“FOOD SAFETY KNOWLEDGE ATTITUDE AND PRACTICES OF ONCOLOGY NURSES, IN LEBANESE HOSPITALS”

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Abstract

Cancer patients undergoing chemotherapy treatment, have a higher risk to foodborne infections as compared to other populations. Oncology nurses, having a direct significant contact with these patients, could be the first information source concerning food safety and play a pivotal role in reducing these risks. This study aims to assess the level of knowledge regarding food safety among oncology nurses, as well as their attitudes and practices in private hospitals in Lebanon. An observational cross-sectional study was carried out, using a self-administered questionnaire, recruiting 134 oncology nurses working in 18 different hospitals located in Mount Lebanon (n=11) and Beirut (n=7). The mean age of the recruited nurses was 30± 8 years, 84% were females and 83% had a bachelor's in nursing. Overall, they scored 76%, 95% and 86.9% on the knowledge, attitude, and practices questions, respectively. Knowledge scores were higher among nurses holding a graduate degree (mean= 85; $p<0.05$), and those who attended a training course (mean=79; $p<0.05$). Knowledge scores were significantly higher when the information was obtained via TV ($p=0.01$), conferences ($p<0.001$), and audio ($p=0.01$). Attitude scores of nurses who read brochures were higher ($p<0.001$). Attending conferences on food safety showed statistically significant effect on better practice scores ($p<0.001$). Accordingly, the findings highlight the need to develop standardized food safety curriculum and training necessary to allow oncology nurses to contribute to the education of cancer patients and decrease their risk of foodborne infection.

Keywords: Oncology nurses, Cancer patients, Food safety knowledge, Attitudes, Practices

Chapter 1

Cancer, the proliferation of cells in an uncontrolled way, is the main reason behind the number of deaths across the world. This malignant disease killed around 7,900,000 people all over the world, which means around 13% of total deaths (Shewach & Kuchta, 2009). This is seen in the United States, where cancer ranked as the second leading cause of death after cardiovascular diseases. Also, in Lebanon, the prevalence of cancer cases, was 154.2 per 100,000 for males and 143.8 per 100,000 females (Shamseddine et al., 2014).

During the last century, cancer treatment has evolved and became more potent. In the beginning of the 1900s, the German chemist Paul Ehrlich decided to create drugs for the treatment of infectious diseases (DeVita & Chu, 2008). He was behind the term of "Chemotherapy" and described it as the utilization of chemicals for the treatment of diseases (DeVita & Chu, 2008). A study showed that there is a large number of individuals reporting mild chemotherapy side effects including constipation, diarrhea, mucositis vomiting and serious fatigue (Pearce et al., 2017).

1. Knowledge about Food safety

Chemotherapy using cytotoxic drugs decreases the lymphocytes' count, inducing immunosuppression. Immunocompromised patients have a high risk of infections, including foodborne diseases, compared to healthy people (Centers for Disease Control and Prevention , 2013; Barkley & Viveiros, 2016). This could lead them to have a high mortality rate since the treatment of such opportunistic pathogens is very difficult and requires a longer period of time due to low immunity (Evans & Redmond, 2017). Cancer

patients suffering from severe neutropenia are highly prone to foodborne infection. They are recommended to follow a neutropenic diet, that is known to restrict certain types of foods (fresh fruits and vegetables, raw or undercooked meat and poultry…) to decrease the frequency of bacterial translocation from the gut to the bloodstream, hence lowering the likelihood of having a foodborne infection (Evans & Redmond, 2017).

A scope of infections originating from food, such as listeriosis, salmonellosis, campylobacteriosis, and toxoplasmosis were determined to be more common among cancerous patients (Evans & Redmond, 2017). Data from the United States shows that cancer and chemotherapy treatment were the most commonly reported morbidities among the non-pregnancy-associated cases of listeriosis (Silk et al., 2012). Furthermore, in the United Kingdom, cancer was the most frequent cause behind recorded cases of listeriosis (26%) in 2014 (Public Health Laboratory Service, 2015). Moreover, research estimated that an elevation of listeriosis occurrence in cancerous people has been reported in the United Kingdom between 1999 and 2009. These patients were shown to have a five-fold high risk of listeriosis (Evans & Redmond, 2017).

Gradel et al. (2009), mentioned that *Salmonella* and *Campylobacter* cause infections in the gastrointestinal tract in patients with hematological malignancies more than people without a malignancy. Also, Toxoplasmosis is generally considered to be a risk for people with cancer. Consuming undercooked meat, unpasteurized milk, raw oysters, contaminated veggies, and having any contact with infected cat feces, or environmental contamination, are all sources of infection from these pathogens (Lund & O'Brien, 2011).

The symptoms of foodborne illness vary according to the microorganism behind the cause of illness (Food Safety During and After Cancer Treatment, 2018). However, usually the

symptoms are similar to those of a stomach flu, including: diarrhea, stomach pain or cramps, nausea, vomiting, fever, headache and muscle aches. The time required for the symptoms to occur, differ widely: It might occur during a couple of hours to ten days after consumption of the contaminated food (Food Safety During and After Cancer Treatment, 2018).

It is important to note that at best, outbreaks of foodborne illnesses in healthcare facilities are inconvenient; at worst, they are deadly. Furthermore, they induce significant disturbance to services for healthcare providers and patients leading to preventable illness and mortality in the susceptible population (Lund & O'Brien, 2011).

Every step in the food supply chain process and especially in health care facilities, is involved in the prevention of foodborne pathogens. It is mainly significant that companies providing food to the susceptible population should ensure the presence of food safety management systems according to the hazard analysis critical control point (HACCP) principles and to the safe food-handling practices (Lund, 2015).

Consumers constitute the significant last linkage in this chain to ensure the consumption of safe food and prevention of foodborne infection. Several food safety duties are required by consumers since they not only buy, and obtain products, yet they also prepare food for themselves and others as well. This is mainly the situation for caregivers, preparing food for relatives undergoing chemotherapy treatment (Evans & Redmond, 2017).

It is generally known that a lot of occasional cases of foodborne diseases arise as a consequence of inappropriate food handling and storage practices by consumers in their houses. Indeed, almost 70% of the mortality due to foodborne disease is related to food

consumed household and it was associated mainly with hygiene practices (Evans & Redmond, 2017).

The domestic kitchen is described as a multi-factorial contributor to foodborne diseases. Moreover, microbiological hazards require control all along the purchasing, transportation, storage, preparation, cooking, and consumption at home phases, in order to ensure the safety of food (Evans & Redmond, 2017).

2. Food Handling Practices

According to food safety recommendations, the practices to reduce the potential of foodborne disease to patients receiving chemotherapy treatment, include the following: (1) avoidance of cross-contamination while handling and storing food, (2) appropriate temperatures during storage, (3) proper heat treatment while cooking, (4) hand hygiene, and (5) staying away from risk-associated food products (Medeiros et al., 2001).

