealed that there was a need for improving food safety practices awareness among Bulgarian students. Greene *et al* (2009) evaluated the incidence of foodborne diseases in many countries including the United Kingdom, the United States, New Zealand and Canada. It was found that around 90% of home foodborne disease outbreaks were caused because of home-prepared food, but the preparation method was not the reason, e.g., Salmonella contamination of peanut butter.

Generally, different factors affected consumer's awareness towards food safety such as gender, age, educational level, living place, career and marital status. In this context, Rossvol *et al* (2013) found that marital status could affect consumer awareness towards food safety in Norway, in which never married consumers exhibited lower safe food practices than married ones. In the same study, gender was also one important factor that could affect awareness of food safety, where women showed higher food safety practices than men in Oslo. Moreover, people who live in the capital city (Oslo) showed more unsafe food practices than other places, which means that living place was another affecting factor (Rossvol *et al.*, 2013). In this context, Kendal *et al* (2018) pointed out that Chinese consumers in

Chengdu exhibited higher levels of food safety awareness and hazard concern compared to consumers in Guangzhou and Beijing. In another study conducted by Stein *et al* (2010) showed that Non-Caucasian consumers had different knowledge in food safety practices than Caucasian consumers, and males and females may also have different needs regarding food safety knowledge.

People in Malaysia especially food handlers and mothers did not exhibit enough information to understand aspects related to food hygiene, such as cleaning surfaces during food preparation (Ismail *et al.*, 2016). In this context, it was found that about 70% of food handlers including mothers in the United Arab Emirates showed a good level of food safety knowledge (Taha *et al.*, 2020). In the same study, it was found that half of the consumers knew the correct cleaning methods and good food preparation practices. In Canada, Murray *et al* (2017) showed that 80% of Canadians had enough awareness towards the risk of foodborne diseases caused by chicken and hamburger. Moreover, 90% of consumers in Canada did the cleaning precautions and separating methods when handling raw meat to prevent foodborne illness. In contrast just 40% of Canadian consumers were aware of foodborne diseases related to frozen chicken. In the same study, it was found that men were less likely take steps to prevent food cross-contamination than women. The youngest consumers (18-29 years) were also less likely to follow steps that prevent cross contamination of food (Murray *et al.*, 2017).

In the USA, Parra *et al* (2014) found that most consumers did not do safe food practices including defrosting food correctly and did not treat with leftovers safely. leaving food at room temperature more than 2 hours). Another study showed that one-third of the United State consumers reported unsafe food hygiene practices especially when dealing with meat, e.g. they did not take precautions to prevent cross-contamination or wash their hands before and after touching meat. Moreover, men and adults with 18-29 years old showed unsafe food practices than women and consumers who were 30 years old and more (Altrekuse *et al.*, 1996).

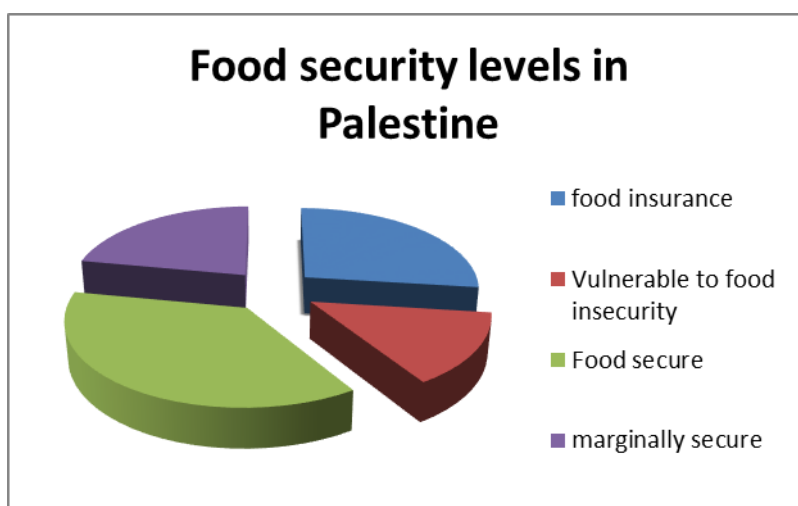
Saudi Arabian women with 60 years old and more, showed higher knowledge in food safety than other age groups except for the knowledge in personal hygiene. Moreover, working Saudi women showed higher knowledge in food safety than non-working ones (Farahat *et al.*, 2015).

Consumers, in general, could get food safety information from different sources including internet websites, magazines, TV programs, doctors and scientists. In South Wales (USA), it was found that consumers' food safety information that comes from packaging followed by medical doctors (Redmond *et al.*, 2005). In the USA, a study showed that consumers in Texas and New York preferred to get their food safety information from TV programs more than other states (Parra *et al.*, 2014). Chinese consumers trusted food safety information that came from personal communications, internet and television (Liu *et al.*, 2014). Shim *et al* (2011) found that 59.5% of married consumers in South Korea trusted

information that came from mass media (TV, newspaper and radio) than other sources.

### 1.9 Food Safety in Palestine

In Palestine, food is affected by new preparation and eating habits that are imported from all over the world. These habits could be not suitable for the Palestinian culture because of improper food usage, thus causing foodborne illness (PCBS - Palestinian Central Bureau of Statistics., 2020). Moreover, importing food products from regions with weak food safety management systems increase the opportunity of having foodborne diseases to the country. According to the classification of the Palestinian central bureau of statistics, 1.3 million Palestinian consumers (represents about 27% of population) were suffered from the absence of food security (PCBS - Palestinian Central Bureau of Statistics., 2020).



**Figure 7.** Food security levels in Palestine, 2011 (PCBS - Palestinian Central Bureau of Statistics., 2011).

In other words, more attention must be given to food issues. Increase consumer awareness towards food safety knowledge is an important goal that can be achieved by the collaborative assistance of authorities of food safety, schools, universities and food industrial sector. Moreover, informing and educating food safety must shed light on susceptible groups such as children, elderly and pregnant women (PCBS - Palestinian Central Bureau of Statistics).

The information related to consumer's awareness toward food safety in Palestine is limited. Moreover, the demographic factors that affect consumer awareness in food safety were not sufficiently studied. Therefore, the aim of this study was to evaluate the Palestinian awareness toward some food practices and safety and their relation with some demographic characteristics.

## **Chapter Two**

### **Methodology**

The aim of this study was to evaluate the Palestinian awareness toward some food practices and safety and their relation with some demographic characteristics. The study was conducted and data were collected from February 2019 to December 2019. Around 300 Palestinian consumers were selected randomly from three different Palestinian governorates which are Nablus, Tulkarem and Qalqilya, representing the north of Palestine. Consumers were different in their education level, marital status, career, living place, and age. Different parameters were measured to determine and analyze consumer awareness towards food safety. That included confidence of respondents in food safety, respondents' concern about potential hazards in food, consumer purchasing behavior and consumer knowledge about food safety. In addition to measuring consumer's food handling practices and the reliability of sources of food safety information. Instructions of the survey were explained to consumers by face to face interviews (duration 15-20 min) to collect all needed information through the questionnaire. Consumers could refuse to participate in the questionnaire. Parts of the results of the questionnaire were not discussed due to low significance, but they were attached in the appendix.

## **1.2 Questionnaire exclusion criteria**

About 312 Palestinian consumers were met and their answers were recorded. 12 answers were excluded due to different reasons:

1. Consumers who were pulled out after beginning the meeting.
2. Consumers who did not answer all questions seriously.
3. Consumers who considered the meeting as personal information.

## **2.2 Questionnaire development**

Designing and developing the questionnaire was according to the HACCP system and the World Health Organization and based on previously published articles. The questionnaire included 11 sections. Section1: Demographic section to collect consumer's characteristics like age, sex, career, living place marital status and educational level. Section 2: was about consumer's confidence in 14 food products in the market and results were scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). Section 3: was about concerns about 9 food hazards in foods in which results were scored as follow: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). Section 4: was about 8 of consumer's purchasing behaviors and answers were scored as: yes or no. Section 5 was 5 questions about consumer's knowledge in food safety and results were scored as follows: excellent (5), very good (4), average (3), good (2), and poor (1). Section 6: was about food poisoning symptoms,

section 7, 8: were 19 questions about food handling practice in which part of the results were scored as follows: always (5), sometimes (4), I don't know (3), rarely (2), and never (1). Section 9: was about food preparation practices and results were recorded as follows: strongly agree (5), agree (4), I don't know (3), (2) disagree, and strongly disagree (1) Section 10: was about reliability of some food information sources, and results were scored as follow: highly reliable (5), reliable somewhat (4), somewhat unreliable (3), unreliable highly (2), and I don't know (1). And section 11: was about food contamination knowledge and answers were scored as follow: strongly agree (5), agree (4), I don't know (3), disagree (2), and strongly disagree (1).

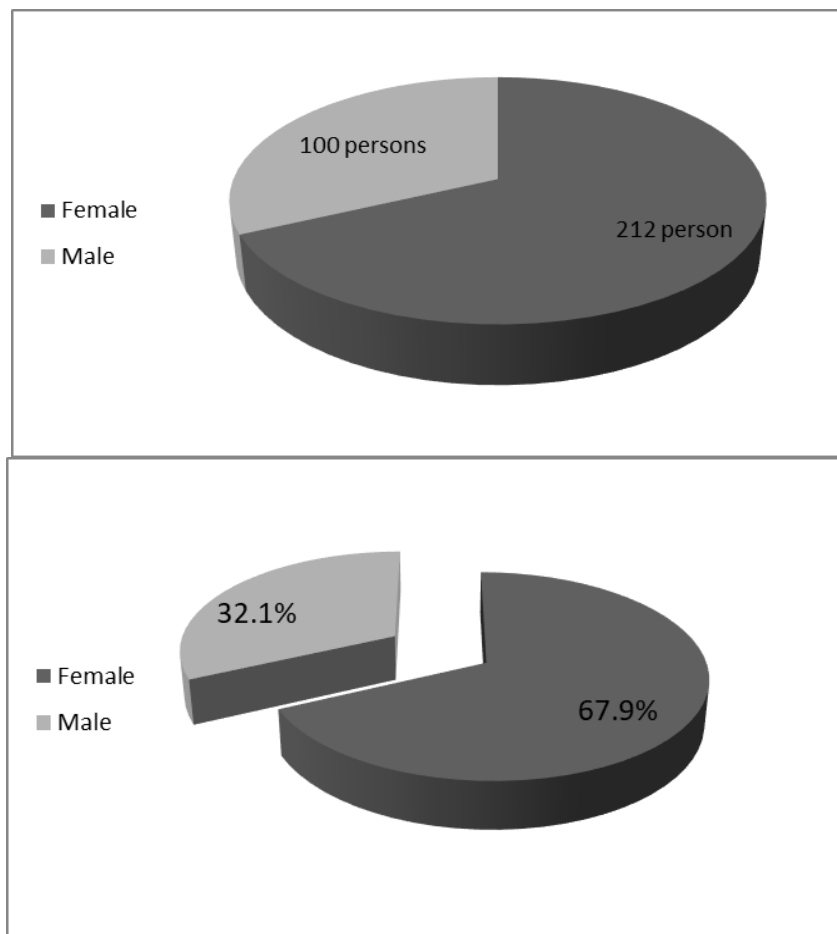
### **2.2.1 Statistical analysis**

Data from the questionnaire were firstly analyzed by descriptive statistics (mean, SEM, minimum and maximum values). The effect of demographic (age, sex, place of living, educational level, etc) factors on consumers' awareness toward food safety were evaluated by using the ANOVA option of procedure of SPSS software (IBM SPSS statistics 21). The separations of means were using Turkey's honestly significant difference multiple range test with  $P \leq 0.05$  considered as significant. Alpha-Cronbach equation was used to measure questionnaire stability and internal consistency paragraphs. A Kolmogorov-Smirnov Z test was performed to examine the normal distribution of the indicators used in the analysis.

## Chapter Three

### Results and Discussion

The effect of gender on all studied parameters (consumer confidence and concerns towards food products, consumers' knowledge in food handling practices, their reliability in information sources and their knowledge in contamination of food) in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers (100 males and 212 females) were asked specific questions about each parameter by face to face interviews.



**Figure 8.** Percentage of males and females who were asked in this study.

The effect of gender on the degree of confidence towards the safety of food products in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers (100 males and 212 females) were asked specific questions about their confidence towards some products by face to face interviews, and results were shown in Table 4. Findings showed that there was no significant effect of gender on consumer confidence towards food products except; supermarket foods and fish products. In which females had a significantly higher degree of confidence in supermarket foods (3.21 vs. 2.92,  $P < 0.5$ ) and fish products (3.48 vs. 3.13,  $P < 0.5$ ) than males. In general, there are several determents that affect the consumer awareness towards food safety that could be good indicators to measure. Consumer's attitudes and awareness towards food safety are generally affected by the nature of food safety issues and according to other determents including their gender, age, career, marital status, living place and educational level (Berwer *et al.*, 1994). According to a survey in the UK, it was found that 45% of consumers discouraged the consumption of supermarket foods and foods from restaurants, and this was attributed due to the high risk of food poisoning (Henson *et al.*, 1993). Berwer *et al* (1994) found that six factors (food additives, hormones in milk, microbial contamination, pesticide residues, and high caloric intake) affected consumer's attitudes towards food safety. Altekruze *et al* (1999) found that men showed more unhygienic practices in food preparation than women in the United States. Also, Burger (1998) found that there were gender differences in fish consumption where women consume less fish than men,

this due to that women believe that fish was not safe. Moreover, Hidaka *et al* (2018) found that females in Spain showed more confidence in foods from supermarkets and restaurants than men.

**Table 4. Consumer confidence in the safety of different food products by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree of confidence <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	Supermarket food	3.21 $\pm$ 0.91	2.92 $\pm$ 0.91	<0.05
2	Bottled water	3.48 $\pm$ 1.13	3.29 $\pm$ 1.18	0.18
3	Egg	3.77 $\pm$ 1.07	3.85 $\pm$ 0.91	0.54
4	Fruits and vegetables	3.92 $\pm$ 0.86	3.93 $\pm$ 0.86	0.89
5	Milk and milk products	3.82 $\pm$ 0.90	3.98 $\pm$ 1.03	0.17
6	Meat and meat products	3.79 $\pm$ 0.98	3.89 $\pm$ 0.96	0.39
7	Chicken and chicken products	3.84 $\pm$ 0.93	3.66 $\pm$ 1.05	0.13
8	Fish and fish products	3.48 $\pm$ 1.02	3.13 $\pm$ 1.21	<0.05
9	Popular foods from street	2.53 $\pm$ 0.87	2.49 $\pm$ 0.81	0.71
10	Popular drinks from street	1.97 $\pm$ 1.35	1.78 $\pm$ 1.11	0.23
11	Eastern desserts (Kunafa, baklava, etc.)	3.78 $\pm$ 1.26	3.61 $\pm$ 1.34	0.28
12	Western desserts (cake, etc.)	2.93 $\pm$ 1.38	3.12 $\pm$ 1.34	0.25
13	Food from popular restaurants	3.32 $\pm$ 1.43	3.37 $\pm$ 1.33	0.77
14	Food from regular restaurants	3.4 $\pm$ 1.07	3.52 $\pm$ 1.09	0.47

<sup>1</sup>The degree of confidence was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (2) of the research questionnaire.

<sup>2</sup>SD is standard deviation.

The pooled effect of gender on consumer concerns toward the presence of hazards in food the governorates of Qalqilya, Tulkarm and Nablus is presented in Table 5. Consumers were selected randomly and asked about their concerns towards food potential hazards. Findings showed that there were no significant differences between males and females' concerns about the presence of antibiotics in meat and milk products and glass fragments. On another hand, there were significant differences between males and females in their concerns to other hazards. In this context, females showed higher concerns about contamination of bacteria (3.49 *vs.* 2.89,  $P < 0.05$ ), pesticide/insecticide residues (4.06 *vs.* 3.55,  $P < 0.05$ ), heavy metals (2.41 *vs.* 1.98,  $P < 0.05$ ), physical hazards in cereals, and hormones in meat (3.18 *vs.* 2.87,  $P < 0.05$ ) than males. In general, our findings showed that females a had higher degree of concern to the presence of the board spectrum of hazards in foods than males. This result may be attributed due to that females are more commonly dedicated to prepare foods in houses than males according to Palestinian culture. In the UK, it was found that men had lower concerns towards food hazards than women, and they did unsafe food preparation practices (Altekruse *et al.*, 1996).

**Table 5. Consumer concerns toward hazards in food products by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	Bacterial contamination	3.49 $\pm$ 1.23	2.89 $\pm$ 1.29	<0.05
2	Pesticide/insecticide residues	4.06 $\pm$ 0.99	3.55 $\pm$ 1.24	<0.05
3	Lead, mercury and aluminum	2.41 $\pm$ 1.48	1.98 $\pm$ 1.38	<0.05
4	Hormones in meat	3.18 $\pm$ 1.27	2.87 $\pm$ 1.35	0.05
5	Antibiotics in meat and milk products	2.66 $\pm$ 1.31	2.95 $\pm$ 1.40	0.07
6	Straw, stem fragment and any plant fragment in cereals	3.57 $\pm$ 1.08	2.68 $\pm$ 1.09	<0.05
7	Glass fragment	3.34 $\pm$ 1.19	3.20 $\pm$ 1.39	0.34
8	Stones in cereals, grains	3.76 $\pm$ 1.05	3.25 $\pm$ 1.30	<0.05
9	Insects	3.53 $\pm$ 1.18	3.28 $\pm$ 1.33	0.09

<sup>1</sup>Potential hazard was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (3) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

Findings in Table 6 showed the effect of gender on the consumer knowledge in food safety. About 310 consumers were asked about their knowledge in food safety on a 1-5 score scale. Results showed that there was a significant effect of gender on consumer knowledge in food safety. Females showed higher knowledge in food safety (3.47 vs. 3.27,  $P < 0.05$ ) and personal assessment (3.91 vs. 3.69,  $p < 0.05$ ) of family health in the past 6 months than males respectively. On the other hand, males showed higher confidence level in food safety authorities (2.66 vs. 2.35,  $P < 0.05$ ), and the knowledge of food handlers in food safety (2.91 vs. 2.65,  $P < 0.05$ ) than

females. In Ankara (the capital of Turkey) it was found that females and males showed similar knowledge in food safety (Sanlier, 2009).

**Table 6. Consumer knowledge in food safety by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	How informed about food safety	3.47 $\pm$ 0.82	3.27 $\pm$ 0.60	<0.05
2	Personal description of health	3.74 $\pm$ 0.88	3.77 $\pm$ 0.89	0.84
3	Personal assessment of family health in the past 6 months	3.91 $\pm$ 0.90	3.69 $\pm$ 0.87	0.05
4	Your confidence for food safety authorities	2.35 $\pm$ 1.16	2.66 $\pm$ 1.32	<0.05
5	The knowledge of food handlers about food safety	2.56 $\pm$ 0.99	2.91 $\pm$ 1.08	<0.05

<sup>1</sup>The consumer knowledge was scored as follows: excellent (5), very good (4), average (3), good (2), and poor (1). In addition, results have been collected from section (5) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

Table 7 showed the gender effect on consumer knowledge in food handling practices. It was found that there was no significant gender effect on the consumer food handling practices except; the case of checking the food packages, cleaning the food preparation area, and separation between raw and cooked meat. In which females had higher knowledge in checking food packages (4.87 vs. 4.45,  $P < 0.05$ ) and cleaning food preparation area (4.98 vs. 4.74,  $P < 0.05$ ) than males. Likewise, a study in Greece showed that

Greek females recorded better food handling practices than males (Lazou *et al.*, 2012). In contrast, males had higher knowledge in separation between raw and cooked meat (2.23 vs. 2.10,  $P < 0.05$ ) than females. In this context, Sanlier (2009) found that females in Turkey showed a higher level in safe food handling and preparation than males.