2.1. Cross-contamination

As noted by the Consumer Food Safety, the cross-contamination incidence is frequent in the kitchen at home, it can arise while handling food improperly from raw food by hands and/or food contact surfaces/instruments. It is mentioned that cross-contamination events are of more significance as compared to the risks related to undercooking. Thus, the recommended first practice, avoiding cross-contamination, is a critical point to assure food safety at home. The most commonly applied practices to reduce and prevent the risk of cross-contamination include: storage of ready-to-eat food above raw meat or poultry in the refrigerator, usage of separate or clean instruments, such as chopping boards and knives, between the use for raw food products and ready-to-eat ones, coverage of raw food in the

fridge, prevention of any contact between raw and ready-to-eat foods, disinfection of the instruments and surfaces after raw meat/poultry (Evans & Redmond, 2017).

2.2. Appropriate storage

In general, foods are susceptible to microbiological changes during storage, hence storing temperature which is the second recommended practice is very critical and should be appropriately controlled (Departement of primary industry, 2017). For example, minimizing storage times of food to be consumed without further heating is required. Moreover, chilled foods should be stored at ≤ 5 ° C for the duration of shelf life to decrease bacterial growth and prevent food poisoning and preserve the quality as well as the safety of food (Departement of primary industry, 2017).

2.3. Adequate cooking

The third recommended practice is involving healthy cooking. Cooking practices are important while preparing food at home, to ensure the safety of food. Hence, consuming incompletely cooked or raw meat, poultry, seafood, or eggs has generally been associated with the occurrence of foodborne infection (Evans & Redmond, 2017). Cooking at adequate temperature ($\geq$75 degrees Celsius) is essential for some foods that are highly loaded microbially in order to inactivate bacteria of food pathogens such as campylobacter spp., Shiga toxin-producing Escherichia coli, Salmonella spp., and L. Monocytogenes (Departement of primary industry, 2017). Hence, it is suggested that immunosuppressed consumers must stay away from consuming undercooked or raw meat, shellfish, and eggs (Evans & Redmond, 2017).

2.4. Hand hygiene

Not only hand hygiene is known to be important in reducing the transmission of pathogens in healthcare settings, and in preventing food to be contaminated from hands in food

manufacturing, but it is also crucial in ensuring food safety at home as well (Evans & Redmond, 2017). Therefore, implementing efficient hand hygiene practices at home has the ability to significantly decrease the occurrence of foodborne infection, since handwashing is essential in the prevention of cross-contamination in the domestic kitchen such as using the same surface for raw and cooked food. Hence, the fourth recommended practice, proper hand washing practices, includes the usage of soap or hand sanitizers in addition to hot water in order to reduce bacterial contamination elimination or killing demolition microbes on hands. After handwashing, hand drying should be done, since the rubbing of hands while drying, eliminates remaining microorganisms from hands (Evans & Redmond, 2017).

2.5. Avoiding risk-associated food products

The fifth recommended practice is staying away from risk-associated food products. Since listeriosis is considered to be nearly completely avoidable through appropriate food handling and proper food choices, some key behaviors required to minimize the potentials related to listeriosis in the domestic kitchen must mainly be communicated to patients receiving chemotherapy treatment (Evans & Redmond, 2017). According to consumer listeriosis risk-reduction food safety information from the UK, Europe and the USA, such practices include obedience to ‘use-by’ dates on unopened pre-packed ready-to-eat food stuff, avoiding long storage of ready-to-eat food stuff and consuming them within two days after opening, in addition to the assurance of safe functioning temperatures ($\leq$5.0 °C) of the refrigerators at home (Evans & Redmond, 2017).

After reviewing the role of consumers and suppliers, we need to highlight the role of caregivers including physicians, nurses, and dietitians, in providing safety guidelines to

cancerous patients. According to the literature, it is suggested that if cancer patients were being provided with more awareness of recommended practices and understand that such practices are significant and will not interfere with their lifestyles, they might be more likely to tolerate food safety guidance (Evans & Redmond, 2017). Some studies found that patients with cancer showed positive behavior towards getting food safety education and are seemingly willing to adhere to the recommendations, nevertheless these patients need to get proper food safety information from sources known to be credible and reliable (Medeiros et al., 2004; Evans & Redmond, 2017).

The health caregivers in hospitals are all responsible of providing food, fluids, and nutritional care. This multifaceted team includes all clinical staff such as physicians, nurses, and dietitians (Department of Health, Social Services & Public Safety, 2007). All health care providers, especially those working with highly susceptible individuals, particularly targeting immunocompromised populations must educate their patients concerning their high susceptibility to infections and teach them how to protect themselves against foodborne pathogens (Buffer et al., 2013). Buffer et al. (2013) stated in their study that family physicians are the most among healthcare providers to provide information regarding nutrition and food safety. Nevertheless, in a study conducted by Wong et al. (2004), showed that almost 40% of medical doctors were not that knowledgeable concerning foodborne diseases. Two main categories of healthcare providers especially registered nurses and registered dietitians were shown to play a significant role in providing adequate and reliable information regarding food safety to these susceptible people (Buffer et al., 2013). But registered dietitians were more likely to have attended training courses

regarding food safety as compared to registered nurses (85% and 28%, respectively) (Buffer et al., 2013).

Despite the fact that few nurses have received formal training in food safety, they are still the main provider of information to patients (Buffer et al., 2013). Nursing service is 24/7 in hospitals and nurses are considered to be the only caregivers to have a direct contact with the patients at all times, and each mealtime. Thus, they have an essential role in providing nutritional care and monitoring the meal experience of patients (Department of Health, Social Services & Public Safety, 2007).

Concerning knowledge of nurses, Buccheri at al. (2007) found that there was a significant lack of appropriate knowledge regarding proper storage temperature of food products. Moreover, 28% of the participants showed lack of awareness concerning the appropriate temperature of a refrigerator, and 83% and 38% were not aware of the adequate storage temperature of hot and cold ready to eat foods, respectively.

Nurses having an intermediate education level, were more likely to know that reheating a food may be hazardous ($p = 0.026$). Furthermore, attending a course on food hygiene and foodborne diseases was significantly related ($p = 0.002$) to a higher number of correct answers to questions concerning risks associated with preparation of food in advance and safe working temperatures of the refrigerator ($p = 0.038$). People with more years of experience (≥21 years), were less likely to specify the correct temperature of storage of cold foods (Buccheri et al., 2007). Seventy percent of participants were knowledgeable about the risks occurring during food preparation prior to consumption that may contribute to food poisoning, meanwhile 43.7% understood that reheating food at improper conditions before eating is likely to contribute to food contamination. Around 97% of participants

knew the importance of hand washing before handling food and 98% of respondents knew the importance of hand washing after using the toilet. More than half of people (51.3%) realized that wearing gloves can decrease the risk of food contamination, while 40.1% of participants were aware of the hospital's standard operating procedure for food handling (Oludare et al., 2016).

In general, out of 340 nurses working in Nigerian hospitals, only 27.1% of them were capable of demonstrating proper knowledge of temperature controls for food storage. Specifically, 19.4% of respondents were able to demonstrate knowledge of proper temperature controls for cold, ready-to-eat food and 6.5% of respondents for hot, ready-to-eat food. Participants had good knowledge concerning foodborne pathogens and diseases with a mean score of 86.9±0.9%. Nearly all of the participants realized that salmonellosis and cholera are foodborne pathogens (96.9% and 98.5%, respectively), meanwhile 87.4% understood that hepatitis B is not transmitted by food (Oludare et al., 2016).