**Table 7. Consumer knowledge in food handling practice by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Handling practice <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	Checking food packages	4.87 $\pm$ 0.39	4.45 $\pm$ 0.92	<0.05
2	Checking frozen foods	4.44 $\pm$ 1.07	4.51 $\pm$ 0.93	0.60
3	Clean food preparation area	4.98 $\pm$ 0.22	4.74 $\pm$ 0.67	<0.05
4	Leaving cooked meat at room temperature more than 4 h	3.14 $\pm$ 3.55	2.52 $\pm$ 1.04	0.10
5	Separation raw and cooked meat	2.10 $\pm$ 0.48	2.23 $\pm$ 0.63	0.05
6	Taste leftovers to check if they are still safe	3.58 $\pm$ 1.30	3.46 $\pm$ 1.30	0.46
7	Use raw eggs	3.05 $\pm$ 0.94	2.90 $\pm$ 1.20	0.26

<sup>1</sup>The consumer handling practice was scored as follows: always (5), sometimes (4), I don't know (3), rarely (2), and never (1). In addition, results have been collected from section (7) of the research questionnaire.

<sup>2</sup>SD is the standard deviation

Table 8 showed the gender effect on consumer knowledge in good and safe food preparation practices in three Palestinian governorates (Qalqilya, Tulkarm and Nablus). It was found that there was no significant effect of gender on consumer knowledge in safe food preparation practices

excluding the practice of freezing food. Females showed higher knowledge in the effect of freezing on microbiological stability than males (4.71 vs. 4.19,  $P < 0.05$ ). In this context, a Lebanese study showed that Lebanese females scored higher knowledge in food safety practices than males in general (Hassan *et al.*, 2014).

**Table 8. Consumer knowledge in good food preparation practice by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Safe food handling <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P value
1	Cooking ground beef patties	3.37 $\pm$ 1.10	3.44 $\pm$ 1.05	0.64
2	Freezing food kills all bacteria	4.71 $\pm$ 0.52	4.19 $\pm$ 1.22	<0.05
3	Cooked food	3.58 $\pm$ 0.70	3.49 $\pm$ 0.92	0.34
4	Leftover foods can be safely kept at room temperature several hours	2.42 $\pm$ 1.02	2.59 $\pm$ 1.02	0.19
5	Irradiation of meat or poultry will destroy bacteria	2.72 $\pm$ 0.97	2.60 $\pm$ 0.84	0.30
6	Safety of irradiated food	2.26 $\pm$ 1.07	2.14 $\pm$ 0.82	0.34

<sup>1</sup> The safe food handling was scored as follows: strongly agree (5), agree (4), I don't know (3), (2) disagree, and strongly disagree (1). In addition, results have been collected from section (9) of the research questionnaire.

<sup>2</sup> SD is the standard deviation

Effect of gender on consumer reliability of sources of food safety information in the three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 9. Consumers were face to face asked about their reliability of food safety information sources. It was found that males had higher reliability in food safety information that came from health professionals

(4.11 *vs.* 3.81,  $p < 0.05$ ), friends or family (3.19 *vs.* 2.96,  $P < 0.05$ ), consumer reports (3.29 *vs.* 3.07,  $P < 0.05$ ), science magazine (3.28 *vs.* 2.94,  $P < 0.05$ ), food magazine (2.67 *vs.* 2.34,  $P < 0.05$ ), television news (3.09 *vs.* 2.78,  $P < 0.05$ ), newspaper (3.01 *vs.* 2.53,  $P < 0.05$ ) and material government (3.56 *vs.* 3.08,  $P < 0.05$ ) more than females, respectively. On the other hand, there were no significant differences between males and females in the reliability of food safety information that came from university scientists, radio, written materials from health food stores supermarket, social media such as Facebook, and internet engines such as Google. Accordingly, Chinese consumers (males and females) trust food safety information that comes from personal communications, internet and television in general (Liu *et al.*, 2014).

**Table 9. Consumer reliability in the source of food safety information by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	University scientist	4.08 $\pm$ 0.83	3.97 $\pm$ 0.87	0.28
2	Health professional	3.81 $\pm$ 1.17	4.11 $\pm$ 1.13	<0.05
3	Friends or family	2.96 $\pm$ 0.87	3.19 $\pm$ 0.91	<0.05
4	Consumer reports	3.07 $\pm$ 0.89	3.29 $\pm$ 0.90	0.05
5	Science magazine	2.94 $\pm$ 1.04	3.28 $\pm$ 1.01	<0.05
6	Food magazine	2.34 $\pm$ 1.19	2.67 $\pm$ 1.30	<0.05
7	Radio	2.82 $\pm$ 2.21	3.32 $\pm$ 3.11	0.11
8	Television news	2.78 $\pm$ 0.98	3.09 $\pm$ 0.84	<0.05
9	Newspaper	2.53 $\pm$ 0.92	3.01 $\pm$ 0.89	<0.05
10	Written materials from health food stores Supermarket	2.57 $\pm$ 2.16	2.99 $\pm$ 0.95	0.07
11	Material government	3.08 $\pm$ 1.01	3.56 $\pm$ 1.14	<0.05
12	Social media such as Facebook	2.65 $\pm$ 0.95	2.79 $\pm$ 0.83	0.22
13	Internet engines such as Google	2.99 $\pm$ 1.07	3.08 $\pm$ 1.00	0.50

<sup>1</sup>Consumer reliability of food safety information sources was scored as follows: highly reliable (5), reliable somewhat (4), I don't know (3), somewhat unreliable (2), and unreliable highly (1). In addition, results have been collected from section (10) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

The effect of gender on consumer's food contamination knowledge in three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 10. Our findings showed that there was significant effect of gender on consumer's food contamination knowledge. Females had higher knowledge in the distribution of microorganism on the surface of human body (4.45 vs. 4.18,  $P < 0.05$ ) and the risk of food poisoning based on target consumers (4.63 vs. 4.37,  $P < 0.05$ ) than males. Moreover; females had higher knowledge in the role of storing raw and cooked food (4.71 vs. 4.33,  $P < 0.05$ ), water (4.78 vs. 4.62,  $p < 0.05$ ) and health state of food handlers in food contamination (4.64 vs. 4.33,  $P < 0.05$ ) than males. Similar results were found in a Canadian study, in which men had lower knowledge and took fewer steps to prevent cross-contamination than women (Murray *et al.*, 2017). On another hand, the gender effect did not appear in the remaining knowledge parameters of our study.

**Table 10. Consumer knowledge in food contamination by considering gender effect in three governorates (Qalqilya, Tulkarm, and Nablus).**

Knowledge level in food contamination <sup>1</sup>		Female (Mean $\pm$ SD <sup>2</sup> )	Male (Mean $\pm$ SD)	P Value
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers.	4.45 $\pm$ 0.66	4.18 $\pm$ 0.98	<0.05
2	Children, pregnant women and older individuals are more at risk of food poisoning.	4.63 $\pm$ 0.59	4.37 $\pm$ 0.93	<0.05
3	Role of personal hygiene.	4.51 $\pm$ 0.67	4.43 $\pm$ 0.68	0.35
4	Role of storing raw and cooked food together.	4.71 $\pm$ 0.57	4.33 $\pm$ 0.98	<0.05
5	Role of water in transporting contaminants.	4.78 $\pm$ 0.48	4.62 $\pm$ 0.53	<0.05
6	Role of uncovered abrasion or cuts.	4.72 $\pm$ 0.60	4.71 $\pm$ 0.52	0.92
7	Role of inadequate cooking of raw food.	4.33 $\pm$ 0.77	4.41 $\pm$ 0.74	0.38
8	Role of smoking during preparing food.	3.73 $\pm$ 1.42	3.61 $\pm$ 1.10	0.49
9	Role of health state of food handlers.	4.64 $\pm$ 0.78	4.33 $\pm$ 0.84	<0.05

<sup>1</sup>Level of food contamination knowledge was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2), and strongly disagree (1). In addition, results have been collected from section (11) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

The effect of consumers' age on all studied parameters (consumer confidence and concerns towards food products, consumers' knowledge in food handling practices, their reliability in information sources, and their knowledge in contamination of food) in three Palestinian governorates (Qalqilya, Tulkarm, and Nablus) was studied.

**Table 11. Percentage of participant's age groups.**

Age (years)	Count (persons)	Percentage%
<30	170	54.48%
30-50	85	27.24%
	57	18.26%
Total	312	100

The effect of consumer age on the degree of confidence towards the safety of food products was studied. Consumers in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) were asked specific questions about their confidence towards some products by face to face interviews, and results were shown in Table 12. Our findings showed that consumers, who were less than thirty years old had higher confidence towards food products safety including supermarket foods (2.65 vs. 1.39,  $P < 0.05$ ), popular drinks from streets (2.06 vs. 1.46,  $P < 0.05$ ) and food from regular restaurants (3.26 vs. 2.43,  $P < 0.05$ ) than consumers who were more than fifty years old. While consumers in the range of 30-50 years old showed an intermediate value. In addition, consumers who were less than thirty years old had the highest confidence towards bottled water (3.35 vs. 2.62 and 2.54,  $P < 0.05$ ) and food from popular restaurants (3.57 vs. 3.08 and 3.00,  $P < 0.05$ ). On the other hand, consumers who were less than thirty years old had the lowest confidence towards eggs (3.14 vs. 3.74 and 3.93  $P < 0.05$ ) and meat products (3.11 vs. 3.84 and 3.74,  $P < 0.05$ ). Moreover, consumers who were  $>50$  years had the lowest confidence towards western desserts (3.07 and 3.14 vs. 2.50,  $P < 0.05$ ). Consumers with age  $>50$  years had higher confidence towards chicken and chicken products (3.89 vs. 3.21,  $P < 0.05$ ) than consumers with age  $<30$  years old. At the same time, consumers who were in the range of 30-50 years old showed an intermediate value. In

contrast, there was no significant effect of consumer's age on the degree of consumers' confidence towards other food products. In general, it was found that consumer's awareness and attitudes towards food safety are different according to demographic factors including age. In the UK, it was found that consumers who had age >40 years exhibited higher hygiene food practices and patterns of consumption than other age groups (Klonts *et al.* 1995). Fien *et al* (1995) found that people who were 18-39 years old had a higher opportunity to have foodborne illness than other age groups. In this context, 74% of Turkish young (14-19 years old) consumers believe that the internal temperature of chicken must be high enough for safe consumption. In addition, 76.5% of adults (20-66 years old) believe that pasteurized milk can be safe for 3 days in the refrigerators (Salnier, 2009). In general, all previous studies were partially in agreement with our results.

**Table 12. Consumer confidence in the safety of different food products by considering Age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Degree of confidence <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	> 50 Mean $\pm$ SD	P Value
<b>1</b>	Supermarket food	2.65 $\pm$ 1.39 <sup>a</sup>	2.37 $\pm$ 1.16 <sup>ab</sup>	1.93 $\pm$ 1.15 <sup>b</sup>	<0.05
<b>2</b>	Bottled water	3.35 $\pm$ 1.49 <sup>a</sup>	2.62 $\pm$ 1.53 <sup>b</sup>	2.54 $\pm$ 1.53 <sup>b</sup>	<0.05
<b>3</b>	Egg	3.14 $\pm$ 1.44 <sup>b</sup>	3.74 $\pm$ 1.43 <sup>a</sup>	3.93 $\pm$ 1.15 <sup>a</sup>	<0.05
<b>4</b>	Fruits and vegetable	3.63 $\pm$ 1.19	3.52 $\pm$ 1.36	3.85 $\pm$ 1.24	0.30
<b>5</b>	Milk and milk products	3.45 $\pm$ 1.32	3.76 $\pm$ 1.31	3.82 $\pm$ 1.15	0.08
<b>6</b>	Meat and meat products	3.11 $\pm$ 1.44 <sup>b</sup>	3.87 $\pm$ 1.32 <sup>a</sup>	3.74 $\pm$ 1.22 <sup>a</sup>	<0.05
<b>7</b>	Chicken and chicken products	3.21 $\pm$ 1.38 <sup>b</sup>	3.60 $\pm$ 1.47 <sup>ab</sup>	3.89 $\pm$ 1.11 <sup>a</sup>	<0.05
<b>8</b>	Fish and fish products	2.81 $\pm$ 1.39	2.93 $\pm$ 1.57	3.22 $\pm$ 1.60	0.21
<b>9</b>	Popular foods from street	1.80 $\pm$ 1.25	1.51 $\pm$ 1.01	1.56 $\pm$ 1.13	0.12
<b>10</b>	Popular drinks from street	2.06 $\pm$ 1.32 <sup>a</sup>	1.89 $\pm$ 1.33 <sup>ab</sup>	1.46 $\pm$ 0.95 <sup>b</sup>	<0.05
<b>11</b>	Eastern desserts (Kunafa, baklava, etc.)	3.82 $\pm$ 1.27	3.68 $\pm$ 1.33	3.50 $\pm$ 1.27	0.27
<b>12</b>	Western desserts (cake, etc.)	3.07 $\pm$ 1.36 <sup>a</sup>	3.14 $\pm$ 1.40 <sup>a</sup>	2.50 $\pm$ 1.23 <sup>b</sup>	<0.05
<b>13</b>	Food from popular restaurants	3.57 $\pm$ 1.31 <sup>a</sup>	3.08 $\pm$ 1.41 <sup>b</sup>	3.00 $\pm$ 1.54 <sup>b</sup>	<0.05
<b>14</b>	Food from regular restaurants	3.26 $\pm$ 1.35 <sup>a</sup>	2.84 $\pm$ 1.60 <sup>ab</sup>	2.43 $\pm$ 1.27 <sup>b</sup>	<0.05

<sup>1</sup>The degree of confidence was scored as follows: Completely confident (5), mostly confident (4), no idea (3), not very confident (2), and

not at all confident (1). Results have been collected from section (2) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

The effect of age on consumer concerns toward the presence of hazards in food the governorates of Qalqilya, Tulkarm and Nablus is presented in Table 13. Consumers were selected randomly and asked about their concerns towards food potential hazards. Results showed that there were no significant concerns differences between consumers in different age ranges towards; bacterial contamination, presence of pesticide/insecticide residues and stones in cereals in foods. On another hand, there were a significant concerns differences between consumers in different age ranges towards other hazards. In this context, consumers who were >50 years old showed the highest concern towards the presence of heavy metals presence (2.87 vs. 2.09 and 2.24,  $P < 0.05$ ), glass fragments (3.87 vs. 3.13 vs. 3.28,  $P < 0.05$ ) and insects (3.94 vs. 3.33 vs. 3.39,  $P < 0.05$ ) in food products. In addition, findings showed that consumers who were >50 years had higher concerns towards the presence of hormones in meat (3.50 vs. 2.91,  $P < 0.05$ ), antibiotics in milk and meat (3.28 vs. 2.57,  $P < 0.05$ ), plant fragment (3.70 vs. 3.15,  $P < 0.05$ ) and stones in cereals (3.91 vs. 3.51,  $P < 0.05$ ) than consumers who were <30 years. At the same time, consumers who are in the range of 30-50 showed intermediate values. Accordingly, it was found that consumers in Kentucky who were between

30-59 years old had higher concerns towards food hazards that cause food illnesses than other age groups (Roseman *et al.*, 2006).

**Table 13. Consumer concerns toward hazards in food products by considering age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Potential hazard <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	> 50 Mean $\pm$ SD	P Value
1	Bacterial contamination	3.10 $\pm$ 1.36	3.00 $\pm$ 1.57	3.48 $\pm$ 1.13	0.11
2	Pesticide/insecticide residues	3.77 $\pm$ 1.20	4.00 $\pm$ 0.94	4.13 $\pm$ 0.93	0.06
3	Lead, mercury and aluminum	2.09 $\pm$ 1.34 <sup>b</sup>	2.24 $\pm$ 1.46 <sup>b</sup>	2.87 $\pm$ 1.66 <sup>a</sup>	< 0.05
4	Hormones in meat	2.91 $\pm$ 1.25 <sup>b</sup>	3.16 $\pm$ 1.38 <sup>ab</sup>	3.50 $\pm$ 1.24 <sup>a</sup>	< 0.05
5	Antibiotics in meat and milk products	2.57 $\pm$ 1.31 <sup>b</sup>	2.77 $\pm$ 1.32 <sup>ab</sup>	3.28 $\pm$ 1.41 <sup>a</sup>	< 0.05
6	Straw, stem fragment and any plant fragment in cereals	3.15 $\pm$ 1.23 <sup>b</sup>	3.30 $\pm$ 1.06 <sup>ab</sup>	3.70 $\pm$ 0.96 <sup>a</sup>	< 0.05
7	Glass fragment	3.13 $\pm$ 1.32 <sup>b</sup>	3.28 $\pm$ 1.23 <sup>b</sup>	3.87 $\pm$ 0.87 <sup>a</sup>	< 0.05
8	Stones in cereals, grains	3.51 $\pm$ 1.30 <sup>b</sup>	3.54 $\pm$ 1.04 <sup>ab</sup>	3.94 $\pm$ 0.71 <sup>a</sup>	0.05
9	Insects	3.33 $\pm$ 1.35 <sup>b</sup>	3.39 $\pm$ 1.16 <sup>b</sup>	3.94 $\pm$ 0.76 <sup>a</sup>	< 0.05

<sup>1</sup>The potential hazard was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). Results have been collected from section (3) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

Findings in Table 14 showed the effect of consumers' age on their knowledge of food safety. About 310 consumers were asked about their knowledge in food safety on a 1-5 score scale. The results showed that

consumers who were >50 years had higher knowledge about their family health (3.93 vs. 3.44,  $P < 0.05$ ) than consumers who were <30 years. At the same time, consumers who were in the range of 30-50 years old exhibited intermediate value. In contrast, there was no significant effect of age on the other food knowledge parameters. In this context, similar results were found in a study on Saudi women (Farahat *et al.*, 2015). The study showed that women who were >60 years old had the highest knowledge in food safety among other age groups.

**Table 14. Consumer knowledge in food safety by considering age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Consumer knowledge <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	> 50 Mean $\pm$ SD	P Value
1	How informed about food safety	2.84 $\pm$ 1.24	2.92 $\pm$ 1.17	2.93 $\pm$ 1.13	0.89
2	Personal description of health	3.27 $\pm$ 1.35	3.30 $\pm$ 1.25	3.74 $\pm$ 1.19	0.06
3	family health	3.44 $\pm$ 1.27 <sup>b</sup>	3.64 $\pm$ 1.19 <sup>ab</sup>	3.93 $\pm$ 1.08 <sup>a</sup>	<0.05
4	Your confident for food safety authorities	2.53 $\pm$ 1.09	2.39 $\pm$ 1.36	2.59 $\pm$ 1.16	0.57
5	The knowledge of food handlers about food safety	2.36 $\pm$ 1.27	2.31 $\pm$ 1.12	2.04 $\pm$ 1.12	0.22

<sup>1</sup>The potential hazard was scored as follows: excellent (5), very good (4), average (3), good (2), poor (1). Results have been collected from section (5) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Table 15 showed consumers' age effect on their knowledge in food handling practices. It was found that there was no significant effect of consumers' age on their food handling practices except; the case of separating between raw and cooked meat. Consumers who were <30 years had higher knowledge (1.31 vs. 1.00,  $P < 0.05$ ) in separating meats than consumers who were >50 years. While consumers in the range of 30-50 years old showed an intermediate value. In this context, Altekrouse *et al* (1996) found that consumers in the UK who were 18-29 years old did more unsafe food handling practices than other age groups.