3. Attitudes towards Food safety

When assessing attitudes, a study showed that 78.3% of participants answered that cooked food should be separated from raw ones, however 16% of respondents ignored the implementation of such measure to avoid cross-contamination (Buccheri et al., 2007). A significant number of participants (86.8%) was not aware that defrosted food must not be refrozen. Almost all participants (>95%) agreed that in order to prevent food spoilage and health hazards, wearing protective clothing and gloves, knowledge and monitoring the temperature of the refrigerator and the freezer in addition to appropriate storage of food products. Only 12.7% of the participants disagreed with the statement that working

individuals having any injury on fingers or hands must not have any contact with unwrapped food (Buccheri et al., 2007).

4. Practices towards Food safety

At last, the practices of nurses in food safety were highlighted. Responses concerning the practice of hand washing before and after unwrapped food handling were: a number of participants ranging from 78.3% to 78.6% for raw foods, and from 77.3% to 83.6% for cooked foods mentioned that washing hands must be done prior and after any contact with the food, respectively (Buccheri et al., 2007). Nevertheless, few participants stated that they rarely washed their hands while having contact with unwrapped foods. Response to the statement about the use of different utensils for cooked and raw foods were the following: only 63.1% of the participants answered always and 27.4% answered often. Defrosting food at room temperature was shown to be a commonly used practice, only 10.5% of nurses mentioned that they rarely applied this practice. Moreover, 95% of nurses stated that they always check the shelf life of foodstuffs and the integrity of packages for food products (Buccheri et al., 2007).

According to Oludare et al. (2016), the findings of a total of 420 Nursing staff, assigned to wards in a tertiary hospital in Osun State, showed that 83.7% of participants “always” wash their hands before handling food, 7.4% “always” wear personal protective equipment (PPE) before food handling, and 41.7% “always” checked and certified food from sources external to the hospital as safe before serving the patients (Oludare et al., 2016). The results also showed that 87.7% of participants became more knowledgeable after attending a professional training on food handling and safety. Despite the presence of a committee in

the hospital monitoring and inspecting food, almost 63.9% of the participants were ignorant about the hospital's standard operating procedure for food handling.

Because safe food handling is of vital importance for the health of the highly vulnerable patients, it is imperative for oncology nurses, in particular, to be aware of what, when, why, and how information is being given to those patients, and if the information is appropriate (Buffer et al., 2013). In brief, according to Lund (2015), prevention of foodborne illnesses among susceptible individuals includes the following measures: control of food provision, avoidance of food from unsafe sources, insurance of adequate cooking, control of holding temperature, prevention of cross-contamination of foods, maintenance of good personal hygiene, and follow-up of low microbial diets.

Many studies evaluated the knowledge, attitudes, and practices among food handlers in the middle east region including Turkey (Tokuç et al., 2009; Baş, Ersun & Kıvanç, 2006), the United Arab Emirates (Taha et al., 2020), the kingdom of Saudi Arabia (Alqurashi, & Jaiswal, 2019; Hamadan & Almhaifer, 2015), Jordan (Osaili et al., 2017; Sharif, Obaidat, & Al-Dalalah, 2013), Iran (Askarian, Kabir, Aminbaig, Memis, & Jafari, 2004), and Kuwait (Al-Kandari, Al-abdeen, & Sidhu, 2019). The findings of these studies showed diverse scores in the level of knowledge, attitudes and practices and reported associations between knowledge, attitudes and practices and the food handlers' demographic and professional characteristics as well as the hospital's characteristics (size, number of beds and affiliations) (Bou-Mitri et al., 2018). Although food safety in has become one of hospitals utmost priority, there is not any published study on the knowledge, attitudes, and practices of nurses, highlighting oncology nurses, in Lebanese hospitals. In Lebanon, the food safety knowledge attitude and practices were assessed among food handlers in

Lebanese hospitals located in Beirut and Mount Lebanon (Bou-Mitri et al., 2018), Lebanese university students in Beirut and Jbeil (Mount Lebanon) (Hassan & Dimassi, 2014), and food handlers in two different types of food business management in Beirut (Faour-Klingbeil, Kuri, & Todd, 2015). The findings of these three studies reported an insufficient knowledge among food handlers in critical areas of food safety such proper thawing food preparation practices, temperature control, prevention of cross contamination, appropriate sanitizing, and hygiene measures (Bou-Mitri et al., 2018).

5. Research problem

Cancer patients are considered to have a high risk to foodborne infections as compared to non-cancerous population, therefore oncology nurses or primary caregivers who have a direct significant contact with these patients, have a pivotal role as being the first source in providing information concerning food safety, in order to reduce that risk, no data is available concerning their knowledge, practices, and attitudes towards food safety.

6. Research questions

The research questions that will guide the study are:

1- What is the level of knowledge about food safety among oncology nurses?

2- Are oncology nurses' attitudes towards food safety appropriate?

3- Are oncology nurses having proper practices when it comes to the safety of food?

4- Are oncology nurses aware of their pivotal role in reducing the risk of foodborne infection among chemotherapy patients?

5- Did oncology nurses receive a specialized training on food hygiene and foodborne diseases among chemotherapy patients?

7. Hypotheses

The hypotheses of this study are:

1- There is a relationship between older oncology nurses and adopting appropriate practices toward food safety.

2- Knowledge of nurses regarding food safety is related to years of experience.

3- There is a relationship between attitudes of oncology nurses towards food safety and sources of information.

Chapter 2

1. Introduction

Cancer is the main reason behind the number of deaths across the world, with an estimate of 1,762,450 new cancer diagnosed and 606,880 patient dead in 2019 (Siegel, Miller, & Jemal, 2019). Chemotherapy is a common treatment for cancer. It uses cytotoxic drugs that decrease the lymphocytes' count, inducing immunosuppression (Mehrling, 2015). These patients suffering from severe neutropenia are highly prone to infections, including foodborne diseases (Centers for Disease Control and Prevention, 2013; Barkley et al., 2016). This leads to a higher mortality rate since the treatment of these opportunistic pathogens is very difficult and lengthy due to patients' low immunity (Evans & Redmond, 2017). These patients are recommended to follow a neutropenic diet, that is known to restrict certain types of foods (fresh fruits and vegetables, raw or undercooked meat and poultry…) to decrease the frequency of bacterial translocation from the gut to the bloodstream, hence lowering the likelihood of having a foodborne infection (Evans & Redmond, 2017).

A scope of foodborne infections, such as listeriosis, salmonellosis, campylobacteriosis, and toxoplasmosis were determined to be more common among cancerous patients as compared to healthy individuals (Evans & Redmond, 2017).

Every step in the food supply chain process and especially in healthcare facilities, is involved in the prevention of foodborne pathogens, highlighting the significant role of caregivers including physicians, nurses and dietitians, in providing safety guidelines to

cancer patients (Faour-Klingbeil, Kuri, & Todd, 2015). According to the literature, it is suggested that if cancer patients were being provided with more awareness and better understanding of recommended practices, they might be more likely to tolerate food safety guidance (Evans & Redmond, 2017). Moreover, studies found that patients with cancer showed positive behavior towards getting food safety education and are seemingly willing to adhere to the recommendations; nevertheless, these patients need to get proper food safety information from sources known to be credible and reliable (Medeiros et al., 2004; Evans & Redmond, 2017).