**Table 15. Consumer knowledge in food handling practice by considering age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Potential hazard <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	>50 Mean $\pm$ SD	P Value
1	Checking food packages	4.68 $\pm$ 0.89	4.67 $\pm$ 0.82	4.75 $\pm$ 0.65	0.83
2	Checking frozen foods	4.41 $\pm$ 1.08	4.48 $\pm$ 1.06	4.33 $\pm$ 1.18	0.74
3	Clean food preparation area	4.89 $\pm$ 0.49	4.94 $\pm$ 0.45	4.73 $\pm$ 0.95	0.12
4	Cooling cooked meat	2.14 $\pm$ 1.45	2.44 $\pm$ 1.45	2.15 $\pm$ 1.35	0.27
5	Raw and cooked meat	1.31 $\pm$ 0.94 <sup>a</sup>	1.16 $\pm$ 0.51 <sup>ab</sup>	1.00 $\pm$ 0.00 <sup>b</sup>	< 0.05
6	Taste leftovers to check if they are still safe	3.15 $\pm$ 1.74	3.20 $\pm$ 1.67	3.12 $\pm$ 1.80	0.97
7	Use raw eggs	1.30 $\pm$ 0.89	1.28 $\pm$ 0.81	1.27 $\pm$ 0.82	0.97

<sup>1</sup>The handling practices were scored as follows: Always (5), sometimes (4), I don't know (3), rarely (2), and never (1). Results have been collected from section (7) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Table 16 showed the effect of consumers' age on their knowledge in good and safe food preparation practices in three Palestinian governorates (Qalqilya, Tulkarm and Nablus). It was found that there was no significant effect of consumer's age on their knowledge in safe food preparation practices excluding the practice of freezing food and irradiated food. Findings showed that consumers who were in the range of 30-50 years old had higher knowledge about bacteria in frozen food (3.48 *vs.* 3.02,  $P < 0.05$ ). At the same time, consumers who were  $>50$  years exhibited intermediate value. Moreover, consumers who were  $>50$  years had higher knowledge about freezing cooked food (4.80 *vs.* 4.47,  $P < 0.05$ ) than those who were  $<30$  years. While consumers who were in the range of 30-50 showed an intermediate value. In the context of the knowledge about irradiated food, it was found that consumers who were in the range of 30-50 years old have lower knowledge (2.01 *vs.* 2.34,  $P < 0.05$ ) than those who were less than thirty years. While consumers who were  $>50$  years showed an intermediate values. Accordingly, a study on Saudi women showed that women who were  $>60$  years, had higher safe food practices than other age groups (Farahat *et al.*, 2015).

**Table 16. Consumer knowledge in good food preparation practice by considering age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Safe food handling <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	>50 Mean $\pm$ SD	P Value
1	Ground beef patties	2.68 $\pm$ 1.34	2.33 $\pm$ 1.22	2.39 $\pm$ 1.08	0.07
2	Freezing food kills all bacteria	3.02 $\pm$ 1.34 <sup>b</sup>	3.48 $\pm$ 1.38 <sup>a</sup>	2.94 $\pm$ 1.17 <sup>ab</sup>	< 0.05
3	Freezing cooked food	4.47 $\pm$ 0.85 <sup>b</sup>	4.66 $\pm$ 0.70 <sup>ab</sup>	4.80 $\pm$ 0.40 <sup>a</sup>	< 0.05
4	Leftover foods can be safely kept at room temperature several hours	3.17 $\pm$ 1.09	3.19 $\pm$ 1.12	3.53 $\pm$ 0.99	0.10
5	Irradiation of meat or poultry will destroy bacteria	2.33 $\pm$ 0.90	2.38 $\pm$ 0.83	2.45 $\pm$ 0.90	0.70
6	Irradiated food	2.34 $\pm$ 0.98 <sup>a</sup>	2.01 $\pm$ 0.89 <sup>b</sup>	2.18 $\pm$ 1.16 <sup>ab</sup>	0.05

<sup>1</sup>The safe food handling was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2), and strongly disagree (1). Results have been collected from section (9) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Effect of consumer's age on their reliability of sources of food safety information in the three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 17. Consumers were face to face asked about their reliability of food safety information sources. It was found that there were no significant effects of consumer's age on the reliability of sources of food safety information except health professionals, friends, or family and science magazines. In which consumers who were <30 years exhibited the

lowest reliability of food information that comes from health professionals (3.68 vs. 4.15 and 4.25,  $P < 0.05$ ). While consumers who were  $>50$  years showed the highest reliability of food information that comes from friends or family (2.02 and 3.34 vs. 3.02,  $P < 0.05$ ). Moreover, consumers who were  $<30$  years showed higher reliability of information coming from science magazine (2.71 vs. 2.21,  $P < 0.0$ ) than consumers who were in the range of 30-50 years old. At the same time, consumers who were  $>50$  years showed an intermediate value.

**Table 17. Consumer reliability in the source of food safety information by considering age effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Reliability of sources <sup>1</sup>	$<30$ Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	$>50$ Mean $\pm$ SD	P Value
1	University scientist	$3.75 \pm 1.16$	$4.08 \pm 1.03$	$3.92 \pm 1.15$	0.14
2	Health professional	$3.68 \pm 1.28^b$	$4.15 \pm 0.96^a$	$4.25 \pm 0.88^a$	$< 0.05$
3	Friends or family	$2.02 \pm 1.09^b$	$2.34 \pm 1.24^b$	$3.02 \pm 1.08^a$	$< 0.05$
4	Consumer reports	$2.34 \pm 1.31$	$2.68 \pm 1.39$	$2.69 \pm 1.28$	0.08
5	Science magazine	$2.71 \pm 1.38^a$	$2.21 \pm 1.21^b$	$2.40 \pm 1.24^{ab}$	$< 0.05$
6	Food magazine	$2.49 \pm 1.30$	$2.36 \pm 1.16$	$2.40 \pm 1.11$	0.73
7	Radio	$2.08 \pm 1.21$	$2.21 \pm 1.28$	$2.27 \pm 1.19$	0.54
8	Television news	$2.27 \pm 1.31$	$2.34 \pm 1.33$	$2.41 \pm 1.20$	0.77
9	Newspaper	$2.66 \pm 0.92$	$2.61 \pm 1.00$	$2.80 \pm 0.92$	0.51
10	Written materials from health food stores supermarket	$1.89 \pm 1.15$	$1.95 \pm 1.23$	$2.20 \pm 1.08$	0.27
11	Material government	$2.70 \pm 1.42$	$2.55 \pm 1.50$	$2.80 \pm 1.50$	0.59
12	Social media such as Facebook	$1.95 \pm 1.20$	$1.78 \pm 1.06$	$2.08 \pm 1.35$	0.24
13	Internet engines such as Google	$2.60 \pm 1.30$	$2.59 \pm 1.46$	$2.31 \pm 1.26$	0.40

<sup>1</sup>The reliability of sources of food safety information was scored as follows: highly reliable (5), reliable somewhat (4), I don't know (3), somewhat unreliable (2), and unreliable highly (1). Results have been collected from section (10) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of consumer's age on their food contamination knowledge in three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 18. Our findings showed that there was no significant effect of consumer's age on their food contamination knowledge except three cases. In this context, consumers in the range of 30-50 years had the lowest knowledge about storing food (4.36 *vs.* 4.71 and 4.65,  $P < 0.05$ ). The same results were observed for the role of uncovered abrasion (4.45 *vs.* 4.74 and 4.90,  $P < 0.05$ ) in food contamination. On the other hand, consumers who were  $>50$  years had the highest information about the role of inadequate food cooking (4.69 *vs.* 4.19 and 4.16,  $P < 0.05$ ) in food contamination. However, Evans *et al* (2019) found that elderly people ( $>60$ ) in Bangladesh had lower information about food contamination than other consumers, and they need to improve their food hygiene practices. In contrast, another study in Canada showed that the youngest age group ( $<30$  years) had the lowest knowledge in food contamination practices (Murray *et al.*, 2017).

**Table 18. Consumer knowledge in food contamination by considering gender effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	Food Contamination Knowledge <sup>1</sup>	<30 Mean $\pm$ SD <sup>2</sup>	30-50 Mean $\pm$ SD	> 50 Mean $\pm$ SD	P Value
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	4.32 $\pm$ 0.88	4.44 $\pm$ 0.74	4.26 $\pm$ 0.91	0.44
2	Children, pregnant women and older individuals are more at risk of food poisoning	4.50 $\pm$ 0.71	4.64 $\pm$ 0.78	4.59 $\pm$ 0.54	0.31
3	Role of personal hygiene	4.44 $\pm$ 0.89	4.44 $\pm$ 0.79	4.29 $\pm$ 0.97	0.57
4	Role of storing raw and cooked food together	4.71 $\pm$ 0.56 <sup>a</sup>	4.36 $\pm$ 0.95 <sup>b</sup>	4.65 $\pm$ 0.48 <sup>a</sup>	< 0.05
5	Role of water	4.69 $\pm$ 0.65	4.75 $\pm$ 0.52	4.78 $\pm$ 0.42	0.53
6	Role of uncovered abrasion or cuts	4.74 $\pm$ 0.56 <sup>a</sup>	4.45 $\pm$ 0.98 <sup>b</sup>	4.90 $\pm$ 0.30 <sup>a</sup>	< 0.05
7	Role of inadequate cooking of raw food	4.16 $\pm$ 1.00 <sup>b</sup>	4.15 $\pm$ 1.00 <sup>b</sup>	4.69 $\pm$ 0.71 <sup>a</sup>	< 0.05
8	Role of smoking during preparing food	3.65 $\pm$ 1.19	3.84 $\pm$ 1.21	3.96 $\pm$ 1.08	0.19
9	Role of health state of food handler	4.47 $\pm$ 0.84	4.68 $\pm$ 0.65	4.68 $\pm$ 0.65	0.08

<sup>1</sup>The food contamination knowledge was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2), and strongly disagree (1). Results have been collected from section (11) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The geographic effect on consumer's awareness towards food safety was studied by categorizing consumers into three governorates (Nablus, Qalqilya and Tulkarm). The effect of consumers living place on all studied

parameters (consumer confidence and concerns towards food products, consumers' knowledge in food handling practices, their reliability in information sources and their knowledge in contamination of food) in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers were asked specific questions about each parameter by face to face interviews.

**Table 19. Percentage of participants from each city (Nablus, Tulkarm and Qalqilya).**

Governorates	Count (persons)	Percentage%
Nablus	115	36.86
Tulkarem	75	24.04
Qalqilya	122	39.10
Total	312	100

The geographic effect on consumer confidence toward the safety of different food products in the Palestinian market was shown in Table 20. In general, our findings showed that there was a significant effect on living place on the consumer confidence towards the safety of food products, except in; egg, dairy products, popular drinks from street and eastern desserts (Kunafa, baklava, etc.). The results showed that the consumers in Qalqilya governorate exhibited higher degree of confidence towards supermarket foods (3.39 vs. 2.84,  $P < 0.05$ ) and popular foods from the street (2.65 vs. 2.35,  $P < 0.05$ ) than consumers in Nablus governorate respectively, while consumers in Tulkarm governorate showed intermediate values. However, consumers in Tulkarm governorate showed a higher degree of

confidence in bottled water (3.64 *vs.* 2.71 and 2.89,  $P < 0.05$ ) than Nablus and Qalqilya respectively. Moreover, consumers in Nablus and Qalqilya governorates showed higher degree of confidence in the safety of fruits and vegetable (4.05 and 3.79 *vs.* 3.64,  $P < 0.05$ ), meat products (3.91 and 3.91 *vs.* 3.55,  $p < 0.05$ ,  $P < 0.05$ ), chicken products (3.94 and 3.89 *vs.* 3.37,  $P < 0.05$ ) than the consumers in Tulkarm governorate. The degree of confidence in the safety of fish products (3.79 *vs.* 3.03 and 3.20,  $P < 0.05$ ) and food from regular restaurants (3.23 *vs.* 2.72 and 3.04,  $P < 0.05$ ) in Qalqilya governorate was significantly a higher than Nablus and Tulkarm governorates respectively. Consumers in Tulkarm and Qalqilya showed a higher confidence toward the safety of western desserts (4.08 *vs.* 3.79,  $P < 0.05$ ) than Nablus governorate. The confidence in the safety of foods from popular restaurants in Qalqilya governorate was significantly higher (4.08 *vs.* 3.42 and 3.61,  $P < 0.05$ ) than Nablus and Tulkarm governorates. Consumption patterns of different types of foods are greatly affected by geographical factors, as it can help in understanding consumer's perceptions towards many things including food (Pirgo, 2004). In this context, it was found that consumers living within a distance of 20-25 miles had almost the same concerns towards food safety, the same knowledge and food handling practices (Pirgo, 2004). Even the distance between three governorates in our study was in the range of 13-17 miles but there were significant differences in the concerns towards food safety. This may be attributed to different food cultures in these areas.

**Table 20. Consumer confidence in the safety of different food products by considering place of living effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree Of Confidence <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	Supermarket food	2.84 $\pm$ 0.77 <sup>b</sup>	3.39 $\pm$ 0.99 <sup>a</sup>	3.09 $\pm$ 0.87 <sup>ab</sup>	< 0.05
2	Bottled water	2.71 $\pm$ 1.51 <sup>b</sup>	2.89 $\pm$ 1.68 <sup>b</sup>	3.64 $\pm$ 1.20 <sup>a</sup>	< 0.05
3	Egg	3.77 $\pm$ 1.19	3.89 $\pm$ 0.97	3.68 $\pm$ 0.81	0.34
4	Fruits and vegetables	4.05 $\pm$ 0.76 <sup>a</sup>	3.97 $\pm$ 0.94 <sup>a</sup>	3.64 $\pm$ 0.82 <sup>b</sup>	< 0.05
5	Milk and milk products	3.80 $\pm$ 0.99	3.99 $\pm$ 0.99	3.79 $\pm$ 0.86	0.18
6	Meat and meat products	3.91 $\pm$ 1.02 <sup>a</sup>	3.91 $\pm$ 0.99 <sup>a</sup>	3.55 $\pm$ 0.81 <sup>b</sup>	< 0.05
7	Chicken and chicken products	3.94 $\pm$ 0.92 <sup>a</sup>	3.89 $\pm$ 0.99 <sup>a</sup>	3.37 $\pm$ 0.90 <sup>b</sup>	< 0.05
8	Fish and fish products	3.03 $\pm$ 1.07 <sup>b</sup>	3.79 $\pm$ 1.11 <sup>a</sup>	3.20 $\pm$ 0.87 <sup>b</sup>	< 0.05
9	Popular foods from street	2.35 $\pm$ 0.75 <sup>b</sup>	2.65 $\pm$ 0.97 <sup>a</sup>	2.56 $\pm$ 0.76 <sup>ab</sup>	< 0.05
10	Popular drinks from street	2.55 $\pm$ 0.85	2.78 $\pm$ 0.97	2.75 $\pm$ 0.90	0.12
11	Eastern desserts (Kunafa, baklava, etc.)	3.82 $\pm$ 1.01	4.08 $\pm$ 0.91	3.93 $\pm$ 0.84	0.09
12	Western desserts (cake, etc.)	2.97 $\pm$ 0.91 <sup>b</sup>	4.08 $\pm$ 2.87 <sup>a</sup>	3.79 $\pm$ 0.87 <sup>a</sup>	< 0.05
13	Food from popular restaurants	3.42 $\pm$ 1.03 <sup>b</sup>	4.08 $\pm$ 0.96 <sup>a</sup>	3.61 $\pm$ 0.73 <sup>b</sup>	< 0.05
14	Food from regular restaurants	2.72 $\pm$ 1.38 <sup>b</sup>	3.23 $\pm$ 1.50 <sup>a</sup>	3.04 $\pm$ 1.38 <sup>ab</sup>	< 0.05

<sup>1</sup>The degree of confidence was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (2) of the research questionnaire.

SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The geographical effect (living place) on consumer concerns towards potential hazards in foods was shown in Table 21. Findings showed that there was a significant effect on living place on consumer concerns towards food potential hazards except having hormones in meat. Consumers in

Qalqilya had higher concerns than Tulkarm towards bacterial contamination (3.44 vs. 2.97,  $P < 0.05$ ), physical hazards in cereals (3.56 vs. 2.91,  $P < 0.05$ ) and glass fragments in food (3.57 vs. 2.92,  $P < 0.05$ ) while Nablus showed intermediate values. For the hazard of having heavy metals (aluminum, lead and mercury) in food, Nablus community showed higher concerns than Qalqilya (2.55 vs. 1.97,  $P < 0.05$ ), where Tulkarm exhibited moderate values. In respect to the presence of antibiotics in meat and milk products, consumers in Nablus and Tulkarm cities showed significantly higher concerns (2.84 and 3.17 vs. 2.41,  $P < 0.05$ ) than Qalqilya city. Consumers in Nablus and Qalqilya had higher concerns towards insects (3.48 and 3.73 vs. 2.96,  $P < 0.05$ ) than consumers in Tulkarm. In agreement with our findings, in Ghana, Omari *et al* (2017) found that urban consumers, in general, have higher concerns towards bacterial contamination, pesticide residues in vegetables and physical hazards than rural ones. Furthermore, Kendall *et al* (2014) found that Chinese consumers living in Beijing had lower levels of hazard concern than ones in Chengdu.

**Table 21. Consumer concerns toward hazards in food products by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	Bacterial contamination	3.35 $\pm$ 1.17 <sup>ab</sup>	3.44 $\pm$ 1.25 <sup>a</sup>	2.97 $\pm$ 1.42 <sup>b</sup>	< 0.05
2	Pesticide/insecticide residues	4.17 $\pm$ 0.84 <sup>a</sup>	3.84 $\pm$ 1.00 <sup>b</sup>	3.56 $\pm$ 1.45 <sup>b</sup>	< 0.05
3	Lead, mercury and aluminum	2.55 $\pm$ 1.64 <sup>a</sup>	1.97 $\pm$ 1.15 <sup>b</sup>	2.35 $\pm$ 1.53 <sup>ab</sup>	< 0.05
4	Hormones in meat	3.17 $\pm$ 1.23	3.07 $\pm$ 1.12	2.97 $\pm$ 1.55	0.61
5	Antibiotics in meat and milk products	2.84 $\pm$ 1.24 <sup>a</sup>	2.41 $\pm$ 1.34 <sup>b</sup>	3.17 $\pm$ 1.40 <sup>a</sup>	< 0.05
6	Straw, stem fragment and any plant fragment in cereals	3.24 $\pm$ 1.06 <sup>ab</sup>	3.56 $\pm$ 1.04 <sup>a</sup>	2.91 $\pm$ 1.35 <sup>b</sup>	< 0.05
7	Glass fragment	3.25 $\pm$ 1.22 <sup>ab</sup>	3.57 $\pm$ 1.19 <sup>a</sup>	2.93 $\pm$ 1.32 <sup>b</sup>	< 0.05
8	Stones in cereals, grains	3.66 $\pm$ 1.05 <sup>ab</sup>	3.71 $\pm$ 1.12 <sup>a</sup>	3.29 $\pm$ 1.31 <sup>b</sup>	< 0.05
9	Insects	3.48 $\pm$ 1.20 <sup>a</sup>	3.73 $\pm$ 1.14 <sup>a</sup>	2.96 $\pm$ 1.31 <sup>b</sup>	< 0.05

<sup>1</sup>The potential hazard was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (3) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05)

The effect of living place (Nablus, Qalqilya and Tulkarm) on consumers' knowledge in food safety was shown in Table 22. In general, results showed that consumer knowledge in food safety was not significantly affected by the place of living except in the case of personal health description. Consumers in Tulkarm and Nablus showed higher

concerns towards personal health description (3.89 and 3.90 vs. 3.53,  $P < 0.05$ ) than consumers in Qalqilya. In this context, Parra *et al* (2014) reported that consumer from the US had higher awareness towards food safety risks than consumers from Mexico.

**Table 22. Consumer knowledge in food safety by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	How informed about food safety	3.43 $\pm$ 0.70	3.42 $\pm$ 0.82	3.32 $\pm$ 0.76	0.62
2	Personal description of health	3.89 $\pm$ 0.76 <sup>a</sup>	3.53 $\pm$ 0.95 <sup>b</sup>	3.90 $\pm$ 0.89 <sup>a</sup>	< 0.05
3	Personal assessment of family health in the past 6 months	3.95 $\pm$ 0.81	3.70 $\pm$ 0.97	3.90 $\pm$ 0.85	0.09
4	Your confident for food safety authorities	2.39 $\pm$ 1.14	2.51 $\pm$ 1.29	2.67 $\pm$ 1.04	0.29
5	The knowledge of food handlers about food safety	2.60 $\pm$ 1.04	2.83 $\pm$ 1.05	2.51 $\pm$ 0.95	0.08

<sup>1</sup>The consumer knowledge was scored as follow: excellent (5), very good (4), average (3), good (2), and poor (1). In addition, results have been collected from section (5) of research questionnaire.