All healthcare providers, especially those working with highly susceptible individuals, particularly targeting immunocompromised populations must educate their patients concerning their high vulnerability to infections and teach them how to protect themselves against foodborne pathogens (Buffer et al., 2013). Two main categories of healthcare providers- registered nurses and registered dietitians- were shown to play a significant role in providing adequate and reliable information regarding food safety to high-risk patients (Medeiros et al., 2004). Registered dietitians were more likely to have attended training courses regarding food safety as compared to registered nurses (85% and 28%, respectively). However, nurses are the main provider of information to patients (Buffer et al., 2013). Nursing service is 24/7 in hospitals and nurses are considered to be the only caregivers to have a direct contact with the patients at all times, and at each mealtime. Thus, they have an essential role in providing the patients' nutritional care and monitoring their meal experience (Department of Health, Social Services & Public Safety, 2007).

Worldwide, only two studies were conducted assessing the knowledge, attitudes, and practices among nurses; including one in Nigeria (Oludare et al., 2016) and another in Italy

(Buccheri et al., 2007). These studies recruited general nurses serving in different wards. To the best of our knowledge no study had addressed specialized nurses and those working with the most vulnerable patients. Therefore, since there are no studies conducted in Lebanon the objective of the current study was to assess the food safety knowledge, attitudes and practices of oncology nurses working in Lebanese hospitals located in Beirut and Mount Lebanon. This study also aims to identify the awareness of oncology nurses regarding their role in reducing the risk of foodborne infection among chemotherapy patients.

2. Methods and materials

2.1. Study design

A cross-sectional study recruiting oncology nurses working in Lebanese hospitals located in Mount Lebanon and Beirut, was conducted between July 2019 and October 2019. The hospitals outside this geographical area were excluded from this study. Forty-nine hospitals were originally contacted, out of which 26 did not respond or were not eligible for recruitment, 5 met the eligibility criteria of having specialized oncology nurses that are involved in administering chemotherapy treatment for cancer patients but did not accept to be part of the study and18 accepted and were recruited. The data collection took place after the NDU-IRB approval (Ref #: IRBSP2019_7_FNHS). The number of registered oncology nurses were determined by the nursing director of each hospital. A convenience sampling method was used. After the hospitals ‘approval, the self-administered questionnaires were distributed in total to 134 oncology nurses.

2.2. Questionnaire and Data collection

A questionnaire was used for data collection. The questionnaire was a ready to use set of questions with a clear answer evaluation, adapted from Bou-Mitri et al. (2018), Buccheri et al. (2007) and Oludare et al. (2016). It included mostly multiple-choice questions and some open-ended questions. It comprised seven sections covering: 1) socio-demographic characteristics; 2) employment status and the type of hospital where they work; 3) knowledge on types of food for patients under chemotherapy based on the Food Safety During and After Cancer Treatment (2018); 4) general food safety knowledge about food hygiene, storage time and temperature conditions, pathogens and foodborne illnesses; 5) attitudes regarding prevention of foodborne diseases; 6) food safety practices used to prevent foodborne diseases; (7) questions addressing opinion of oncology nurses regarding food safety trainings. The questionnaire was in English, translated into Arabic and back translated into English. It was piloted on 5 oncology nurses in order to assess its length and check for any incongruences or unclear questions. The questionnaire was distributed to all targeted healthcare professionals working in oncology units, after getting the approval from each hospital.

2.3. Ethical considerations

Before the study was conducted, permission was asked from the hospitals to participate in the research. The study participants were informed about the research objectives and their consent was obtained in order to fill the questionnaire. Anonymity and confidentiality were guaranteed.

2.4. Plan for analysis

After the data collection, all the questionnaires were recoded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 (IBM, Inc, Chicago, IL). Qualitative variables were presented by frequencies and percentages, while quantitative variables were displayed by means and standard deviations. The responses frequency and percentages in each category were calculated and tabulated. Independent sample t- test, ANOVA and correlation (confidence interval 95%) were used to compare selected test parameters such as age, gender, education level and work experience with selected questions about knowledge, attitudes and practices. Age was reclassified into 4 different groups corresponding to the age groups defined by Oludare et al. (2017). A one-point score was attributed to the correct answer on every question, and a null score was attributed to the incorrect answer as well as to the "I don't know", "Uncertain", "Often" answers. The KAP scores were categorized as poor (less than and equal to 50%), fair (51 to 79%) and good (80% and above) (Norhanslinda, Norhayati, & Mohd, 2016). Differences were considered statistically significant at $p \leq 0.05$.

3. Results

3.1. Sample characteristic

Socio-demographic characteristics of oncology nurses in Lebanese hospitals are presented in Table 1. The mean age of the recruited oncology nurses (n=134) was equal to 30 ± 8 years old, 84% were females, 58% were married, 83% had a bachelor in nursing, and 55% had a work experience less than 5 years.

Table 1: Descriptive Statistics of the socio-demographic characteristics of the oncology nurses (n=134).

Socio-demographic characteristics	Frequency (n)	Percentage (%)
Gender		
Male	22	16.0
Female	111	84.0
Age (in years) Mean ± SD*	30± 8	
[20-30]	77	57.0
[31-40]	41	31.0
[41-50]	8	6.0
>50	8	6.0
Marital Status		
Single	56	42.0
Ever married (married, divorced, widowed)	77	58.0
Level of Education		
Technical degree	8	6.0
Bachelor in Nursing	108	83.0
Graduate degree: Master's or Doctorate degree	14	11.0
Years of Experience (in years)		
< 5	68	55.0
[5-10]	34	27.0
>10	22	18.0
Attending a course on food safety for chemotherapy patients		
No	75	56.0
Yes	58	44.0
Sources of information about food safety **		
Media	47	36.0
TV	26	20.0
Audio	6	5.0
Brochures	62	47.0
Conferences	97	74.0

*SD=Standard Deviation

** The total is not 134 because it is a multiple-choice question

3.2. Nurses' knowledge on neutropenic diet

All the nurses (100%) agreed that unwashed fresh fruits and vegetables as well as raw or undercooked food should be avoided by cancer patients especially those undergoing chemotherapy treatment. Most of them agreed that food should be heat treated and washed before consumption. However, 19% and 13% of nurses misstated respectively that soft cheeses and unpasteurized beverages should be avoided (Figure 1).

Among the participants, only 44% attended a course on food safety for chemotherapy patients and 74% relied on conferences as a source of information about food safety, 47% relied on brochures, 36% on media, 20% on TV, and 5% on Audio.