<sup>2</sup>SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Table 23 showed consumers living place effect on their knowledge in food handling practices. It was found that consumers living places significantly affect their food handling practices except; the case of checking frozen

food. Consumers who live in Tulkarm city scored the lowest value in their knowledge in two cases: checking food packages (4.23 *vs.* 4.87 and 4.78,  $P<0.05$ ) and using raw eggs (1.00 *vs.* 1.41 and 1.31,  $P<0.05$ ). In contrast, they showed the highest knowledge in separating raw and cooked meat (1.55 *vs.* 1.09 and 1.14,  $P<0.05$ ). Consumers in Nablus city clean their food preparation area more than consumers in Tulkarm city (4.99 *vs.* 4.70,  $P<0.05$ ), while consumers in Qalqilya city showed an intermediate value. Moreover, consumers in Nablus city scored the lowest value in leaving cooked meat at room temperature for more than two hours (1.81 *vs.* 2.48 and 2.45,  $P<0.05$ ). In respect with tasting leftovers to check if they are still safe, consumers in Qalqilya city scored the lowest value (2.73 *vs.* 3.44 and 3.42,  $p<0.05$ ). Parra *et al* (2014) found that generally, consumers who were born in Mexico were less likely to follow food safety practices than those who were born in the US.

**Table 23. Consumer knowledge in food handling practice by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Handling practice <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	Checking food packages	4.87 $\pm$ 0.41 <sup>a</sup>	4.78 $\pm$ 0.61 <sup>a</sup>	4.23 $\pm$ 1.34 <sup>b</sup>	< 0.05
2	Checking frozen foods	4.48 $\pm$ 0.97	4.33 $\pm$ 1.20	4.45 $\pm$ 1.08	0.54
3	Clean food preparation area	4.99 $\pm$ 0.09 <sup>a</sup>	4.87 $\pm$ 0.65 <sup>ab</sup>	4.70 $\pm$ 0.85 <sup>b</sup>	< 0.05
4	Leaving cooked meat at room temp	1.81 $\pm$ 1.22 <sup>b</sup>	2.48 $\pm$ 1.56 <sup>a</sup>	2.45 $\pm$ 1.39 <sup>a</sup>	< 0.05
5	Raw and cooked meat	1.09 $\pm$ 0.41 <sup>b</sup>	1.14 $\pm$ 0.73 <sup>b</sup>	1.55 $\pm$ 1.09 <sup>a</sup>	< 0.05
6	Taste leftovers to check if they are still safe	3.44 $\pm$ 1.75 <sup>a</sup>	2.73 $\pm$ 1.73 <sup>b</sup>	3.42 $\pm$ 1.55 <sup>a</sup>	< 0.05
7	Use raw eggs	1.44 $\pm$ 1.05 <sup>a</sup>	1.31 $\pm$ 0.87 <sup>a</sup>	1.00 $\pm$ 0.00 <sup>b</sup>	< 0.05

<sup>1</sup>The consumer handling practice was scored as follows: always (5), sometimes (4), I don't know (3), rarely (2) and never (1). In addition, results have been collected from section (7) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of living place on the consumer safe food preparation practices was shown in Table 24. Results showed that there was a significant effect of consumers living place on their safe food preparation practices except for the knowledge about cooling cooked food and dealing with food leftovers. Considering the knowledge of cooking ground beef patties (3.13 vs. 2.53 and 2.19,  $P < 0.05$ ) and irradiated food (2.70 vs. 1.98

and 2.18,  $P < 0.05$ ), it was found that consumers living in Tulkarm city scored the highest value. With respect to consumer's knowledge about freezing food and bacteria, it was found that consumers in Qalqilya city scored the highest value (3.50 vs. 2.94 and 2.58,  $P < 0.05$ ). For the knowledge about the relation between irradiation of meat and destroying bacteria, it was found that consumers in Tulkarm city scored higher value than ones in Qalqilya (2.66 vs. 2.15,  $P < 0.05$ ), while consumers in Nablus city showed an intermediate value. In this context, Gomaa (2007) found that women who live in Alexandria city had lower knowledge in food preparation practices than other cities. In which 42% of them bought non-refrigerated meat, and 78.46% could buy fish that was partially frozen.

**Table 24. Consumer knowledge in good food preparation practice by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Safe food handling <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	Cooking ground beef patties	2.53 $\pm$ 1.38 <sup>b</sup>	2.19 $\pm$ 1.08 <sup>b</sup>	3.13 $\pm$ 1.21 <sup>a</sup>	< 0.05
2	Freezing food kills all bacteria	2.94 $\pm$ 1.35 <sup>b</sup>	3.50 $\pm$ 1.21 <sup>a</sup>	2.85 $\pm$ 1.40 <sup>b</sup>	< 0.05
3	Cooling cooked food	4.63 $\pm$ 0.83	4.54 $\pm$ 0.70	4.56 $\pm$ 0.74	0.63
4	Leftover foods can be safely kept at room temperature several hours	3.30 $\pm$ 1.04	3.17 $\pm$ 1.13	3.24 $\pm$ 1.10	0.67
5	Irradiation of meat or poultry will destroy bacteria	2.40 $\pm$ 0.91 <sup>ab</sup>	2.15 $\pm$ 0.76 <sup>b</sup>	2.66 $\pm$ 0.95 <sup>a</sup>	< 0.05
6	Irradiated food	1.98 $\pm$ 0.95 <sup>b</sup>	2.18 $\pm$ 0.93 <sup>b</sup>	2.70 $\pm$ 1.04 <sup>a</sup>	< 0.05

<sup>1</sup>The safe food handling was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In

addition, results have been collected from section (9) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

Effect of living place on the reliability of information sources in food safety was shown in Table 25, it was found that there was a significant effect of living place on the reliability of the information sources in food safety. Consumers in Nablus had significantly higher reliability in university scientists (4.16 vs. 3.82,  $P < 0.05$ ) than Tulkarm, while Qalqilya had an intermediate value. In respect to the reliability of information in food safety from friends or family, consumers in Qalqilya exhibited significantly higher reliability (3.38 vs. 2.87 and 2.70,  $P < 0.05$ ) than consumers in Nablus and Tulkarm. It was also found that consumers in Tulkarm had higher reliability (3.51 vs. 3.03 and 2.78,  $P < 0.05$ ) in science magazine as a source of information in food safety more than Qalqilya and Nablus. Consumers in Nablus showed the lowest reliability in television news (2.55 vs. 3.10 and 3.03,  $P < 0.05$ ) and food magazines (1.95 vs. 2.77 and 2.70,  $P < 0.05$ ) if compared to consumers in Qalqilya and Tulkarm. Consumers in Tulkarm had higher reliability in newspapers (3.04 vs. 3.03 and 2.66,  $P < 0.05$ ) and internet engines (3.51 vs. 2.94 and 2.79,  $P < 0.05$ ) than Nablus and Qalqilya. On the other hand, the living place had no effect on consumer's reliability in the other sources. Accordingly, a study was made in the USA showed that consumers in Texas and New York prefer to

get their food safety information from TV programs more than other states (Parra *et al.*, 2014).

**Table 25. Consumer reliability in the sources of food safety information by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	University scientist	4.16 $\pm$ 0.76 <sup>a</sup>	4.08 $\pm$ 0.95 <sup>ab</sup>	3.82 $\pm$ 0.47 <sup>b</sup>	< 0.05
2	Health professional	4.12 $\pm$ 0.68	4.17 $\pm$ 0.82	4.09 $\pm$ 0.91	0.76
3	Friends or family	2.87 $\pm$ 0.87 <sup>b</sup>	3.38 $\pm$ 0.82 <sup>a</sup>	2.70 $\pm$ 0.82 <sup>b</sup>	< 0.05
4	Consumer reports	2.45 $\pm$ 1.30	2.69 $\pm$ 1.32	2.23 $\pm$ 1.37	0.06
5	Science magazine	3.03 $\pm$ 0.99 <sup>b</sup>	2.78 $\pm$ 1.05 <sup>b</sup>	3.51 $\pm$ 0.95 <sup>a</sup>	< 0.05
6	Food magazine	1.95 $\pm$ 0.86 <sup>b</sup>	2.77 $\pm$ 1.21 <sup>a</sup>	2.70 $\pm$ 1.50 <sup>a</sup>	< 0.05
7	Radio	2.63 $\pm$ 0.71	3.30 $\pm$ 3.9	2.94 $\pm$ 0.89	0.12
8	Television news	2.55 $\pm$ 0.73 <sup>b</sup>	3.10 $\pm$ 1.07 <sup>a</sup>	3.03 $\pm$ 0.93 <sup>a</sup>	< 0.05
9	Newspaper	3.03 $\pm$ 0.68 <sup>b</sup>	2.66 $\pm$ 1.08 <sup>b</sup>	3.04 $\pm$ 0.93 <sup>a</sup>	< 0.05
10	Written materials from health food stores Supermarket	2.41 $\pm$ 0.82	2.85 $\pm$ 2.80	2.92 $\pm$ 0.98	0.11
11	Material government	3.15 $\pm$ 0.91	3.19 $\pm$ 1.21	3.41 $\pm$ 1.04	0.25
12	Social media such as Facebook	2.66 $\pm$ 0.82	2.59 $\pm$ 0.92	2.90 $\pm$ 1.03	0.07
13	Internet engines such as Google	2.94 $\pm$ 1.00 <sup>b</sup>	2.79 $\pm$ 1.08 <sup>b</sup>	3.51 $\pm$ 0.92 <sup>a</sup>	< 0.05

<sup>1</sup>The reliability in sources of food safety information was scored as follows: highly reliable (5), reliable somewhat (4), somewhat unreliable (3), unreliable highly (2), and I don't know (1). In addition, Results have been collected from section (10) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of living place on consumer's knowledge in food contamination was shown in Table 26. It was found that there was no significant effect for living place on consumer's knowledge in food contamination, except in four cases. Consumers in Qalqilya and Nablus showed significantly higher (4.09 *vs.* 4.74 and 4.64,  $P < 0.05$ ) knowledge at risk of food poisoning than Tulkarm. In addition, consumers in Tulkarm and Nablus showed significantly higher (4.58 and 4.63 *vs.* 4.30,  $P < 0.05$ ) knowledge in the role of personal hygiene in food contamination than Qalqilya. Moreover, consumers in Nablus showed higher knowledge (4.83 *vs.* 4.65,  $P < 0.05$ ) in the role of water in food contamination than consumers in Qalqilya. At the same time, consumers in Tulkarm exhibited an intermediate value. According to a study made on consumers in Egypt, it was found that women who live in Alexandria had lower food safety knowledge in food contamination than other sites. For example, 60% of women living in Alexandria didn't wash their hands when preparing food (Gomaa, 2007).

**Table 26. Consumer knowledge in food contamination by considering the place of living effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Food contamination knowledge <sup>1</sup>		Nablus (Mean $\pm$ SD <sup>2</sup> )	Qalqilya (Mean $\pm$ SD)	Tulkarm (Mean $\pm$ SD)	P Value
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	4.34 $\pm$ 0.76	4.48 $\pm$ 0.64	4.24 $\pm$ 0.99	0.11
2	Children, pregnant women and older individuals are more at risk of food poisoning	4.74 $\pm$ 0.48 <sup>a</sup>	4.64 $\pm$ 0.56 <sup>a</sup>	4.09 $\pm$ 1.02 <sup>b</sup>	< 0.05
3	Role of personal hygiene	4.58 $\pm$ 0.65 <sup>a</sup>	4.30 $\pm$ 0.74 <sup>b</sup>	4.63 $\pm$ 0.51 <sup>a</sup>	< 0.05
4	Role of storing raw and cooked food together	4.56 $\pm$ 0.77	4.70 $\pm$ 0.48	4.48 $\pm$ 0.98	0.11
5	Role of water	4.83 $\pm$ 0.73 <sup>a</sup>	4.65 $\pm$ 0.66 <sup>b</sup>	4.66 $\pm$ 0.70 <sup>ab</sup>	< 0.05
6	Role of uncovered abrasion or cuts	4.75 $\pm$ 0.59	4.68 $\pm$ 0.57	4.72 $\pm$ 0.57	0.67
7	Role of inadequate cooking of raw food	4.43 $\pm$ 0.65	4.36 $\pm$ 0.84	4.20 $\pm$ 0.77	0.12
8	Role of Smoking during preparing food	3.90 $\pm$ 1.035	3.53 $\pm$ 1.44	3.63 $\pm$ 1.05	0.10
9	Role of health state of food handler	4.69 $\pm$ 0.61	4.47 $\pm$ 0.98	4.42 $\pm$ 0.73	0.06

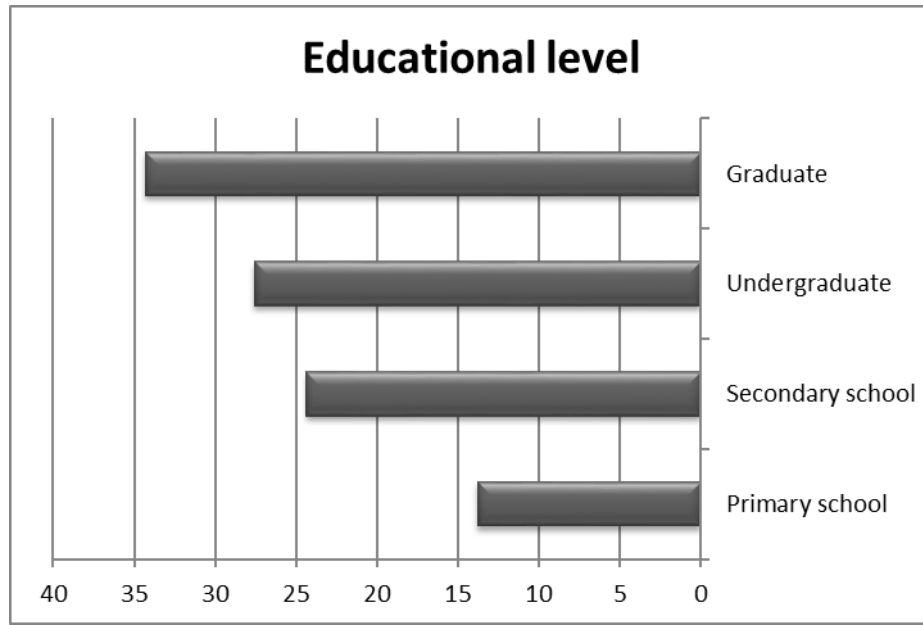
<sup>1</sup>Food contamination knowledge was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (11) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of consumers educational level on all studied parameters (consumer confidence and concerns towards food products, consumers knowledge in food handling practices, their reliability in information sources and their knowledge in contamination of food) in three Palestinian

governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers were asked specific questions about each parameter by face to face interviews.



**Figure 9.** Consumers educational level in the three Palestinian governorates.

The effect of educational levels on consumer confidence towards the safety of different food products was shown in Table 27. In general, our study revealed that there was a significant effect for educational levels on the confidence of the safety of different food product categories except for supermarket foods and bottled water. Undergraduate consumers exhibited significantly lower levels of confidence in the safety of eggs than other groups (graduate, primary, and secondary). The confidence of primary educated consumers in the safety of fruits and vegetables was significantly higher than secondary and graduated consumers while undergraduate exhibited intermediate values. For milk and dairy products, primary educated consumers had significantly higher confidence in safety than

secondary educated consumers (4.21 *vs.* 3.74,  $p < 0.05$ ) while other groups showed intermediate values. In respect to meat and meat products, under graduated consumer had significantly lower confidence in the safety if compared with other groups. Similar results were observed for chicken and chicken products. Graduated consumers exhibited the lowest values (3.15 *vs.* 3.79,  $p < 0.05$ ) in the confidence of the safety of fish and fish products if compared to primary educated consumers while the others exhibited intermediate values. In respect to popular foods and drinks from the street as well as eastern desserts, graduated consumers exhibited significantly the lowest values of confidence if compared with other groups. Similar findings were seen for the food from popular and regular restaurants. Finally, primary educated consumers showed the highest confidence in the safety of western desserts if compared to other groups. As general conclusions, there was a clear effect for education levels on the confidence of consumers towards the safety of food products. For wide food categories, it was observed that the higher the educational level, the lower the confidence towards food safety. Accordingly, Hidaka *et al* (2018) found that educated consumers (graduated and more) especially women exhibited higher consumption of supermarket food and food from restaurants than not educated ones. The aim of food safety education in general is to protect consumers from foodborne illnesses. Such factors that affect foodborne illness including: inadequate cooking, avoiding cross-sectional contamination, personal hygiene and preserving food at a suitable temperature. According to American Council for Agricultural Science and

Technology (CAST) it was found that each food borne illness highly affected the economy. Thus education has a greatly important role in protecting consumers from different illnesses and reduces the economic burden. In 1997 an American campaign was established to teach consumers about cleaning surfaces and hands when dealing with food, separating raw and cooked food, and chilling and cooking at suitable temperature (Department of Agriculture, Food Safety and Inspection Service: irradiation of meat food products 2000). On another hand, Webb *et al* (2015) found that there was no relationship between education level and food safety knowledge in Arizona. In which the study was made on consumers who are in different education levels (primary, secondary and tertiary). 63.5% of consumers had limited knowledge, 79% had good hygienic practices knowledge, while 33.5% of consumers knew the correct cooking temperature (Webb *et al.*, 2015).