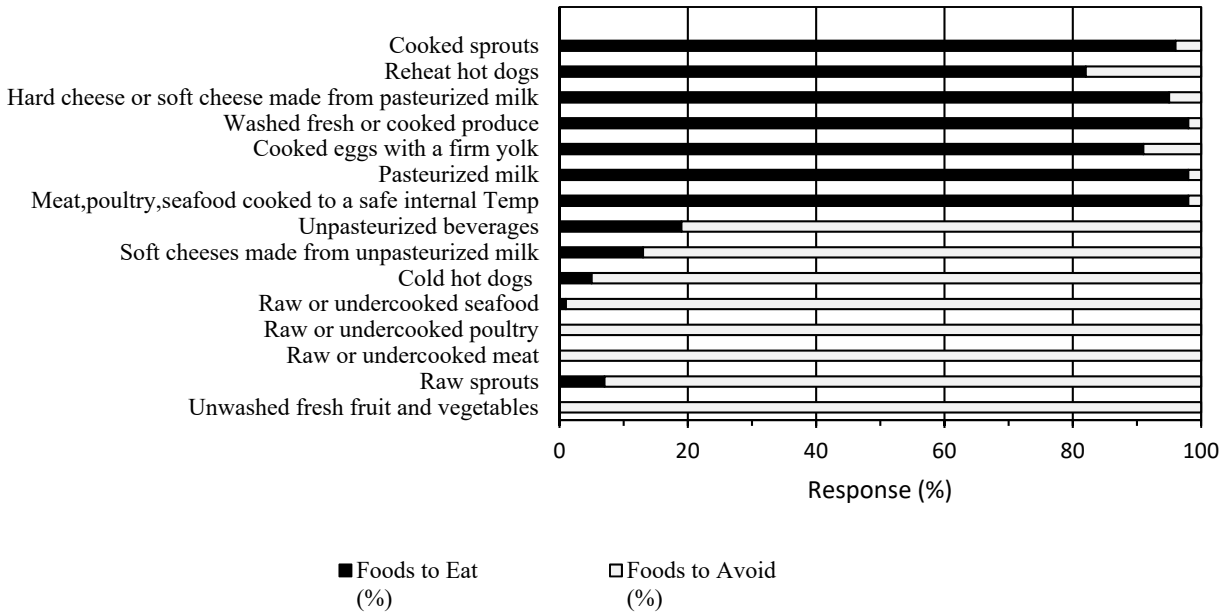


Figure 1: Type of foods recommended to consume or to avoid for cancer patients (n=134).

3.3. Food safety knowledge

The participants' mean knowledge score was 76±12, ranging from 38 to 95 (Table 2). The findings showed that 74% of nurses were aware that the preparation of food in advance could contribute to food poisoning and that reheating food is likely to contribute to food contamination. Most of the participants (95% and 98% respectively) knew that incorrect application of cleaning and sanitization procedures on equipment can increase the risk of foodborne disease, and that hand washing before handling food can reduce the risk of food contamination. Moreover, 78% of nurses agreed that wearing hand gloves while handling food reduces the risk of transmitting infection to patients' food. On the other hand, only 65% of nurses knew the correct temperature for a refrigerator, 65% and 64%, respectively stated properly the storage temperature for hot and cold ready to eat foods. Regarding oncology nurses' knowledge on foodborne diseases, their correct answers ranged from 72 to 82% to the related questions.

Table 2: Knowledge of oncology nurses on food safety and hygiene (n=134).

Item	Description	Agree (%)	Don't agree (%)
4.1	Preparation of food in advance is likely to contribute to food poisoning	99(74.0)	35(26.0)
4.2	Reheating of food is likely to contribute to food contamination	99(74.0)	35(26.0)
4.3	Incorrect application of cleaning/sanitizing procedures on equipment (refrigerator, slicing machine) can increase the risk of foodborne disease to inpatients	127(95.0)	7(5.0)
4.4	Hand washing before handling food can reduce the risk of food contamination	131(98.0)	3(2.0)
4.5	Wearing hand gloves while handling food reduces the risk of transmitting foodborne infection to patients' food	105(78.0)	29(22.0)
4.6	The correct temperature for a refrigerator is (<5°C)	87(65.0)	47(35.0)
4.7	Hot ready to eat foods should be maintained at (>60°C)	86(64.0)	48(36.0)

4.8	Cold ready to eat foods should be maintained at (<5°C)	80(60.0)	54(40.0)
4.9	Hepatitis B can be transmitted by food	37(28.0)	97(72.0)
4.10	Cholera can be transmitted by food	110(82.0)	24(18.0)
4.11	Food items are associated to the transmission of *Vibrio cholerae*	98(73.0)	36(27.0)
4.12	Food items are associated to the transmission of gastroenteritis	121 (90.0)	13(10.0)
Knowledge score		Mean±SD	Min-Max
		76±12	38-95

3.4. Food safety attitudes

The participants' mean attitude score was 95±10 ranging from 50 to 100 (Table 3). Ninety eight percent of nurses noted the necessity of checking the refrigerator/freezer operating conditions periodically, proper storage of foods, and washing hands at critical times in order to reduce food spoilage and health risks to patients. Ninety six percent and 95% of nurses agreed respectively that wearing personal protective equipment (PPE) before handling food and separating cooked foods from raw ones may cause health hazard to consumers. Moreover, 92% of nurses believed that healthcare workers with respiratory/diarrhea diseases should be excluded from food handling until full recovery. Ninety percent of nurses agreed that "food-handler with abrasions or cuts on hands should not touch unwrapped food" and 89% stated that "defrosted foods should not be refrozen".

Table 3: Attitudes of oncology nurses on food safety and hygiene (n=134).

Item	**Description**	Yes (%)	No (%)

5.1	Raw foods should be kept separated from cooked foods	127(95.0)	7(5.0)
5.2	Defrosted food should not be refrozen	119(89.0)	15(11.0)
5.3	It is necessary to check the refrigerator/freezer operating conditions periodically to reduce the risk of food spoilage	132(98.0)	2(2.0)
5.4	The risk of food contamination will reduce if we wear personal protective equipment before handling food	129(96.0)	5(4.0)
5.5	Improper storage of foods may cause health hazard to consumers	131(98.0)	3(2.0)
5.6	Hand washing at critical times contributes to food safety and hygiene	132 (98.0)	2(2.0)
5.7	Nurses with respiratory/diarrhea diseases should be excluded from food handling until full recovery	123(92.0)	11(8.0)
5.8	Food-service staff with abrasions or cuts on hands should not touch unwrapped food	121(90.0)	13(10.0)
Attitude score		Mean±SD	Min-Max
		95±10	50-100

3.5. Food safety practices

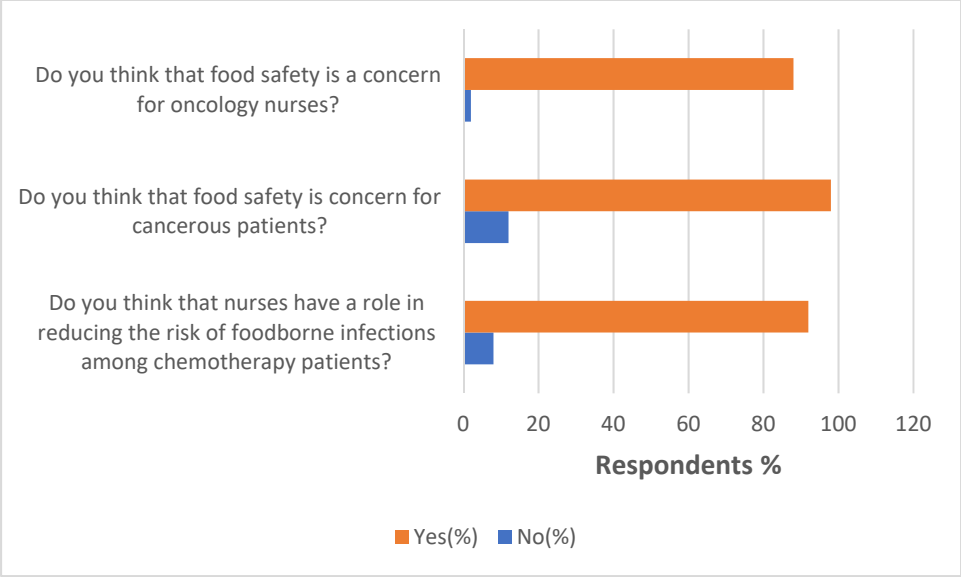
The participants' mean practices score was 86.9±15.2, with 33 and 100 as the minimum and maximum scores respectively (Table 4). The practice of handwashing among oncology nurses before and after handling unwrapped raw foods is 84% and 91%, respectively. While for cooked foods, the participants declared that they always wash their hands before and after touching food, 84% and 86%, respectively. Sixty five percent of nurses stated that they use separate kitchen utensils to prepare cooked and raw food. Out of the respondents, only 59% and 58% reported always checking the integrity of hospital wheeler-bin foods as well as the shelf-life before serving to patients, respectively. Furthermore, half of nurses mentioned that they always wear personal protective equipment before handling food. Finally, 45% of nurses stated that they always thaw frozen food at room temperature.