**Table 27. Consumer confidence in the safety of different food products by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree Of Confidence <sup>1</sup>	Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P Value
1 Supermarket food	3.05 $\pm$ 0.86	3.33 $\pm$ 1.04	3.01 $\pm$ 0.93	3.20 $\pm$ 0.89	0.21
2 Bottled water	3.19 $\pm$ 1.47	2.72 $\pm$ 1.65	2.74 $\pm$ 1.62	3.16 $\pm$ 1.50	0.11
3 Egg	3.87 $\pm$ 0.92 <sup>a</sup>	4.21 $\pm$ 0.91 <sup>a</sup>	3.87 $\pm$ 1.09 <sup>a</sup>	3.44 $\pm$ 1.04 <sup>b</sup>	< 0.05
4 Fruits and vegetables	3.82 $\pm$ 0.84 <sup>b</sup>	4.28 $\pm$ 0.67 <sup>a</sup>	3.86 $\pm$ 0.92 <sup>b</sup>	3.92 $\pm$ 0.87 <sup>ab</sup>	< 0.05
5 Milk and milk products	3.82 $\pm$ 0.87 <sup>ab</sup>	4.21 $\pm$ 0.77 <sup>a</sup>	3.74 $\pm$ 1.08 <sup>b</sup>	3.88 $\pm$ 0.96 <sup>ab</sup>	0.06
6 Meat and meat products	3.90 $\pm$ 0.97 <sup>a</sup>	4.10 $\pm$ 0.75 <sup>a</sup>	4.04 $\pm$ 0.90 <sup>a</sup>	3.41 $\pm$ 1.00 <sup>b</sup>	< 0.05
7 Chicken and chicken products	3.73 $\pm$ 1.05 <sup>ab</sup>	4.16 $\pm$ 0.75 <sup>a</sup>	3.84 $\pm$ 0.93 <sup>ab</sup>	3.61 $\pm$ 0.95 <sup>b</sup>	< 0.05
8 Fish and fish products	3.15 $\pm$ 1.14 <sup>b</sup>	3.79 $\pm$ 1.10 <sup>a</sup>	3.40 $\pm$ 1.11 <sup>ab</sup>	3.40 $\pm$ 0.97 <sup>ab</sup>	< 0.05
9 Popular foods from street	2.29 $\pm$ 0.64 <sup>c</sup>	2.93 $\pm$ 1.01 <sup>a</sup>	2.39 $\pm$ 0.71 <sup>bc</sup>	2.70 $\pm$ 1.00 <sup>ab</sup>	< 0.05
10 Popular drinks from street	2.49 $\pm$ 0.82 <sup>b</sup>	2.81 $\pm$ 0.96 <sup>ab</sup>	2.61 $\pm$ 0.83 <sup>ab</sup>	2.94 $\pm$ 1.01 <sup>a</sup>	< 0.05
11 Eastern desserts (Kunafa, baklava, etc.)	3.71 $\pm$ 1.01 <sup>b</sup>	4.17 $\pm$ 0.92 <sup>a</sup>	4.09 $\pm$ 0.82 <sup>a</sup>	4.01 $\pm$ 0.91 <sup>ab</sup>	< 0.05
12 Western desserts (cake, etc.)	3.25 $\pm$ 0.93 <sup>b</sup>	4.65 $\pm$ 4.65 <sup>a</sup>	3.59 $\pm$ 1.05 <sup>b</sup>	3.52 $\pm$ 0.92 <sup>b</sup>	< 0.05
13 Food from popular restaurants	3.43 $\pm$ 0.90 <sup>b</sup>	4.00 $\pm$ 0.79 <sup>a</sup>	3.79 $\pm$ 1.16 <sup>ab</sup>	3.90 $\pm$ 0.90 <sup>a</sup>	< 0.05
14 Food from regular restaurants	3.14 $\pm$ 1.02 <sup>b</sup>	3.49 $\pm$ 0.91 <sup>ab</sup>	3.67 $\pm$ 1.20 <sup>a</sup>	3.64 $\pm$ 1.02 <sup>a</sup>	< 0.05

<sup>1</sup>The degree of confidence was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2) and

not at all confident (1). In addition, results have been collected from section (2) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-c</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Findings about the effect of educational levels on consumer's concerns towards food hazards in three governorates (Qalqilya, Tulkarm and Nablus) are shown in Table 28. In general, our study showed that there was a significant effect on consumer's educational levels on their concerns toward hazards that are present in food products. Under graduated people had higher significant concerns (3.59 vs. 3.08, for  $P < 0.05$ ) towards bacterial contamination of food products than graduated ones while primary and secondary educated people were intermediate. Secondary educated consumers had higher concerns towards pesticide/insecticide residues in food products (4.30 vs. 3.61 and 3.68,  $P < 0.05$ ) than primary and graduated consumers, respectively, while under graduated people showed an intermediate value. In respect to heavy metals (lead, mercury and aluminum) in some food products, under graduated consumers had more concerns than secondary educated ones (3.71 vs. 3.84, for  $P < 0.05$ ), while graduated and primary educated consumers exhibited intermediate values. For antibiotics in meat and milk products, results showed that graduated consumers had higher significant concerns than secondary educated ones (2.97 vs. 2.41, for  $P < 0.05$ ), while primary educated and under graduated consumers showed intermediate values. On the other hand, primary

educated consumers showed higher significant concerns toward presence of physical hazards (straw, stem fragment and any plant fragment in cereals) than graduated people (3.74 vs. 3.08, for  $P < 0.05$ ). While secondary and under graduated consumers had intermediate values. In respect to glass fragments in some food products, primary, secondary and under graduated consumers exhibited similar concerns and at the same time, they were significantly higher than graduated ones. The same results were shown for insects. In respect to the presence of stones in grains, it was found that secondary and under graduated consumers had higher significant concern (3.71 and 3.84 vs. 3.01) than graduated ones, in which primary educated consumers were intermediate. On the other hand, there was no significant effect of educational level on having hormones in meat. Doseman *et al* (2001) found that higher educated consumers had more concerns towards food hazards including food additives and contaminants than less educated ones in Canada.

**Table 28. Consumer concerns toward hazards in food products by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>	Graduate (Mean $\pm$ SD <sup>2</sup> )	primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P Value
1 Bacterial contamination	3.08 $\pm$ 1.23 <sup>b</sup>	3.35 $\pm$ 1.36 <sup>ab</sup>	3.24 $\pm$ 1.24 <sup>ab</sup>	3.59 $\pm$ 1.28 <sup>a</sup>	< 0.05
2 Pesticide/insecticide residues	3.68 $\pm$ 1.15 <sup>b</sup>	3.61 $\pm$ 1.12 <sup>b</sup>	4.30 $\pm$ 0.83 <sup>a</sup>	3.94 $\pm$ 1.14 <sup>ab</sup>	< 0.05
3 Lead, mercury and aluminum	2.35 $\pm$ 1.39 <sup>ab</sup>	2.02 $\pm$ 1.19 <sup>ab</sup>	1.87 $\pm$ 1.46 <sup>b</sup>	2.66 $\pm$ 1.56 <sup>a</sup>	< 0.05
4 Hormones in meat	3.32 $\pm$ 1.30	2.74 $\pm$ 1.35	3.07 $\pm$ 1.19	2.98 $\pm$ 1.33	0.07
5 Antibiotics in meat and milk products	2.97 $\pm$ 1.24 <sup>a</sup>	2.54 $\pm$ 1.49 <sup>ab</sup>	2.41 $\pm$ 1.32 <sup>b</sup>	2.88 $\pm$ 1.38 <sup>ab</sup>	< 0.05
6 Straw, stem fragment and any plant fragment in cereals	3.08 $\pm$ 1.23 <sup>b</sup>	3.74 $\pm$ 1.07 <sup>a</sup>	3.33 $\pm$ 1.09 <sup>ab</sup>	3.28 $\pm$ 1.11 <sup>ab</sup>	< 0.05
7 Glass fragment	2.78 $\pm$ 1.17 <sup>b</sup>	3.70 $\pm$ 1.10 <sup>a</sup>	3.51 $\pm$ 1.15 <sup>a</sup>	3.56 $\pm$ 1.33 <sup>a</sup>	< 0.05
8 Stones in cereals, grains	3.26 $\pm$ 1.22 <sup>b</sup>	3.72 $\pm$ 1.14 <sup>ab</sup>	3.71 $\pm$ 0.95 <sup>a</sup>	3.84 $\pm$ 1.18 <sup>a</sup>	< 0.05
9 Insects	3.01 $\pm$ 1.23 <sup>b</sup>	3.70 $\pm$ 1.12 <sup>a</sup>	3.58 $\pm$ 1.05 <sup>a</sup>	3.77 $\pm$ 1.31 <sup>a</sup>	< 0.05

<sup>1</sup>The potential hazard was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (3) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The educational level effect on consumer knowledge about food safety was shown in Table 29. It was found that educational level significantly affected consumer knowledge in the personal health and confidence of food safety authorities. Graduated consumers and secondary

educated ones had more knowledge in personal description of health than primary educated and under graduated ones (4.09 and 3.84 vs. 3.31 and 3.47, for  $P < 0.05$ ). In respect to confidence for food safety authorities, secondary educated consumers had higher significant value than graduated ones (2.88 vs. 2.09 for  $P < 0.05$ ), while primary educated consumers and under graduated ones exhibited intermediate values. Similar results were found in Nigeria, in which secondary educated students had good knowledge in food safety practices (Aluh *et al.*, 2019). However, there were no significant effects of the educational level on how consumers were informed about food safety, personal assessment of family health in the past 6 months and how much knowledge food handlers had about food safety. In Canada- Ontario, it was found that primary educated students in general had low knowledge in food safety (Majowicz *et al.*, 2015).

**Table 29. Consumer knowledge in food safety by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P Value
1	How informed about food safety	3.47 $\pm$ 0.64	3.33 $\pm$ 0.85	3.27 $\pm$ 0.83	3.48 $\pm$ 0.81	0.22
2	Personal description of health	4.09 $\pm$ 0.82 <sup>a</sup>	3.31 $\pm$ 1.00 <sup>b</sup>	3.84 $\pm$ 0.70 <sup>a</sup>	3.47 $\pm$ 0.86 <sup>b</sup>	< 0.05
3	Personal assessment of family health in the past 6 months	3.85 $\pm$ 0.89	3.74 $\pm$ 0.89	4.05 $\pm$ 0.82	3.70 $\pm$ 0.93	0.07
4	Your confident for food safety authorities	2.09 $\pm$ 1.11 <sup>c</sup>	2.74 $\pm$ 1.11 <sup>ab</sup>	2.88 $\pm$ 1.27 <sup>a</sup>	2.37 $\pm$ 1.23 <sup>bc</sup>	< 0.05
5	The knowledge of food handlers about food safety	2.57 $\pm$ 0.99	2.76 $\pm$ 0.98	2.76 $\pm$ 0.96	2.66 $\pm$ 1.16	0.58

<sup>1</sup>The consumer knowledge was scored as follows: Excellent (5), very good (4), average (3), good (2) and poor (1). In addition, results have been collected from section (5) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-c</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

Table 30 showed the effect of educational level on consumer food handling practices in three governorates (Qalqilya, Tulkarm and Nablus). Our findings showed a significant effect of educational level on consumer food handling practices. Under graduated consumers had higher knowledge in checking food packages (4.91 *vs.* 4.66 and 4.59,  $P < 0.05$ ) than graduated and primary educated ones. Secondary educated consumers showed an intermediate values. For cleaning of food preparation area, it was found that graduated consumers had higher knowledge than primary educated ones (5.00 *vs.* 4.79,  $P < 0.05$ ), while secondary educated and under graduated ones had intermediate effect. Primary educated consumers had the highest knowledge in separation between raw and cooked meat (2.49 *vs.* 2.16 and 1.97 and 2.09,  $P < 0.05$ ) in comparison with other groups. Moreover, under graduated consumers had higher knowledge in tasting leftovers to check if they are still safe than graduated ones (3.87 *vs.* 3.19,  $P < 0.05$ ), while primary and secondary educated consumers had intermediate values. In contrast, there wasn't any significant effect of the educational level on the other handling food practices. In Japan, university

students who had more food safety knowledge, exhibited high ability to confirm food-safety information when selecting food (Takeda *et al.*, 2011).

**Table 30. Consumer knowledge in food handling practice by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Handling practice <sup>1</sup>		Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P
1	Checking food packages	4.66 $\pm$ 0.82 <sup>b</sup>	4.59 $\pm$ 0.59 <sup>b</sup>	4.73 $\pm$ 0.60 <sup>ab</sup>	4.91 $\pm$ 0.33 <sup>a</sup>	< 0.05
2	Checking frozen foods	4.48 $\pm$ 0.99	4.26 $\pm$ 1.04	4.47 $\pm$ 1.11	4.52 $\pm$ 1.01	0.61
3	Clean food preparation area	5.00 $\pm$ 0.00 <sup>a</sup>	4.79 $\pm$ 0.61 <sup>b</sup>	4.86 $\pm$ 0.60 <sup>ab</sup>	4.87 $\pm$ 0.40 <sup>ab</sup>	< 0.05
4	Cooked meat	2.76 $\pm$ 1.04	3.15 $\pm$ 1.20	3.40 $\pm$ 5.77	2.67 $\pm$ 1.06	0.40
5	same plate for raw and cooked meat,	2.16 $\pm$ 0.52 <sup>b</sup>	2.49 $\pm$ 0.97 <sup>a</sup>	1.97 $\pm$ 0.16 <sup>b</sup>	2.09 $\pm$ 0.43 <sup>b</sup>	< 0.05
6	Taste leftovers to check if they are still safe	3.19 $\pm$ 1.27 <sup>b</sup>	3.67 $\pm$ 1.27 <sup>ab</sup>	3.61 $\pm$ 1.33 <sup>ab</sup>	3.87 $\pm$ 1.20 <sup>a</sup>	< 0.05
7	Use raw eggs	2.32 $\pm$ 0.82	2.05 $\pm$ 0.22	2.15 $\pm$ 0.46	2.15 $\pm$ 0.52	0.06

<sup>1</sup>The consumer handling practice was scored as follows: always (5), sometimes (4), I don't know (3), rarely (2) and never (1). In addition, results have been collected from section (7) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05)

The effect of educational level on the safe food preparation practices was shown in Table 31. It was found that there was a significant effect for the education level on safe food preparation practices. Graduated consumers had higher knowledge in dealing with cooked food (cooked

food should be cooled to room temperature before refrigeration or freezing) than under graduated ones (4.66 vs. 4.34,  $P < 0.05$ ). While primary and secondary educated ones showed intermediate values. On the other hand, educational levels did not show any significant effect on the other good preparation practices. In this context, a Lebanese study showed that under graduated students in Lebanese universities scored highest safety knowledge information among other ones (graduated and primary and secondary educated) (Hassan *et al.*, 2014).

**Table 31. Consumer knowledge in good food preparation practice by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Safe Food Handling <sup>1</sup>		Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P
1	Ground beef patties	3.15 $\pm$ 1.05	2.89 $\pm$ 0.79	3.07 $\pm$ 0.99	2.81 $\pm$ 1.10	0.12
2	Freezing food kills all bacteria	3.45 $\pm$ 1.13	3.56 $\pm$ 1.08	3.31 $\pm$ 0.97	3.32 $\pm$ 1.12	0.57
3	Cooked food	4.66 $\pm$ 0.76 <sup>a</sup>	4.58 $\pm$ 0.65 <sup>ab</sup>	4.64 $\pm$ 0.76 <sup>ab</sup>	4.34 $\pm$ 1.01 <sup>b</sup>	< 0.05
4	Leftover foods can be safely kept at room temperature *several hours	2.95 $\pm$ 1.06 <sup>a</sup>	3.64 $\pm$ 0.96 <sup>b</sup>	3.40 $\pm$ 1.03 <sup>b</sup>	3.27 $\pm$ 1.14 <sup>ab</sup>	< 0.05
5	Irradiation of meat or poultry will destroy bacteria	2.56 $\pm$ 0.82	2.33 $\pm$ 1.07	2.40 $\pm$ 1.19	2.48 $\pm$ 1.09	0.63
6	Irradiated food is considered	2.69 $\pm$ 0.74	2.44 $\pm$ 1.09	2.85 $\pm$ 1.02	2.62 $\pm$ 0.98	0.15

<sup>1</sup>The safe food handling was scored as follows: strongly agree (5), agree (4), disagree (3), strongly disagree (2) and I don't know (1). In addition, results have been collected from section (9) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Consumers in Qalqilya, Tulkarm and Nablus were randomly asked about their reliability in different sources of food safety information, and results were shown in Table 32. It was clear that there was a significant effect for the level of education on the reliability of information sources about food safety. Secondary educated consumers exhibited more reliability in health professionals as a source of information (4.37 vs. 4.06 and 3.98,  $P < 0.05$ ) than graduated and under graduated ones, while primary educated consumers showed intermediate value. In respect to reliability in friends or family, primary and secondary educated consumers exhibited more reliable than graduated and under graduated ones (3.47 and 3.42 vs. 2.75 and 2.84,  $P < 0.05$ ). On the side of consumer reports, graduated consumers trust consumer reports less than other categories that had almost the same values (2.86 vs. 3.34 and 3.29 and 3.26,  $P < 0.05$ ). Primary educated consumers showed also the lowest reliability in science magazines (2.37 vs. 3.21 and 3.00 and 3.17,  $P < 0.05$ ) if compared with other educational levels. However, primary educated consumers exhibited the highest reliability in radios (2.75 vs. 2.16 and 2.04 and 1.97,  $P < 0.05$ ) as a source of food safety information. On another hand, the level of education had no significant effect on the reliability of the other sources of food safety information. In China, Zhao *et al* (2020) found that approximately 68% of educated Chinese consumers obtained their

knowledge about food safety from social media. While Liu *et al* (2014) showed that knowledgeable Chinese consumers trust researches, medical doctors and personal experience.

**Table 32. Consumer reliability in the source of food safety information by considering educational level effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P
1	University scientist	4.05 $\pm$ 0.79	4.13 $\pm$ 0.84	4.20 $\pm$ 0.77	3.87 $\pm$ 0.94	0.09
2	Health professional	4.06 $\pm$ 0.86 <sup>b</sup>	4.22 $\pm$ 0.76 <sup>ab</sup>	4.37 $\pm$ 0.54 <sup>a</sup>	3.98 $\pm$ 0.85 <sup>b</sup>	< 0.05
3	Friends or family	2.75 $\pm$ 0.66 <sup>b</sup>	3.47 $\pm$ 0.86 <sup>a</sup>	3.42 $\pm$ 1.05 <sup>a</sup>	2.84 $\pm$ 0.78 <sup>b</sup>	< 0.05
4	Consumer reports	2.86 $\pm$ 0.83 <sup>b</sup>	3.34 $\pm$ 0.85 <sup>a</sup>	3.29 $\pm$ 0.76 <sup>a</sup>	3.26 $\pm$ 1.04 <sup>a</sup>	< 0.05
5	Science magazine	3.21 $\pm$ 0.97 <sup>a</sup>	2.37 $\pm$ 1.13 <sup>b</sup>	3.00 $\pm$ 1.01 <sup>a</sup>	3.17 $\pm$ 1.00 <sup>a</sup>	< 0.05
6	Food magazine	2.82 $\pm$ 0.88	2.63 $\pm$ 1.24	2.83 $\pm$ 0.92	3.43 $\pm$ 4.5	0.23
7	Radio	2.16 $\pm$ 1.29 <sup>b</sup>	2.75 $\pm$ 1.16 <sup>a</sup>	2.04 $\pm$ 1.29 <sup>b</sup>	1.97 $\pm$ 1.03 <sup>b</sup>	< 0.05
8	Television news	2.81 $\pm$ 0.93	2.84 $\pm$ 1.17	2.87 $\pm$ 0.97	2.98 $\pm$ 0.87	0.68
9	Newspaper	2.65 $\pm$ 0.96	2.57 $\pm$ 1.17	2.68 $\pm$ 0.98	2.74 $\pm$ 0.74	0.79
10	Written materials from health food stores Supermarket	2.63 $\pm$ 0.82	2.60 $\pm$ 1.24	2.39 $\pm$ 0.85	3.09 $\pm$ 3.22	0.11
11	Material government	3.17 $\pm$ 1.05	3.57 $\pm$ 1.37	3.26 $\pm$ 1.08	3.12 $\pm$ 0.93	0.17
12	Social media such as Facebook	2.58 $\pm$ 0.79	2.92 $\pm$ 1.09	2.71 $\pm$ 0.94	2.71 $\pm$ 0.96	0.26
13	Internet engines such as Google	3.17 $\pm$ 1.05	3.57 $\pm$ 1.37	3.26 $\pm$ 1.08	3.12 $\pm$ 0.93	0.17

<sup>1</sup>The reliability in sources of food safety information was scored as follows: highly reliable (5), reliable somewhat (4), I don't know (3), somewhat unreliable (2) and unreliable highly (1). In addition, results have been collected from section (10) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The educational level effect on consumer's food contamination knowledge in three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 33. It was found that educational level had a significant effect on some food contamination knowledge parameters. Graduated and secondary educated consumers showed higher knowledge in individuals that are more at risk of food poisoning (4.62 and 4.64 *vs.* 4.24 and 4.50,  $P < 0.05$ ) than other levels. Graduated consumers had more knowledge in the role of water in food contamination (4.89 *vs.* 4.59 and 4.62,  $P < 0.05$ ) than primary and under graduated consumers. While secondary educated consumers exhibited intermediate values. In respect to the role of smoking in food contamination, it was found that graduated consumers had higher knowledge than secondary educated and under graduated consumers (4.15 *vs.* 3.16 and 3.58,  $P < 0.05$ ), while secondary educated ones had an intermediate value. Primary educated consumers showed the lowest knowledge in the role of the health state of food handler in food contamination, while other levels were significantly the same (4.08 *vs.* 4.64 and 4.61 and 4.56,  $P < 0.05$ ). However, the educational level had not any significant effect of the other food contamination knowledge parameters. In this context, Garayoa *et al* (2005) pointed out that 60% of under graduated consumers in Spain did accurate safety practices when storing food to prevent cross-contamination.

**Table 33. Consumer knowledge in food contamination by considering educational effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Food contamination knowledge <sup>1</sup>		Graduate (Mean $\pm$ SD <sup>2</sup> )	Primary (Mean $\pm$ SD)	Secondary (Mean $\pm$ SD)	Under.G (Mean $\pm$ SD)	P
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	4.37 $\pm$ 0.71	4.14 $\pm$ 1.23	4.38 $\pm$ 0.63	4.47 $\pm$ 0.63	0.20
2	Children, pregnant women and older individuals are more at risk of food poisoning	4.62 $\pm$ 0.65 <sup>a</sup>	4.24 $\pm$ 1.23 <sup>b</sup>	4.64 $\pm$ 0.56 <sup>a</sup>	4.50 $\pm$ 0.59 <sup>ab</sup>	< 0.05
3	Role of personal hygiene	4.58 $\pm$ 0.63	4.35 $\pm$ 0.72	4.45 $\pm$ 0.62	4.45 $\pm$ 0.75	0.24
4	Role of storing raw and cooked food together	4.64 $\pm$ 0.59	4.38 $\pm$ 1.26	4.47 $\pm$ 0.82	4.73 $\pm$ 0.45	0.03
5	Role of water	4.89 $\pm$ 0.32 <sup>a</sup>	4.59 $\pm$ 0.50 <sup>b</sup>	4.71 $\pm$ 0.48 <sup>ab</sup>	4.62 $\pm$ 0.63 <sup>b</sup>	< 0.05
6	Role of uncovered abrasion or cuts	4.77 $\pm$ 0.50	4.57 $\pm$ 0.77	4.62 $\pm$ 0.63	4.79 $\pm$ 0.49	0.07
7	Role of inadequate cooking of raw food	4.28 $\pm$ 0.77	4.41 $\pm$ 1.04	4.47 $\pm$ 0.70	4.30 $\pm$ 0.65	0.34
8	Role of smoking during preparing food	4.15 $\pm$ 0.89 <sup>a</sup>	3.73 $\pm$ 1.52 <sup>ab</sup>	3.16 $\pm$ 1.62 <sup>b</sup>	3.58 $\pm$ 1.23 <sup>b</sup>	< 0.05
9	Role of health state of food handler	4.64 $\pm$ 0.55 <sup>a</sup>	4.08 $\pm$ 1.83 <sup>b</sup>	4.61 $\pm$ 1.75 <sup>a</sup>	4.56 $\pm$ 0.75 <sup>a</sup>	< 0.05

<sup>1</sup>The food contamination knowledge was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (11) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

The effect of consumers' career on all studied parameters (consumer confidence and concerns towards food products, consumers' knowledge in safe food practices, their reliability in information sources) in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers were asked specific questions about each parameter by face to face interviews.

**Table 34. Percentage of participants from different career types.**

Field of job	Count (persons)	Percentage%
Medical	10	3.21
Agriculture and Food	55	17.63
Others	247	79.17
Total	312	100

The effect of consumers' career (Agricultural, medical and other careers) on their confidence towards the safety of different food products available in Palestinian markets was shown in Table 35. Our study revealed that there was no significant effect of career type on consumer confidence towards the safety of different food product categories that are available in the market except for chicken and chicken products. Consumers that have a

career in the agricultural field had lower confidence towards chicken products (3.49 vs. 3.85,  $P < 0.05$ ) than other careers, while medical careers showed an intermediate value. Despite the great social science of knowledge in food safety among consumers, the application and practices of this knowledge are generally limited. In the last decades, foodborne illnesses are changing by pathogen changes, as food is such a vehicle that could transport pathogens (Mackenzie *et al.*, 2004). Many people do not know the basic rules of food hygiene, so it is important to shed light on parameters that could affect consumer awareness towards food safety including their career. Bучcheri *et al* (2007) pointed out that there was a lack of food safety practices among consumers working in the medical field in Italy. It was found that there was no enough consumers' information about the suitable cooling temperatures for stored food. On another career side, it was found that also there was an information lack about chemical pollutants in the food chain among agricultural consumers in different countries including Bangladesh and China (Heikens *et al.*, 2007). There were limited studies about the awareness of Palestinian consumers in this subject. Therefore, this study tried to measure the effect of consumers' career (medical, agricultural, and others) on their awareness towards food safety.

**Table 35. Consumer confidence in the safety of different food products by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree of confidence <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P Value
1	Supermarket food	2.87 $\pm$ 0.72	3.20 $\pm$ 0.63	3.17 $\pm$ 0.96	0.09
2	Bottled water	3.56 $\pm$ 1.14	3.60 $\pm$ 1.17	3.38 $\pm$ 1.15	0.48
3	Egg	3.66 $\pm$ 1.06	4.00 $\pm$ 0.82	3.82 $\pm$ 1.02	0.45
4	Fruits and vegetables	3.93 $\pm$ 0.77	4.10 $\pm$ 0.57	3.91 $\pm$ 0.89	0.79
5	Milk and milk products	3.80 $\pm$ 0.89	4.50 $\pm$ 0.83	3.86 $\pm$ 0.96	0.09
6	Meat and meat products	3.60 $\pm$ 1.05	3.50 $\pm$ 0.97	3.88 $\pm$ 0.95	0.08
7	Chicken and chicken products	3.49 $\pm$ 0.94 <sup>b</sup>	3.70 $\pm$ 1.16 <sup>ab</sup>	3.85 $\pm$ 0.96 <sup>a</sup>	< 0.05
8	Fish and fish products	3.27 $\pm$ 1.21	2.80 $\pm$ 0.63	3.41 $\pm$ 1.08	0.18
9	Popular foods from street	2.33 $\pm$ 0.58	2.30 $\pm$ 0.48	2.57 $\pm$ 0.91	0.12
10	Popular drinks from street	2.91 $\pm$ 0.91	2.50 $\pm$ 0.53	2.64 $\pm$ 0.92	0.12
11	Eastern desserts (Kunafa, baklava, etc.)	4.18 $\pm$ 0.72	4.10 $\pm$ 0.99	3.89 $\pm$ 0.98	0.10
12	Western desserts (cake, etc.)	3.80 $\pm$ 0.80	4.00 $\pm$ 0.82	3.54 $\pm$ 2.18	0.56
13	Food from popular restaurants	3.75 $\pm$ 0.87	3.90 $\pm$ 0.74	3.71 $\pm$ 1.00	0.83
14	Food from regular restaurants	3.66 $\pm$ 0.84	3.40 $\pm$ 1.08	3.41 $\pm$ 1.12	0.32

<sup>1</sup>The degree of confidence was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2) and not at all confident (1). In addition, results have been collected from section (2) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of career types on consumer concerns about food was shown in Table 36. In general, our study showed that career type had a significant effect on the consumer concerns about all types of food hazards except the presence of pesticide/insecticide residues. It was found that medical field had the highest significant concerns towards food bacterial contamination (4.80 *vs.* 2.96 and 3.30,  $P < 0.05$ ), antibiotics in meat and milk products (4.30 *vs.* 2.93 and 2.65,  $P < 0.05$ ) and glass fragment (4.30 *vs.* 3.22 and 3.28,  $P < 0.05$ ) in comparison with other groups, while agricultural and other careers were significantly the same. With respect to consumers concerns towards lead, mercury and aluminum, it was found that the medical field had higher concerns (3.60 *vs.* 2.16,  $P < 0.05$ ) than other careers, while agricultural field showed an intermediate value. Same results were found for straw/stem fragment/ any plant fragment in cereals (4.20 *vs.* 3.19,  $P < 0.05$ ) and insects (4.40 *vs.* 3.37, for  $P < 0.05$ ). For hormones in meat, other careers had lower concerns than medical and agricultural careers that showed almost the same significant values (2.92 *vs.* 3.62 and 4.20,  $P < 0.05$ ). In this context, Stratev *et al* (2017) found that Bulgarian consumers working in the medical field had higher concerns towards hazards in food than other consumers.

**Table 36. Consumer concerns toward hazards in food products by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P Value
1	Bacterial contamination	2.96 $\pm$ 1.41 <sup>b</sup>	4.80 $\pm$ 0.42 <sup>a</sup>	3.30 $\pm$ 1.22 <sup>b</sup>	< 0.05
2	Pesticide/insecticide residues	3.95 $\pm$ 1.01	4.40 $\pm$ 0.52	3.86 $\pm$ 1.13	0.30
3	Lead, mercury and aluminum	2.53 $\pm$ 1.44 <sup>ab</sup>	3.60 $\pm$ 1.71 <sup>a</sup>	2.16 $\pm$ 1.42 <sup>b</sup>	< 0.05
4	Hormones in meat	3.62 $\pm$ 1.24 <sup>a</sup>	4.20 $\pm$ 0.92 <sup>a</sup>	2.92 $\pm$ 1.27 <sup>b</sup>	< 0.05
5	Antibiotics in meat and milk products	2.93 $\pm$ 1.50 <sup>b</sup>	4.30 $\pm$ 1.25 <sup>a</sup>	2.65 $\pm$ 1.28 <sup>b</sup>	< 0.05
6	Straw, stem fragment and any plant fragment in cereals	3.55 $\pm$ 1.18 <sup>ab</sup>	4.20 $\pm$ 0.63 <sup>a</sup>	3.19 $\pm$ 1.14 <sup>b</sup>	< 0.05
7	Glass fragment	3.22 $\pm$ 1.29 <sup>b</sup>	4.30 $\pm$ 0.48 <sup>a</sup>	3.28 $\pm$ 1.25 <sup>b</sup>	< 0.05
8	Stones in cereals, grains	3.84 $\pm$ 1.18 <sup>a</sup>	4.30 $\pm$ 0.48 <sup>a</sup>	3.51 $\pm$ 1.15 <sup>a</sup>	< 0.05
9	Insects	3.66 $\pm$ 1.35 <sup>ab</sup>	4.40 $\pm$ 0.52 <sup>a</sup>	3.37 $\pm$ 1.21 <sup>b</sup>	< 0.05

<sup>1</sup>The potential hazard was scored as follows: completely confident (5), mostly confident (4), not very confident (3), not at all confident (2) and no idea (1). In addition, results have been collected from section (3) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of career type on consumer knowledge about food safety in the Palestinian governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 37. It was found that career had a significant effect on all parameters of consumer knowledge about food safety except the knowledge in the personal description of health. Other careers had

significantly the lowest effect on consumer knowledge about food safety, in which medical and agricultural careers were significantly the same (3.31 vs. 3.69 and 4.20,  $P < 0.05$ ) respectively. In respect to the knowledge in the assessment of family health in the past 6 months, it was found that consumers with agricultural career had higher knowledge than other careers (4.11 vs. 3.77,  $P < 0.05$ ), while medical career was intermediate. Considering consumer knowledge in food safety authorities, other careers had higher knowledge than agricultural ones (2.56 vs. 1.85,  $P < 0.05$ ), while consumers in medical sector had intermediate value. Medical and other careers had the same and higher significant values in the knowledge of food handlers about food safety than consumers in the agricultural sector (3.30 and 2.71 vs. 2.35,  $P < 0.05$ ). In this context, Stratev *et al* (2017) found that consumers in the medical field in Bulgaria have a high level (85.06%) of food safety information in comparison to consumers working in other fields.

**Table 37. Consumer knowledge in food safety by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P Value
1	How informed about food safety	3.69 $\pm$ 0.75 <sup>a</sup>	4.20 $\pm$ 0.63 <sup>a</sup>	3.31 $\pm$ 0.74	< 0.05
2	Personal description of health	3.96 $\pm$ 1.08	3.70 $\pm$ 0.82	3.71 $\pm$ 0.83	0.15
3	Personal assessment of family health in the past 6 months	4.11 $\pm$ 0.90 <sup>a</sup>	4.20 $\pm$ 1.03 <sup>ab</sup>	3.77 $\pm$ 0.87 <sup>b</sup>	< 0.05
4	Your confident for food safety authorities	1.85 $\pm$ 1.28 <sup>b</sup>	2.80 $\pm$ 1.40 <sup>ab</sup>	2.56 $\pm$ 1.16 <sup>a</sup>	< 0.05
5	The knowledge of food handlers about food safety	2.35 $\pm$ 1.17 <sup>b</sup>	3.30 $\pm$ 0.82 <sup>a</sup>	2.71 $\pm$ 0.99 <sup>a</sup>	< 0.05

<sup>1</sup>The consumer knowledge was scored as follow: excellent (5), very good (4), average (3), good (2) and poor (1). In addition, results have been collected from section (5) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05).

Table 38 presented the career effect on the consumer good food handling practices for about 310 consumers from the three governorates (Qalqilya, Tulkarm and Nablus). It was found that there were no significant effects for a career on the consumer good food handling practices except in the case of separation between raw and cooked meat and tasting leftovers to check if they are still safe. Consumers working in other careers had higher knowledge in separation between raw and cooked meat than consumers with agricultural careers (2.18 vs. 1.96, P< 0.05), while

consumers working in medical sector exhibited intermediate value. In respect to tasting leftovers to check if they are still safe, medical and other careers had almost the same and higher knowledge than agricultural career (4.30 and 3.64 vs. 2.96.,  $P < 0.05$ ). Accordingly, it was found that consumers working in medical field in Bulgaria, practiced food safety in their daily lives (65.28%) more than consumers from other fields (Stratev *et al.*, 2017).

**Table 38. Consumer knowledge in food handling practice by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Handling practice <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P
1	Checking food packages	4.85 $\pm$ 0.41	4.90 $\pm$ 0.32	4.71 $\pm$ 0.68	0.24
2	Checking frozen foods	4.32 $\pm$ 1.09	4.90 $\pm$ 0.32	4.47 $\pm$ 1.03	0.24
3	Clean food preparation area	4.92 $\pm$ 0.27	4.90 $\pm$ 0.32	4.90 $\pm$ 0.46	0.93
4	Cooked meat	2.68 $\pm$ 1.12	3.40 $\pm$ 0.97	2.98 $\pm$ 3.33	0.71
5	Raw and cooked meat	1.96 $\pm$ 0.19 <sup>b</sup>	2.00 $\pm$ 0.00 <sup>ab</sup>	2.18 $\pm$ 0.59 <sup>a</sup>	< 0.05
6	Taste leftovers to check if they are still safe	2.96 $\pm$ 1.26 <sup>b</sup>	4.30 $\pm$ 1.06 <sup>a</sup>	3.64 $\pm$ 1.27 <sup>a</sup>	< 0.05
7	Use raw eggs	2.34 $\pm$ 0.78	2.00 $\pm$ 0.00	2.17 $\pm$ 0.58	0.12

<sup>1</sup>The consumer handling practice was scored as follows: always (5), sometimes (4), I don't know (3), rarely (2) and never (1). In addition, results have been collected from section (7) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of career type on the consumer safe food preparation practices was shown in Table 39. Results showed that there was no significant effect of career type on safe food preparation practices except the knowledge about freezing food and food leftovers. Considering the knowledge of freezing in microbial destruction, it was found that consumers having other careers had higher knowledge than consumers having agricultural careers (3.55 *vs.* 2.67,  $P < 0.05$ ), while consumers in the medical field exhibited intermediate values. In respect to leaving food at room temperature for several hours, results showed that consumers in medical field had higher awareness than consumers in the agricultural field (4.10 *vs.* 3.40,  $P < 0.05$ ), while consumers in other fields showed an intermediate value. In this context, Samapundo *et al* (2015) found that 70% of consumers working in the agricultural sector exhibited lower food handling practices than other consumers.

**Table 39. Consumer knowledge in good food preparation practice by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

	* Safe food handling <sup>1</sup>	Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P Value
1	Ground beef patties	3.02 $\pm$ 1.13	3.10 $\pm$ 0.57	3.00 $\pm$ 1.02	0.95
2	Freezing food kills all bacteria	2.67 $\pm$ 1.04 <sup>b</sup>	3.30 $\pm$ 1.49 <sup>ab</sup>	3.55 $\pm$ 1.01 <sup>a</sup>	< 0.05
3	Cooked food	4.41 $\pm$ 1.20	4.80 $\pm$ 0.42	4.58 $\pm$ 0.75	0.29
4	Leftover foods can be safely kept at room temperature several hours	3.40 $\pm$ 0.89 <sup>b</sup>	4.10 $\pm$ 0.57 <sup>a</sup>	3.56 $\pm$ 0.75 <sup>ab</sup>	< 0.05
5	Irradiation of meat or poultry will destroy bacteria	2.58 $\pm$ 1.02	2.60 $\pm$ 1.43	2.44 $\pm$ 1.01	0.64
6	Irradiated food is considered	2.73 $\pm$ 1.03	3.10 $\pm$ 0.99	2.65 $\pm$ 0.90	0.30

<sup>1</sup>The safe food handling was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (9) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ )

The effect of career types on the reliability of sources of food safety information in the three governorates (Qalqilya, Tulkarm and Nablus) was shown in Table 40. Findings showed significant effects of career types on the reliability of sources of food safety information excluding university scientists, radio, newspaper, written materials from health food stores supermarket and internet engines such as Google. Consumers in the medical field showed the highest reliability in health professionals (4.90 *vs.* 3.67 and 4.20,  $P < 0.05$ ). Considering consumer reports as source of information, it was found that consumers having other careers had more reliability than medical ones (3.19 *vs.* 2.40,  $P < 0.05$ ), while consumers having agricultural career were intermediate. However, consumers having agricultural career exhibited higher reliability in science magazines than consumers having medical and other careers (3.46 *vs.* 2.40 and 2.98,  $P < 0.05$ ). Findings showed that consumers working in other careers had higher reliability in food safety information from television news (2.95 *vs.* 2.52,  $P < 0.05$ ) than consumer working in agricultural sector, while medical careers scored an intermediate value. The same results were found for

social media such as Facebook (2.78 vs. 2.33,  $P < 0.05$ ). In respect to materials from governmental bodies, consumers in medical and other careers had higher reliability in governmental materials in food safety than consumers in agricultural careers (3.80 and 3.30 vs. 2.79,  $P < 0.05$ ). In South Wales, it was found that consumers working in the medical sectors trust food safety information that come from packaging followed by medical doctors (Redmond *et al.*, 2005).

**Table 40. Consumer reliability in the source of food safety information concerns by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P Value
1	University scientist	4.06 $\pm$ 0.92	3.60 $\pm$ 0.70	4.06 $\pm$ 0.83	0.23
2	Health professional	3.67 $\pm$ 0.86 <sup>c</sup>	4.90 $\pm$ 0.32 <sup>a</sup>	4.20 $\pm$ 0.74 <sup>b</sup>	< 0.05
3	Friends or family	2.02 $\pm$ 1.32	2.00 $\pm$ 1.16	2.34 $\pm$ 1.23	0.19
4	Consumer reports	3.02 $\pm$ 1.04 <sup>ab</sup>	2.40 $\pm$ 0.52 <sup>b</sup>	3.19 $\pm$ 0.87 <sup>a</sup>	< 0.05
5	Science magazine	3.46 $\pm$ 0.85 <sup>a</sup>	2.40 $\pm$ 0.52 <sup>b</sup>	2.98 $\pm$ 1.06 <sup>b</sup>	< 0.05
6	Food magazine	4.65 $\pm$ 0.59	5.00 $\pm$ 0.00	4.51 $\pm$ 0.74	0.05
7	Radio	2.39 $\pm$ 0.77	2.60 $\pm$ 0.97	3.11 $\pm$ 2.79	0.15
8	Television news	2.52 $\pm$ 0.80 <sup>b</sup>	2.90 $\pm$ 1.20 <sup>ab</sup>	2.95 $\pm$ 0.96 <sup>a</sup>	< 0.05
9	Newspaper	2.48 $\pm$ 0.73	2.90 $\pm$ 1.29	2.71 $\pm$ 0.95	0.21
10	Written materials from health food stores supermarket	2.31 $\pm$ 0.61	2.80 $\pm$ 1.23	2.78 $\pm$ 2.07	0.26
11	Material government	2.79 $\pm$ 1.00 <sup>b</sup>	3.80 $\pm$ 0.63 <sup>a</sup>	3.30 $\pm$ 1.07 <sup>a</sup>	< 0.05
12	Social media such as Facebook	2.33 $\pm$ 0.65 <sup>b</sup>	2.40 $\pm$ 0.70 <sup>ab</sup>	2.78 $\pm$ 0.95 <sup>a</sup>	< 0.05
13	Internet engines such as Google	2.96 $\pm$ 0.84	3.30 $\pm$ 0.82	3.01 $\pm$ 1.01	0.65

<sup>1</sup>The reliability of sources of food safety information was scored as follow: highly reliable (5), reliable somewhat (4), I don't know (3),

somewhat unreliable (2) and unreliable highly (1). In addition, results have been collected from section (10) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

<sup>a-c</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

Results of asking consumers who had a different type of careers, from the three Palestinian governorates (Qalqilya, Tulkarm and Nablus) about their knowledge in food contamination were shown in Table 41. Findings showed that there was a significant effect of career type on consumer's knowledge about food contamination except for three cases. Findings showed that consumers who had agricultural careers, had higher knowledge in food contamination by microorganisms that could be found on the surface of human skin, nose and mouth of healthy handlers (4.63 *vs.* 4.30,  $P < 0.05$ ), than consumers who had other careers. Consumers in the medical sector showed an intermediate value. Consumers, who had agricultural careers, had higher knowledge in the role of personal hygiene in food contamination than consumers who had other careers (4.90 *vs.* 4.39,  $P < 0.05$ ). Same results were found in respect to knowledge in the role of storing raw and cooked food together (4.85 *vs.* 4.54,  $P < 0.05$ ) and uncovered abrasion or cuts (4.27 *vs.* 4.37,  $P < 0.05$ ) in contamination of food, consumers who had medical careers showed an intermediate value. In this context, Stein *et al* (2010) found that consumers who worked in "biology, arts, engineering" fields showed higher knowledge about food contaminants than other careers.