Table 4: Practices of oncology nurses on food safety and hygiene (n=134).

Item	Description	Always (%)	Often (%)	Rarely (%)	Never (%)
6.1	Do you wash your hands before touching unwrapped raw food?	112(84.0)	15(11.0)	7(5.0)	0(0.0)
6.2	Do you wash your hands after touching unwrapped raw food?	122(91.0)	9(7.0)	3(2.0)	0(0.0)
6.3	Do you wash your hands before touching unwrapped cooked food?	113(84.0)	17(13.0)	4(3.0)	0(0.0)
6.4	Do you wash your hands after touching unwrapped cooked food?	114(86.0)	18(13.0)	1(1.0)	0(0.0)
6.5	Do you use separate kitchen utensils to prepare cooked and raw food?	87(65.0)	26(19.0)	15(11.0)	6(4.0)
6.6	Do you thaw frozen food at room temperature?	61(45.0)	36(27.0)	25(19.0)	12(9.0)
6.7	Do you wear personal protective equipment before handling food?	66(50.0)	28(21.0)	27(20.0)	12(9.0)
6.8	Do you check and certify external food items before consumption by patients?	77(58.0)	36(27.0)	15(11.0)	5(4.0)
6.9	Do you check integrity of hospital wheeler-bin foods before packaging to patients?	79(59.0)	33(25.0)	12(9.0)	9(7.0)
Practices score		Mean±SD		Min-max	
		87±15		33±100	

3.6. Oncology nurses' opinion

Around 92% of oncology nurses stated that they have a role in reducing the risk of foodborne infections among chemotherapy patients. According to Figure 2 and 3, 88% of nurses believed that food safety is a concern for cancerous patients, 57% and 34% of them agreed and strongly agreed to this statement, respectively. Moreover, 98% nurses believed that food safety is a concern for oncology nurses, 57% agreed and 25% of them strongly agreed to such statement.



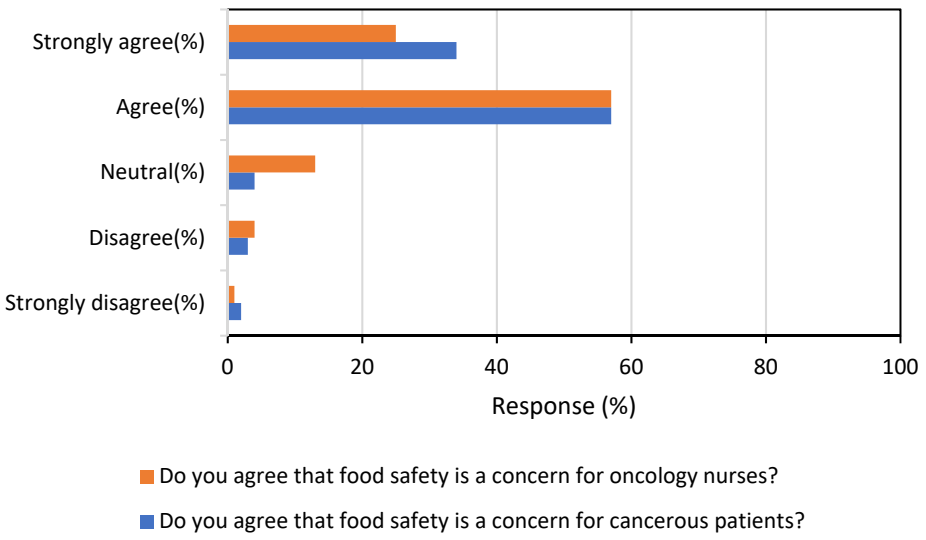


Figure 2 and 3: Distribution of oncology nurses in terms of their opinions (n=134).

3.7. Association between socio-demographic characteristics and knowledge, attitude, practices dimensions

Table 5 displays the relationship between socio-demographic characteristics and knowledge, attitude, practices (KAP) dimensions. The results showed a significant relationship between marital status and the practices score ($p=0.04$). Single oncology nurses scored the highest in practices with a mean score 91 and a standard deviation of 13, as compared to the married and ever married nurses which had each a mean practice score of 85 and 83, respectively. Moreover, a statistical significance was found between the level of education and knowledge score ($p<0.001$). The results showed that nurses holding a graduate degree scored (mean= 85) more than the ones holding a technical degree (mean= 80). While nurses holding a university undergraduate degree, (Bachelor in Nursing) had the lowest mean score (74). Regarding the relationship between gender and KAP scores, no statistical significance was found. The same applies for age.

Moreover, there was not an observation of a statistically significant relationship between years of experience and KAP dimensions. A significant association was found between knowledge score and attending a course on food hygiene and foodborne diseases for chemotherapy patients ($p<0.001$). Nurses that attended such course had higher mean knowledge score (79) than the ones who did not (73). Another significant association was observed between knowledge score and the following sources of information about food safety: TV ($p=0.01$), conferences ($p<0.001$), and audio ($p=0.01$). Furthermore, results showed a significant association between attitude score and nurses who read brochures to get information about food safety ($p<0.001$). And finally, a statistically significant association was found between practice score and attending conferences to get information about food safety ($p<0.001$).

Table 5: Association between socio-demographic characteristics and knowledge, attitude, practices dimensions (n=134).