**Table 41. Consumer knowledge in food contamination by considering career effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Food contamination knowledge <sup>1</sup>		Agri. (Mean $\pm$ SD <sup>2</sup> )	Medical (Mean $\pm$ SD)	Other (Mean $\pm$ SD)	P
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	4.63 $\pm$ 0.66 <sup>a</sup>	4.80 $\pm$ 0.63 <sup>ab</sup>	4.30 $\pm$ 0.79 <sup>b</sup>	< 0.05
2	Children, pregnant women and older individuals are more at risk of food poisoning	4.65 $\pm$ 0.59 <sup>a</sup>	5.00 $\pm$ 0.00 <sup>a</sup>	4.50 $\pm$ 0.73 <sup>a</sup>	0.05
3	Role of personal hygiene	4.90 $\pm$ 0.30 <sup>a</sup>	4.70 $\pm$ 0.68 <sup>ab</sup>	4.39 $\pm$ 0.70 <sup>b</sup>	< 0.05
4	Role of storing raw and cooked food together	4.85 $\pm$ 0.46 <sup>a</sup>	4.70 $\pm$ 0.48 <sup>ab</sup>	4.54 $\pm$ 0.78 <sup>b</sup>	< 0.05
5	Role of water	4.84 $\pm$ 0.36	5.00 $\pm$ 0.00	4.68 $\pm$ 0.63	0.06
6	Role of uncovered abrasion or cuts	4.88 $\pm$ 0.32 <sup>a</sup>	4.90 $\pm$ 0.32 <sup>ab</sup>	4.67 $\pm$ 0.62 <sup>b</sup>	< 0.05
7	Role of inadequate cooking of raw food	4.27 $\pm$ 0.80	4.40 $\pm$ 0.52	4.37 $\pm$ 0.76	0.69
8	Role of smoking during preparing food	4.04 $\pm$ 0.82	3.70 $\pm$ 0.68	3.62 $\pm$ 1.43	0.12
9	Role of health state of food handler	4.69 $\pm$ 0.47	4.40 $\pm$ 0.52	4.52 $\pm$ 0.87	0.31

<sup>1</sup>The food contamination knowledge was scored as follows: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (11) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

The effect of consumers' marital status on all studied parameters (consumer confidence and concerns towards food products, consumers' knowledge in food handling practices, their reliability in information

sources and their knowledge in contamination of food) in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied. About 312 consumers were asked specific questions about each parameter by face to face interviews.

**Table 42. Percentage of marital status of participants.**

Marital status	Count (persons)	Percentage%
Married	209	66.98%
Never married	103	33.01%
Total	312	100

The effect of marital status on the degree of confidence towards the safety of food products in three Palestinian governorates (Qalqilya, Tulkarm and Nablus) was studied and results were shown in Table 43. Married consumers exhibited a higher degree of confidence in the egg (3.64 *vs.* 3.04,  $P < 0.5$ ), milk (3.77 *vs.* 3.26,  $P < 0.5$ ), meat (3.64 *vs.* 3.02,  $P < 0.5$ ), chicken (3.56 *vs.* 3.17,  $P < 0.5$ ) and their products than never married consumers. In contrast, findings showed no significant differences between married and never-married consumers in the degree of confidence towards the remaining food products. Marital status is one important factor that affects consumer's awareness towards food safety. Several studies revealed the relationship between marital status and consumer awareness toward safety of food. In this context, Jones *et al* (2006) reported that there was a variation in food insecurity across American women according to their marital status. Moreover, divorce and separation created negative consequences on food, which in turn affected the economy (Zagorsky, 2005). Also, Olson (2005) found that parents deprive themselves to feed their children and they try to take care of their health and food safety. In the

same study it was found that married consumers had higher concerns towards foods than single consumers.

**Table 43. Consumer confidence in the safety of different food products by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree Of Confidence <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P Value
1	Supermarket food	2.44 $\pm$ 1.30	2.46 $\pm$ 1.34	0.92
2	Bottled water	3.01 $\pm$ 1.55	3.01 $\pm$ 1.56	0.98
3	Egg	3.64 $\pm$ 1.34	3.04 $\pm$ 1.51	< 0.05
4	Fruits and vegetables	3.59 $\pm$ 1.27	3.72 $\pm$ 1.27	0.41
5	Milk and milk products	3.77 $\pm$ 1.27	3.26 $\pm$ 1.29	< 0.05
6	Meat and meat products	3.64 $\pm$ 1.40	3.02 $\pm$ 1.35	< 0.05
7	Chicken and chicken products	3.56 $\pm$ 1.40	3.17 $\pm$ 1.33	< 0.05
8	Fish and fish products	2.95 $\pm$ 1.55	2.85 $\pm$ 1.35	0.60
9	Popular foods from street	1.65 $\pm$ 1.16	1.73 $\pm$ 1.20	0.56
10	Popular drinks from street	1.84 $\pm$ 1.27	2.04 $\pm$ 1.29	0.20
11	Eastern desserts (Kunafa, baklava, etc.)	3.69 $\pm$ 1.33	3.81 $\pm$ 1.21	0.44
12	Western desserts (cake, etc.)	2.94 $\pm$ 1.34	3.10 $\pm$ 1.40	0.33
13	Food from popular restaurants	3.40 $\pm$ 1.36	3.20 $\pm$ 1.27	0.24
14	Food from regular restaurants	2.92 $\pm$ 1.46	3.15 $\pm$ 1.39	0.20

<sup>1</sup>The degree of confidence was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (2) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

The pooled effect of marital status on consumer concerns toward the presence of hazards in food in the governorates of Qalqilya, Tulkarm and Nablus is presented in Table 44. Consumers were selected randomly and

asked about their concerns towards food potential hazards. Our results showed that there were no significant differences between married and never married consumers in their concerns towards presence of hazards in food except three cases. Never married consumers showed higher concerns towards the presence of plant fragments (3.51 *vs.* 3.18,  $P < 0.05$ ), stones in cereals (3.90 *vs.* 3.44,  $P < 0.05$ ), and insects (3.68 *vs.* 3.34,  $P < 0.05$ ). In USA (Minnesota), Robinson *et al* (2002) pointed out that never married consumers exhibit less concerns toward food hazards than married ones.

**Table 44. Consumer concerns toward hazards in food products by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P Value
1	Bacterial contamination	3.20 $\pm$ 1.40	3.01 $\pm$ 1.36	0.27
2	Pesticide/insecticide residues	3.87 $\pm$ 1.12	3.94 $\pm$ 1.06	0.59
3	Lead, mercury and aluminum	2.36 $\pm$ 1.51	2.10 $\pm$ 1.33	0.14
4	Hormones in meat	3.13 $\pm$ 1.29	2.98 $\pm$ 1.31	0.33
5	Antibiotics in meat and milk products	2.73 $\pm$ 1.33	2.80 $\pm$ 1.40	0.67
6	Straw, stem fragment and any plant fragment in cereals	3.18 $\pm$ 1.14	3.51 $\pm$ 1.16	< 0.05
7	Glass fragment	3.22 $\pm$ 1.22	3.45 $\pm$ 1.31	0.14
8	Stones in cereals, grains	3.44 $\pm$ 1.11	3.90 $\pm$ 1.19	< 0.05
9	Insects	3.34 $\pm$ 1.8	3.68 $\pm$ 1.31	< 0.05

<sup>1</sup>Potential hazard was scored as follows: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (3) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

The marital status effect on consumer knowledge about food safety was shown in Table 45. It was found that marital status has no significant effect on consumer knowledge about food safety except one case. It was found that married consumers have higher personal knowledge in food safety (3.03 *vs.* 2.56 for  $P < 0.05$ ) than never-married ones. However, results showed that there was no significant effect of marital status on the other parameters. In Iran, it was found that married consumers had significantly higher food safety knowledge than never-married ones (Tabrizi *et al.*, 2017).

**Table 45. Consumer knowledge in food safety by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P Value
1	How informed about food safety	3.03 $\pm$ 1.17	2.56 $\pm$ 1.20	<0.05
2	Personal description of health	3.39 $\pm$ 1.29	3.30 $\pm$ 1.33	0.60
3	Personal assessment of family health in the past 6 months	3.58 $\pm$ 1.19	3.57 $\pm$ 1.30	0.92
4	Your confidence for food safety authorities	2.52 $\pm$ 1.23	2.47 $\pm$ 1.08	0.72
5	The knowledge of food handlers about food safety	2.22 $\pm$ 1.15	2.43 $\pm$ 1.32	0.16

<sup>1</sup>The consumer knowledge was scored as follow: excellent (5), very good (4), average (3), good (2), and poor (1). In addition, results have been collected from section (5) of the research questionnaire.

<sup>2</sup> SD is the standard deviation.

Table 46 shows the effect of marital status on consumer food handling practices in three governorates (Qalqilya, Tulkarm and Nablus). Our findings showed that there was a significant effect of marital status on some consumer food handling practices. Never married consumers had higher knowledge of checking food packages (4.83 *vs.* 4.61,  $P < 0.05$ ) than married ones. In contrast, married consumers exhibited higher knowledge in checking frozen foods (4.52 *vs.* 4.20,  $P < 0.05$ ) and the risk of leaving cooked meat (2.35 *vs.* 1.96,  $P < 0.05$ ) at room temperature 4 hours than never married consumers. On another hand, our study showed no significant effect of marital status on the other food handling practices. In this context, Whiley *et al* (2017) found that 86% of consumers in general (married and never married) in Australia using raw eggs in their food style. In contrast, raw eggs were not used in that high percent in the Palestinian culture.

**Table 46. Consumer knowledge in food handling practice by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Handling practice <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P
1	Checking food packages	4.61 $\pm$ 0.94	4.83 $\pm$ 0.51	<0.05
2	Checking frozen foods	4.52 $\pm$ 1.02	4.20 $\pm$ 1.19	<0.05
3	Clean food preparation area	4.90 $\pm$ 0.57	4.83 $\pm$ 0.62	0.36
4	Leaving cooked meat at room temperature more than 4h	2.35 $\pm$ 1.50	1.96 $\pm$ 1.26	<0.05
5	Raw and cooked meat	1.24 $\pm$ 0.82	1.17 $\pm$ 0.62	0.44
6	Taste leftovers to check if they are still safe	3.16 $\pm$ 1.71	3.16 $\pm$ 1.77	0.99
7	Use raw eggs	1.29 $\pm$ 0.83	1.28 $\pm$ 0.93	0.87

<sup>1</sup>The consumer handling practice was scored as follow: always (5), sometimes (4), I don't know (3), rarely (2), and never (1). In addition, results have been collected from section (7) of the research questionnaire.

<sup>2</sup>SD is the standard deviation.

The effect of marital status on the safe food preparation practices was shown in Table 47. It was found that there was a significant effect for the marital status on the safe food preparation practices. Results showed that never married consumers have higher knowledge in cooking ground beef patties (2.76 vs. 2.43,  $P < 0.05$ ), irradiation of meat (2.51 vs. 2.29,  $P < 0.05$ ) and safety of irradiated food (2.48 vs. 2.10,  $P < 0.05$ ) than married ones. In contrast, married consumers exhibited higher knowledge in freezing food (3.34 vs. 2.74,  $P < 0.05$ ) and in cooling cooked food (4.71 vs. 4.33,  $P < 0.05$ ) than never-married consumers. On another hand, leftover foods have not been affected by marital status. In this context, it was found that Asian single consumers exhibited higher knowledge in food handling practices than married ones (Stein *et al.*, 2010).

**Table 47. Consumer knowledge in good food preparation practice by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Safe food handling <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P
1	Cooking ground beef patties	2.43 $\pm$ 1.23	2.76 $\pm$ 1.34	<0.05
2	Freezing food kills all bacteria	3.34 $\pm$ 1.31	2.74 $\pm$ 1.30	<0.05
3	Cooling cooked food	4.71 $\pm$ 0.58	4.33 $\pm$ 0.98	<0.05
4	Leftover foods can be safely kept at room temperature several hours	3.20 $\pm$ 1.11	3.30 $\pm$ 1.04	0.48
5	Irradiation of meat or poultry will destroy bacteria	2.29 $\pm$ 0.89	2.51 $\pm$ 0.84	0.05
6	Safety of irradiated food	2.10 $\pm$ 0.94	2.48 $\pm$ 1.06	<0.05

<sup>1</sup> The safe food handling was scored as follow: strongly agree (5), agree (4), I don't know (3), (2) disagree, and strongly disagree (1). In addition, results have been collected from section (9) of research questionnaire.

<sup>2</sup> SD is standard deviation.

Consumers in Qalqilya, Tulkarm and Nablus were randomly asked about their reliability in different sources of food safety information, and results were shown in Table 48. It was clear that there was significant effect for the marital status on the reliability of some information sources about food safety. In this context, married consumers showed higher reliability to university scientists (4.02 vs. 3.55,  $P < 0.05$ ), health professionals (4.14 vs. 3.45,  $P < 0.05$ ), health professionals (2.42 vs. 1.99,  $P < 0.05$ ), food magazine (2.54 vs. 2.23,  $P < 0.05$ ), and material government (2.82 vs. 2.39,  $P < 0.05$ ) than never married ones. On the other hand, there was no significant effect of marital status on the other food information sources. In South Korea, Shim *et al* (2011) found that 59.5% of married consumers trust information that comes from mass media (TV, newspaper and radio) than other sources.

**Table 48. Consumer reliability in the source of food safety information by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P
1	University scientist	4.02 $\pm$ 1.05	3.55 $\pm$ 1.23	<0.05
2	Health professional	4.14 $\pm$ 1.01	3.45 $\pm$ 1.31	<0.05
3	Friends or family	2.42 $\pm$ 1.27	1.99 $\pm$ 1.15	<0.05
4	Consumer reports	2.56 $\pm$ 1.27	2.37 $\pm$ 1.44	0.25
5	Science magazine	2.44 $\pm$ 1.31	2.70 $\pm$ 1.36	0.10
6	Food magazine	2.54 $\pm$ 1.27	2.23 $\pm$ 1.12	<0.05
7	Radio	2.17 $\pm$ 1.23	2.11 $\pm$ 1.21	0.69
8	Television news	2.41 $\pm$ 1.31	2.12 $\pm$ 1.24	0.07
9	Newspaper	2.61 $\pm$ 0.99	2.80 $\pm$ 0.81	0.09
10	Written materials from health food stores Supermarket	2.03 $\pm$ 1.17	1.82 $\pm$ 1.14	0.14
11	Material government	2.83 $\pm$ 1.50	2.39 $\pm$ 1.32	<0.05
12	Social media such as Facebook	1.96 $\pm$ 1.19	1.83 $\pm$ 1.21	0.38
13	Internet engines such as Google	2.60 $\pm$ 1.35	2.45 $\pm$ 1.32	0.35

<sup>1</sup>Consumer reliability of food safety information sources was scored as follow: highly reliable (5), reliable somewhat (4), I don't know (3), somewhat unreliable (2), and unreliable highly (1). In addition, results have been collected from section (10) of research questionnaire.

<sup>2</sup>SD is standard deviation.

The effect of marital status on consumer's knowledge in food contamination was shown in Table 49. It was found that there was no significant effect for marital status on consumer's knowledge in food contamination, except in two cases. Married consumers showed significantly higher knowledge in risk of food poisoning (4.62 vs. 4.41,  $P < 0.05$ ) than never married ones. Also they exhibited higher knowledge in the role of inadequate cooking in food contamination (4.34 vs. 4.08,

P<0.05) than never married consumers. In this context, 86% of married consumers in Slovenia showed higher knowledge in food contamination than never married ones, including the role of water in contamination of food (Jevsnik *et al.*, 2007).

**Table 49. Consumer knowledge in food contamination by considering marital status effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Knowledge level in food contamination <sup>1</sup>		Married (Mean $\pm$ SD <sup>2</sup> )	Never married (Mean $\pm$ SD)	P Value
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers.	4.34 $\pm$ 0.79	4.35 $\pm$ 0.96	0.94
2	Children, pregnant women and older individuals are more at risk of food poisoning.	4.62 $\pm$ 0.74	4.41 $\pm$ 0.62	<0.05
3	Role of personal hygiene.	4.34 $\pm$ 0.92	4.55 $\pm$ 0.78	0.05
4	Role of storing raw and cooked food together.	4.61 $\pm$ 0.73	4.61 $\pm$ 0.60	0.94
5	Role of water in transporting contaminants.	4.73 $\pm$ 0.56	4.70 $\pm$ 0.63	0.69
6	Role of uncovered abrasion or cuts.	4.71 $\pm$ 0.70	4.64 $\pm$ 0.66	0.42
7	Role of inadequate cooking of raw food.	4.34 $\pm$ 0.91	4.08 $\pm$ 1.07	<0.05
8	Role of smoking during preparing food.	3.80 $\pm$ 1.17	3.65 $\pm$ 1.20	0.31
9	Role of health state of food handlers.	4.55 $\pm$ 0.79	4.58 $\pm$ 0.74	0.72

<sup>1</sup>Level of food contamination knowledge was scored as follow: strongly agree (5), agree (4), I don't know (3), disagree (2), and strongly disagree (1). In addition, results have been collected from section (11) of the research questionnaire.

<sup>2</sup>SD is the standard deviation

## **Chapter Four**

### **Conclusions**

Our study showed that the consumer awareness towards food safety in Palestinian community was affected by several factors (age, gender, educational level, career, living place and marital status). In general, our study showed that gender had no effect on most parameters of consumer's knowledge in food safety. Reliability in the sources of food safety information came from health professionals, family, consumer reports, and scientists. These results can help policy makers to adopt the proper tools to disseminate food safety information in effective ways. Moreover, our findings revealed that consumers with lower age (<30) exhibited higher confidence in the safety of food products in Palestinian market than consumers with higher age (>50). On another hand, educational level was one of the most important factors in building the consumer knowledge in food safety. Differences in consumer's awareness in food safety were not similar in the three studied governorates. The confidence of consumers in Palestinian governmental food safety authorities is still low. Therefore, it is necessary for policy makers, stakeholders, health organizations, etc. to focus more on the recent findings of researches related to food safety awareness in Palestine in order to set up effective food regulations.