Dimensions / Variables	Knowledge Mean±SD	P	Attitude Mean±SD	P	Practice Mean+SD	P
Gender						
Male	75±13	0.99	91±12	0.21	92±13	0.26
Female	76±12		95 ±10		86±15	
Age		0.30		0.05		0.66
[20-30]	76±12		90±13		94±11	
[31-40]	74±13		84±18		96±8	
[41-50]	74±10		78±17		95±6	
>50	83±6		92± 11		97±9	
Marital Status						
Single	78±13	0.17	94±12	0.32	91±13	0.04
Married	74±11		96±7		85±17	
Ever married	72±14		92±14		83±13	
Level of Education						
Technical degree	80±11	0.00	89±15	0.09	94±11	0.30
Bachelor in Nursing	74±12		84±10		86±15	
Graduate degree	85±2		99±3		90±11	
Years of Experience						
Less than 5	76±12	0.82	94±10	0.39	88±14	0.70
[5-10]	76±12		94±9		86±16	
More than 10	75±13		97±8		85±17	
Training for a relevant course						
No	73±14	0.00	94±10	0.90	86±16	0.35
Yes	79±9		95±11		89±13	
Sources of information Media						
No	77±11	0.12	95±10	0.06	87±16	0.32
Yes	74±13		93±11		88±13	
TV	72±15	0.01	94±9	0.81	88±12	0.33
Audio	75±20	0.01	98±5	0.09	81±17	0.43
Brochures	77±13	0.30	97±8	0.00	88±15	0.44
Conferences	76±11	0.00	94±16	0.33	86±16	0.00

4. Discussion

This study provides many critical information regarding the knowledge, attitudes and practices of oncology nurses working in private hospitals located in Beirut and Mount Lebanon, with patients during their chemotherapy treatments.

4.1. Knowledge on neutropenic diet

Most of oncology nurses participating in this study agreed that they have an important role in educating their patients in order to reduce foodborne illness. Food safety remains a concern to most of them and their patients. In a study, chemotherapy patients reported that they were provided with food safety recommendations only when experiencing neutropenia, and they stated that it was preferable to be informed earlier (Paden et al., 2019). Previous studies have shown that although patients receiving chemotherapy reported awareness of food safety practices, self-reporting indicated that potentially unsafe practices may be used in relation to temperature control, handwashing, safe cooking and adherence to use-by-dates (Evans & Redmond, 2018). Hence, food safety education for chemotherapy patients should be implemented by oncology nurses during the first six months after diagnosis, and at the beginning of chemotherapy treatment. Moreover, food safety instructions on how to decrease the risk of foodborne infections must be added as a standard of practice for health professionals working with vulnerable populations as found in (Buffer et al., 2013). It is also suggested that inconsistencies on the nurses' interpretation of neutropenic diet can lead to patient being misinformed about food safety standards and permitted foods in their diet (Sosa et al., 2019). Accordingly, it is suggested that the low knowledge on neutropenic diet could be alleviated if patients are educated on food safety

to improve the safe food preparation and storage as well as implement best attitudes and safe practices.

The main sources of information about food safety were cited from the most used to the least one: conferences (74%), brochures (47%), media (36%), TV (20%), audio (5%). In contrast to the findings of Buccheri et al., (2007), where the most frequently adopted sources of information reported were mass media, and audio/visual materials. Buffer et al., (2013) also reported that more than half of nurses (56%) did not attend a course on food safety for chemotherapy patients. These findings show that most of the nurses obtained their food safety knowledge through unreliable sources that are not always peer reviewed and could be not very accurate or science based.

4.2. Knowledge of safe food preparation and storage

Lebanese oncology nurses showed a good knowledge regarding safe food preparation and reheating, proper working temperature of refrigerators, and appropriate storage temperature for both hot and cold ready to eat food with 60% to 99% range of correct answers to the related questions. Similar results were reported by Buccheri et al., (2007) and Oludare et al., (2016) where 68.1% (n=401) 70% (n=340) of nurses respectively agreed that preparation of food in advance may contribute to food poisoning, while 91.5% and 43.7% of them respectively agreed that reheating food may lead to food contamination. Furthermore, it was also reported that among 254 food handlers working in Lebanese hospitals, 58.7% and 78.3% of them were aware of the hazards behind the preparation of food in advance and reheating it, respectively (Bou-Mitri et al., 2018). In the present study, 65% of the Lebanese nurses demonstrated good understanding of correct working temperature of a refrigerator to maintain food under healthy conditions; a similar score was

shown with Italian nurses (Buccheri et al., 2007) where among 401 nurses 67.1% demonstrated proper knowledge of temperature controls for food storage, in contrast to the score of Nigerian nurses (Oludare et al., 2016) where only 27.1% were knowledgeable of such information. The proper storage temperature of hot and cold ready to eat food was expressed by 64% and 60% of respondents of the current study, respectively. Among 254 food handlers working in Lebanese hospitals, most of them (72.4%) acknowledged the correct working temperature of a refrigerator (Bou-Mitri et al., 2018). These results showed higher percentage of nurses unable to provide proper temperature controls for cold and hot, ready-to-eat food as compared to those reported by Buccheri et al. (2007) reported with 83.5% and 37.7% of participants failing in these respectively. Furthermore, among 340 Nigerian nurses, 80.6% and 93.5% of them were not aware of the proper storage temperature of hot and cold ready to eat foods, respectively (Oludare et al., 2016). However, similar to this study, among 254 food handlers working in Lebanese hospitals, 66.5% and 67.3%, respectively specified correctly the storage temperature for hot and cold ready to eat foods (Bou-Mitri et al., 2018).

In consistence with this study findings, among 401 nurses, more than 95% knew that the incorrect application of cleaning/sanitizing procedures on equipment (refrigerator, slicing machine) can increase the risk of foodborne disease to inpatients (Buccheri et al., 2007). Moreover, the same results were reported by Bou-Mitri et al. (2018), where among 254 food handlers, 91.7% answered correctly to the relevant questions.

Around 96% of nurses were informed about the hospital's standard operating procedure for food handling reflected by a very high score in comparison to the findings of Oludare et al. (2016), where among 340 nurses working in Nigerian hospitals, only 40.1% of

participants were aware of these standards. Accordingly, almost all oncology nurses (98%) agreed that hand washing before handling food can reduce the risk of food contamination, which is consistent with the findings of Oludare et al. (2016) where 97% of respondents acknowledged this statement. In addition, about 78% of respondents were aware of the importance of wearing gloves while handling food to reduce the risk of transmitting foodborne infection to patients' food, in contrast to the findings of other studies where only 61.1% (n=401) and 51.3% (n=340) of participants answered correctly to the question (Buccheri et al., 2007). Moreover, Bou-Mitri et al. (2018), also reported that among 254 food handlers working in Lebanese hospitals, 66.1% stated that wearing gloves while handling food reduces the risk of transmitting infection to consumers.

These conflicting results and low level of knowledge among oncology nurses in Lebanese hospitals could be due to the fact that less than half of them had attended a course on food safety and they mostly based their information on conferences, brochures, media and TV. A more structured and standardized training could be suggested for these nurses. Free and routine training could be also suggested in order to reach out to large number of these nurses.

4.3. Knowledge on foodborne diseases

This study results showed that oncology nurses working in Lebanese hospitals had lower knowledge on food associated with the transmission of cholera and hepatitis B as compared to nurses working in Nigerian hospitals.

This shows that oncology nurses working in Lebanese hospitals lack knowledge regarding the transmission of foodborne diseases, which might be due to inadequate training courses. Those results represent a major concern especially that it was reported that cancer patients

have a five-fold higher risk of listeriosis and that 15% to 25% of serious salmonellosis occur among them (Evans & Redmond, 2018). Thus, it is recommended to adopt training courses for oncology nurses targeting the causes of foodborne infections, the sources of organisms causing these infections, and the appropriate preventive measures. It is also suggested to empower these nurses to communicate correct information by supporting them with needed training tools, documents, and adapted flyers. The communication with nurses, patients and their families is important in order to share and deliver information and advice on food safety issues and emerging risks. The communication activities range from providing science based and accurate information to patients and training nurses and other health workers to providing educational programs (Faour-Klingbeil et al., 2020).