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## **Appendix**

**Table A: Consumer confidence in the safety of different food products by considering their income rate effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Degree Of Confidence <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P Value
1	Supermarket food	2.57 ± 1.31	2.28 ± 1.31	2.66 ± 1.29	0.08
2	Bottled water	2.93 ± 1.68	3.07 ± 1.45	2.97 ± 1.59	0.76
3	Egg	3.53 ± 1.46	3.45 ± 1.44	3.30 ± 1.35	0.61
4	Fruits and vegetables	3.53 ± 1.34	3.59 ± 1.22	3.91 ± 1.04	0.14
5	Milk and milk products	3.45 ± 1.40	3.67 ± 1.22	3.66 ± 1.31	0.41
6	Meat and meat products	3.52 ± 1.33	3.34 ± 1.39	3.55 ± 1.57	0.49
7	Chicken and chicken products	3.44 ± 1.46	3.41 ± 1.34	3.47 ± 1.43	0.56
8	Fish and fish products	3.30 <sup>a</sup> ± 1.50	2.70 <sup>b</sup> ± 1.40	2.84 <sup>ab</sup> ± 1.56	< 0.05
9	Popular foods from street	1.58 ± 1.13	1.66 ± 1.07	1.84 ± 1.43	0.36
10	Popular drinks from street	1.90 ± 1.27	1.89 ± 1.22	1.95 ± 1.43	0.95
11	Eastern desserts (Kunafa, baklava, etc.)	3.51 ± 1.39 <sup>b</sup>	3.73 ± 1.27 <sup>ab</sup>	4.05 ± 1.13 <sup>a</sup>	< 0.05
12	Western desserts (cake, etc.)	3.05 ± 1.44	3.01 ± 1.32	2.86 ± 1.34	0.67
13	Food from popular restaurants	3.55 ± 1.44	3.17 ± 1.40	3.41 ± 1.31	0.11
14	Food from regular restaurants	2.89 ± 1.53	3.07 ± 1.42	2.98 ± 1.40	0.61

<sup>1</sup>The degree of confidence was scored as follow: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (2) of research questionnaire.

SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05).

**Table B: Consumer concerns toward hazards in food products by considering their income rate effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Potential hazard <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P Value
1	Bacterial contamination	3.25 ± 1.35	3.04 ± 1.41	3.19 ± 1.40	0.49
2	Pesticide/insecticide residues	3.918 ± 1.22	3.96 ± 0.96	3.70 ± 1.19	0.28
3	Lead, mercury and aluminum	1.81 ± 1.29 <sup>b</sup>	2.41 ± 1.51 <sup>a</sup>	2.64 ± 1.42 <sup>a</sup>	< 0.05
4	Hormones in meat	3.14 ± 1.32 <sup>b</sup>	2.89 ± 1.34 <sup>b</sup>	3.44 ± 1.08 <sup>a</sup>	< 0.05
5	Antibiotics in meat and milk products	2.60 ± 1.37	2.84 ± 1.34	2.77 ± 1.33	0.38
6	Straw, stem fragment and any plant fragment in cereals	3.36 ± 1.33	3.21 ± 1.12	3.34 ± 1.00	0.55
7	Glass fragment	3.22 ± 1.32	3.43 ± 1.29	3.11 ± 1.04	0.17
8	Stones in cereals, grains	3.64 ± 1.24	3.64 ± 1.15	3.41 ± 1.05	0.35
9	Insects	3.38 ± 1.27	3.55 ± 1.24	3.33 ± 1.17	0.39

<sup>1</sup>The potential hazard was scored as follow: completely confident (5), mostly confident (4), no idea (3), not very confident (2), and not at all confident (1). In addition, results have been collected from section (3) of research questionnaire.

<sup>2</sup> SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05)

**Table C: Consumer knowledge in food safety by considering their income rate effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Consumer knowledge <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P
1	How informed about food safety	3.02 ± 1.23 <sup>a</sup>	2.62 ± 1.13 <sup>b</sup>	3.23 ± 1.21 <sup>a</sup>	< 0.05
2	Personal description of health	3.22 ± 1.32	3.41 ± 1.31	3.45 ± 1.27	0.42
3	Personal assessment of family health in the past 6 months	2.55 ± 1.23	2.54 ± 1.17	2.36 ± 1.15	0.54
4	Your confident for food safety authorities	2.40 ± 1.18	2.37 ± 1.30	1.95 ± 0.89	0.04
5	The knowledge of food handlers about food safety	3.22 ± 1.32	3.41 ± 1.31	3.45 ± 1.27	0.42

<sup>1</sup>The consumer knowledge was scored as follow: excellent (5), very good (4), average (3), good (2), and poor (1). In addition, results have been collected from section (5) of research questionnaire.

<sup>2</sup>SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05).

**Table D: Consumer knowledge in food handling practice by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Handling practice <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P Value
1	Checking food packages	4.53 ± 1.15	4.72 ± 0.64	4.83 ± 0.58	0.06
2	Checking frozen foods	4.52 ± 1.01	4.35 ± 1.13	4.39 ± 1.12	0.49
3	Clean food preparation area	4.91 ± 0.58	4.83 ± 0.63	4.94 ± 0.50	0.38
4	Leaving cooked meat at room temp	2.22 ± 1.51	2.22 ± 1.38	2.22 ± 1.45	1.00
5	Raw and cooked meat	1.52 ± 1.21 <sup>a</sup>	1.11 ± 0.41 <sup>b</sup>	1.00 ± 0.00 <sup>b</sup>	< 0.05
6	Taste leftovers to check if they are still safe	3.16 ± 1.69	3.10 ± 1.75	3.30 ± 1.75	0.74
7	Use raw eggs	1.28 ± 0.83	1.33 ± 0.95	1.20 ± 0.67	0.61

<sup>1</sup>The consumer handling practice was scored as follow: always (5), sometimes (4), I don't know (3), rarely (2) and never (1). In addition, results have been collected from section (7) of research questionnaire.

<sup>2</sup>SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05).

**Table E: Consumer knowledge in good food preparation practice by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

* Safe food handling <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P Value
1	Cooking ground beef patties	2.95 ± 1.26 <sup>a</sup>	2.55 ± 1.25 <sup>b</sup>	1.91 ± 1.09 <sup>c</sup>	< 0.05
2	Freezing food kills all bacteria	3.45 ± 1.12 <sup>a</sup>	2.83 ± 1.37 <sup>b</sup>	3.34 ± 1.43 <sup>a</sup>	< 0.05
3	Cooling cooked food	4.68 ± 0.64	4.49 ± 0.91	4.63 ± 0.52	0.13
4	Leftover foods can be safely kept at room temperature several hours	3.01 ± 1.08 <sup>b</sup>	3.46 ± 1.01 <sup>a</sup>	3.06 ± 1.17 <sup>b</sup>	< 0.05
5	Irradiation of meat or poultry will destroy bacteria	2.24 ± 0.75 <sup>b</sup>	2.56 ± 0.99 <sup>a</sup>	2.11 ± 0.72 <sup>b</sup>	< 0.05
6	Irradiated food	1.90 ± 0.73 <sup>b</sup>	2.54 ± 1.16 <sup>a</sup>	2.02 ± 0.72 <sup>b</sup>	< 0.05

<sup>1</sup>The safe food handling was scored as follow: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (9) of research questionnaire.

<sup>2</sup>SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05)

**Table F: Consumer reliability in the sources of food safety information by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Reliability of sources <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P
1	University scientist	4.06 ± 0.90	3.80 ± 1.15	3.73 ± 1.36	0.12
2	Health professional	3.97 ± 1.06	3.90 ± 1.21	3.81 ± 1.22	0.71
3	Friends or family	2.18 ± 1.18 <sup>ab</sup>	2.49 ± 1.63 <sup>a</sup>	1.94 ± 0.96 <sup>b</sup>	< 0.05
4	Consumer reports	2.70 ± 1.39 <sup>a</sup>	2.53 ± 1.36 <sup>ab</sup>	2.09 ± 1.12 <sup>b</sup>	< 0.05
5	Science magazine	2.43 ± 1.11 <sup>ab</sup>	2.78 ± 1.44 <sup>a</sup>	2.11 ± 1.26 <sup>b</sup>	< 0.05
6	Food magazine	2.53 ± 1.23	2.44 ± 1.22	2.31 ± 1.26	0.55
7	Radio	2.23 ± 1.29	2.15 ± 1.19	2.02 ± 1.19	0.56
8	Television news	2.38 ± 1.35	2.29 ± 1.22	2.27 ± 1.37	0.84
9	Newspaper	2.62 ± 1.07	2.74 ± 0.88	2.61 ± 0.85	0.50
10	Written materials from health food stores Supermarket	2.05 ± 1.09 <sup>a</sup>	2.09 ± 1.23 <sup>a</sup>	1.55 ± 1.02 <sup>b</sup>	< 0.05
11	Material government	2.68 ± 1.42	2.62 ± 1.47	2.81 ± 1.49	0.68
12	Social media such as Facebook	1.87 ± 1.09	1.99 ± 1.26	1.83 ± 1.23	0.57
13	Internet engines such as Google	2.28 ± 1.29	2.52 ± 1.30	3.00 ± 1.39	< 0.05

<sup>1</sup>The reliability in sources of food safety information was scored as follow: highly reliable (5), reliable somewhat (4), somewhat unreliable (3), unreliable highly (2), and I don't know (1). In addition, Results have been collected from section (10) of research questionnaire.

<sup>2</sup>SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly ( $P < 0.05$ ).

**Table G: Consumer knowledge in food contamination by considering living place effect in three governorates (Qalqilya, Tulkarm and Nablus).**

Food contamination knowledge <sup>1</sup>		< 3000 NIS/month	3000-5000 NIS/month	> 5000 NIS/ month	P Value
1	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	4.40 ± 0.86	4.30 ± 0.89	4.34 ± 0.74	0.71
2	Children, pregnant women and older individuals are more at risk of food poisoning	4.45 ± 0.83 <sup>b</sup>	4.49 ± 0.70 <sup>b</sup>	4.81 ± 0.39 <sup>a</sup>	< 0.05
3	Role of personal hygiene	4.37 ± 1.01	4.37 ± 0.68	4.25 ± 1.04	0.09
4	Role of storing raw and cooked food together	4.71 ± 0.56	4.52 ± 0.80	4.66 ± 0.57	0.10
5		4.83 ± 0.57 <sup>a</sup>	4.63 ± 0.57 <sup>b</sup>	4.77 ± 0.61 <sup>ab</sup>	< 0.05
6	Role of uncovered abrasion or cuts	4.52 ± 0.98 <sup>b</sup>	4.78 ± 0.48 <sup>a</sup>	4.73 ± 0.45 <sup>ab</sup>	< 0.05
7	Role of inadequate cooking of raw food	4.25 ± 1.05	4.30 ± 0.95	4.16 ± 0.91	0.64
8	Role of Smoking during preparing food	4.02 ± 0.95 <sup>a</sup>	3.48 ± 1.22 <sup>b</sup>	3.95 ± 1.27 <sup>a</sup>	< 0.05
9	Role of health state of food handler	4.48 ± 0.91	4.58 ± 0.75	4.64 ± 0.57	0.40

<sup>1</sup>food contamination knowledge was scored as follow: strongly agree (5), agree (4), I don't know (3), disagree (2) and strongly disagree (1). In addition, results have been collected from section (11) of research questionnaire.

<sup>2</sup> SD is standard deviation.

<sup>a-b</sup> Means within a row followed by different superscript letters differ significantly (P < 0.05).

## **Questionnaire about food Safety Awareness**

### 1. Demographic characteristics of respondents:

Gender:

Male		Female	
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Age group:

<30 years		30- 50 years		>50 Years
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Where do you live?

City ( Nablus, Tulkarem, Qalqeelya)	
--	--

Marital Status

Never married	
Married	

Formal Education

Primary school	
Secondary school	
Undergraduate(	

S, A)	
Graduate (S,A)	

## Gross Family Income (NIS)

<3000		3000-5000		>5000		
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## Carrier Field

Medical field						
Agricultural	food	Engineering				
Others						

## 2. Confidence of Respondents in food safety

	Variables Completely confident	Mostly confident	Not very confident	Not at all confident	No idea
Supermarket food					
Bottled water					
Egg					
Fruits and vegetables					
Milk and milk products					
Meat and meat products					
Chicken and chicken products					
Fish and fish products					
Popular Foods from street					
Popular Drinks from street					
Eastern desserts (kunafah, baklava, etc)					
Western desserts (cake, etc)					
Food from popular restaurants					
Food from regular restaurants					

## 3. Respondents concern about potential hazards in food

potential hazards	Complete concern	Most concern	Minor concern	No concern	No idea
Bacterial contamination					
Pesticide/insecticide residues					
Lead, mercury and aluminium					
Hormones in meat					
Antibiotics in meat and milk products					
Straw, stem fragment and any plant fragment in cereals					
Glass fragment					
Stones in cereals, grains					
Insects					

## 4. Respondents purchasing behavior

Question	Answer	Answer	In case yes, why
Purchased less meat and meat products in the last few years	No	Yes	<input type="checkbox"/> Microbial count <input type="checkbox"/> Fat content <input type="checkbox"/> High price <input type="checkbox"/> Pesticide residues <input type="checkbox"/> Antibiotic residues <input type="checkbox"/> Others
Buy bottled water/use in home filter	No	Yes	<input type="checkbox"/> Don't like tap water taste <input type="checkbox"/> Concerned about high metal <input type="checkbox"/> content Concerned about high <input type="checkbox"/> microbial count <input type="checkbox"/> Others
Purchased fewer eggs in the last few years	No	yes	<input type="checkbox"/> Cholesterol content <input type="checkbox"/> Fat content <input type="checkbox"/> Bacterial count <input type="checkbox"/> High price <input type="checkbox"/> Taste
Purchased less fish and fish	No	yes	<input type="checkbox"/> Chemical contamination <input type="checkbox"/> Fat content

products in the last few years		Bacterial count
		High price
		Taste
		Other
Purchased less No Yes chicken and chicken products in the last few years		Fat content
		Microbial count
		High price
		Hormone residues
		Antibiotic residues
		Taste
Purchased less No Yes fruit and vegetables in the last few years		Poor quality
		Pesticide residues
		Microbial count
		High price
Purchased less No Yes food with additives in the last few years		Don't have enough information about additives
		Additives are bad for health
		Can taste the existence of additives in food
		Concerns from allergy
Purchase less ready foods from restaurants		High prices

in the last few years		Adulterated Not safe Not clean Bad for health

### 5. Consumer knowledge about food safety

knowledge	Excellent	Very good	Good	Average	Poor
How informed about food safety					
Personal description of health					
Personal assessment of family health in the past 6 months					
Your confidence for food safety authorities					
The knowledge of food handlers about food safety					

6. Did you suffer from food poisoning?

Yes	
No	

Symptoms	Present	Frequency
Nausea		
Vomiting		
Fever		
Diarrhoea		
Flu		

## 7. Consumer frequent use of food handling practices

food handling practices	Always	Sometimes	Rarely	Never	I do not know
Practice Examine food packages to see if they have been opened or damaged					
When purchasing frozen foods, check to be sure they are frozen solid					
After preparing foods, clean food preparation area with soap and water					
Leave cooked meat on the counter at room temperature for over 4 h					
Use same plate for raw and cooked meat, do not wash plate before using it for cooked meat					
Taste leftovers to check if they are still safe					
Use raw eggs in salads, desserts, and drinks					

## 8. Consumer food handling practices

When I cook a large portion of food, I refrigerate the leftovers		In several small containers
		In a large container
		In the pot I cook it in
		Never prepare this
When I need to defrost frozen foods, I take it out of the freezer and put it		In the refrigerator(always, in case of limited time )
		In the microwave (always, in case of limited time )
		On the countertop (always, in case of limited time )
		In a bag in warm water (always, in case of limited time )
		Never use frozen food
If a luncheon meat, pasta, or sauce item is past package date, I		Do not use after the date
		Ignore date, use if smells OK
		Use if 1-2 weeks past date
		Use if 2-3 days past date
		Use if 4-7 days past date
		Do not buy this type of food Sources

## 9. Consumer knowledge of safe food handling practices

food handling practices	Strongly Agree	Agree	Disagree	Disagree Strongly	Don't know
For greater safety, ground beef patties should be cooked until they are no longer pink					
Freezing food kills all bacteria that may cause illness					
Cooked food should be cooled to room temperature before refrigeration or freezing					
Leftover foods can be safely kept at room temperature several hours					
Irradiation of meat or poultry will destroy bacteria that causes food-borne illness					
Irradiated food is considered safe by the major health and safety organizations					

## 10. Reliability of sources of food safety information

food safety information	Highly Reliable	Reliable Somewhat	Somewhat Unreliable	Unreliable Highly	I do not know
University scientist					
Health professional					
Friends or family					
Consumer Reports					
Science Magazine					
Food Magazine					
Radio					
Television news					
Newspaper					
Written materials from Health Food Stores Supermarket					
Material Government					
Social media such as facebook					
Internet engines such as google					

## 11. Food Poisoning and infection:

Food contamination knowledge	Strongly Agree	Agree	Disagree	Strongly Disagree	I don't care
Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers					
Children, pregnant women and older individuals are more at risk of food poisoning					
Personal hygiene can prevent food contamination					
Storing raw and cooked food together can cause contamination of food					
Contaminated Water can be a vehicle for foodborne disease transmission					
Uncovered abrasion or cuts on fingers and hands can cause cross contamination of food					
Inadequate cooking of raw food like meat, chicken and vegetable can cause outbreak of foodborne illness					

Smoking during preparing food can case food contamination					
The health state of food handler affects food contamination					

جامعة النجاح الوطنية

كلية الدراسات العليا

# قياس وعي المستهلك الفلسطيني نحو صحة وسلامة الغذاء

إعداد

تسنيم زاهر عودة

إشراف

د. سامر مدلل

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على درجة الماجستير في التغذية وتكنولوجيا الغذاء بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

2020

ب

قياس وعي المستهلك الفلسطيني نحو صحة وسلامة الغذاء

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## الملخص

إن لسوء التعامل مع الأطعمة سواء من خلال تصنيعها أو تخزينها أو تحضيرها أثراً سيئاً على صحة المستهلكين، لذلك فإن قضية وعي المستهلك تجاه صحة وسلامة الغذاء قضية مهمة، حيث أنه يمكن الحد من انتشار الأمراض التي تنقلها الأغذية من خلال زيادة وعي المستهلك تجاه سلامة الغذاء.

هناك العديد من العوامل التي يمكن أن تؤثر على وعي المستهلك تجاه سلامة الغذاء، حيث أن الوعي مازال منخفضاً لدى المستهلكين الفلسطينيين تجاه صحة وسلامة الأغذية.

أجريت هذه الدراسة لتقييم وعي المستهلك الفلسطيني تجاه الممارسات الغذائية وسلامتها وعلاقتها ببعض الخصائص الديموغرافية، حيث تم اختيار حوالي 300 مستهلك فلسطيني (32.1% ذكوراً و 67.9% إناثاً) عشوائياً من ثلاث محافظات فلسطينية مختلفة (نابلس وطولكرم وقلقيلية)، وقد خضع المستهلكون لمقابلة وجهاً لوجه لتعبئة استبيان يتعلق بممارسات سلامة الأغذية، وقد تم تحليل البيانات بواسطة نظام الإحصاء الوصفي (المتوسط والقيم القصوى والدنيا) وتم تقييم النتائج باستخدام اختبار ANOVA من برنامج SPSS.

أظهرت هذه الدراسة أنه لا يوجد تأثير لنوع جنس المستهلك على معظم معايير معرفة سلامة الغذاء، وأن لدى الفلسطينيين ثقة عالية بمهنيي الصحة والعلماء كمصادر موثوقة لمعرفة معلومات سلامة الغذاء أكثر من باقي المصادر الأخرى، إضافة إلى أنها أظهرت أيضاً أن المستهلكين الأصغر سناً لديهم ثقة أعلى في سلامة المنتجات الغذائية المتوفرة في السوق

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الفلسطيني من كبار السن. من ناحية أخرى، كان المستوى التعليمي من أهم العوامل في بناء معرفة المستهلك في مجال سلامة الأغذية.

لا تزال ثقة المستهلكين الفلسطينيين في سلطات سلامة الغذاء الفلسطينية الحكومية منخفضة، لذلك يجب إيلاء قضية سلامة وصحة الغذاء اهتماماً أكثر من قبل أصحاب القرارات السياسية وقطاع الصناعات الغذائية.

الكلمات المفتاحية : سلامة الغذاء، المستهلكون، الوعي، الخصائص الديموغرافية.