4.4. Total knowledge score and associations

Nurses working in Lebanese hospitals (n=134) showed a fair mean knowledge score (76%) toward food safety, in contrast to the mean knowledge score of nurses working in Nigerian and Italian hospitals which was 29.4% (n=340) and 51.1% (n=401), respectively (Oludare et al., 2016; Buccheri et al., 2007). This fair score could be a result of the continual influx of research providing new information about food, which is challenging for nurses to stay up to date and well informed on a broad variety of health subjects (Buffer et al., 2013). This knowledge score could be also the result of the food safety campaign launched in 2014 via the social media across the country (Bou-Mitri et al., 2018). In Lebanon nurses scored higher on knowledge (76%) as compared to food handlers working in the same hospitals (59.2%) (Bou-Mitri et al., 2018), food handlers working in different types of food business management (56.6%) and Lebanese university students (53.6%) (Hassan & Dimassi, 2014; Faour-Klingbeil et al., 2015). These results might be due to the fact that

nurses are more familiar with hygiene protocols, infection sources and the measures to prevent it, since these points are considered as a priority in their daily nursing care plan. According to literature, it is expected nurses must score higher since working with vulnerable patients is a key motivator to the health caregivers to engage the nurses to be more knowledgeable about food safety and educate their patients to prevent their risk of a foodborne infection (Buffer et al., 2013).

Moreover, the findings of this study proved that attending a course on food hygiene and foodborne diseases was significantly associated with a higher mean knowledge score ($p<0.001$). Similarly, Bou-Mitri et al. (2018), reported that trained food handlers (60.8%) ($n=254$) working in Lebanese hospitals had significant higher knowledge scores ($p=0.001$) as compared to the food handlers that had not attended any training course. Moreover, the same was reported in the study of Buccheri et al. (2007), where they concluded that nurses who attended a minimum of one educational course performed way better in knowledge questions. These findings highlight the need to include food safety chapters in the training curriculum of nurses at all levels and there should be a credible standardized food safety source specific for chemotherapy patients.

4.5. Attitude toward food safety

Most of the oncology nurses (98%) knew the necessity of checking the refrigerator/freezer operating conditions periodically, to reduce food spoilage and health risks to patients, similarly to the nurses in Italian hospitals (Buccheri et al., 2007) and food handlers in the Lebanese hospitals (Bou-Mitri et al., 2018). Moreover, the majority of nurses noted the importance of wearing 254 protective equipment before handling food, similarly to the Italian nurses (more than 95%) (Buccheri et al., 2007) and much better that the Nigerian

nurses (80.4%) (Oludare et al., 2016) and the food handlers working in Lebanese hospitals (40% out of 254) (Bou-Mitri et al., 2018). The high knowledge of oncology nurses in regard to the refrigerator/freezer operating temperatures could be due to the fact that Lebanon experience frequent electricity shortage that may lead to fluctuating temperatures and even spoilage incidences. This highlight the fact that knowledge could be developed from previous experiences.

Furthermore, 95% of oncology nurses in this study acknowledged the importance of separating raw food from cooked ones. However, those findings were higher among oncology nurses as compared to nurses serving general wards in Italy and Nigeria (Buccheri et al., 2007; Oludare et al., 2016), where 78.3% (n=401) and 86% (n=340) of respondents respectively stated that they adopted this key measure to avoid cross-contamination. Moreover, 90% of Italian nurses and 94.1% of food handlers in Lebanon stated that food-service staff with abrasions or cuts on hands should not touch unwrapped food which is consistent with the findings the previous mentioned study (Buccheri et al., 2007; Bou-Mitri et al., 2018).

Most of the oncology nurses (89%) in this study knew that defrosted foods should not be refrozen; showing a higher score than that of the food handlers working in Lebanese hospitals where 79.9% of them (n=254) knew this (Bou-Mitri et al., 2018). Moreover, only 13.2% of the nurses in Italian hospital knew that defrosted foods should not be refrozen (Buccheri et al., 2007).

Those results suggest the importance of having a special food safety committee in each hospital to enforce food safety and hygiene protocols and monitor the staff's attitude.

4.5.1. Attitude score

In general, nurses had a good attitude score 95%, in contrast to other studies where only out of 340 and 401 nurses, 57% and 58.1% respectively exhibited a good attitude towards food safety and hygiene (Oludare et al., 2016; Buccheri et al., 2007).

Yet, similar results to the present study were reported by Bou-Mitri et al. (2018), where among 254 food handlers working in Lebanese hospitals, had a score of 83.7% on attitudes questions. Furthermore, Faour-Klingbeil et al. (2015) also reported consistent attitudes score of food handlers working in different types of food business management in Lebanon which was 86.3% over 100 possible points.

The reasons behind these scores were higher than the other studies, might be related to the fact that this study was conducted recently, where food safety is being taken more into consideration and more awareness is being spread in the country. Moreover, food safety incidents are reported more frequently in the news and goes viral on social media.

4.6. Practices toward food safety

Similar to this study findings, Faour-Klingbeil et al. (2015) and Bou-Mitri et al. (2018) reported that the majority of food handlers wash their hands with soap and water before eating or preparing food. Moreover, Hassan & Dimassi (2014) also reported that among 1172 Lebanese university students, 87% stated that proper hand washing before and after touching food reduce the risk of food contamination.

Most of the nurses agreed that permanent handwashing before and after handling unwrapped raw and cooked foods is important in preventing foodborne illnesses. These findings were slightly better than those reported by Buccheri et al. (2007), in which 78.3%

and 78.6% of participants adopted this practice respectively, for raw foods and for cooked foods, 77.3% and 83.6% of participants implemented this practice, respectively.

Only 65% of nurses stated that they “always” use separate kitchen utensils to prepare cooked and raw food. A very close percentage was also reported among 401 nurses working in Italian hospitals where only 63.1% of the participants stated “always” as an answer. However, Faour-Klingbeil et al. (2015) and Bou-Mitri et al. (2018), reported that 89.5% (n=80) and 77% (n=254) of food handlers, respectively used separate kitchen utensils and cutting boards to prepare raw and cooked foods.

Moreover, more than half of the participants (59%) noted that they “always” check the integrity of hospital wheeler-bin foods before packaging to patients, while none of the respondents (0%) in Oludare et al. (2016) study adopted this practice. Only fifty eight percent of nurses noted that they “always” check shelf life of the products and integrity of packages, which is considered an unsatisfactory adopted behavior compared to the findings of Buccheri et al. (2007) and Bou-Mitri et al. (2018) where the majority of respondents reported checking shelf life of food products and the integrity of the packaging.

Furthermore, half of nurses mentioned that they “always” wear PPE before handling food, which represents a significantly high score as compared to results reported by the nurses in Italian hospital where among 340 nurses, only 7.4% of respondents noted that they “always” wear PPE.

Finally, 45% of nurses mentioned that they “always” thaw frozen food at room temperature compared to the findings reported by Buccheri et al. (2007) and Bou-Mitri et al. (2018) where 61.3% (n=401) and 78.2% (n=254), respectively stated that they still adopt this practice that is not a safe one and more education is required for nurses. It is suggested that

having deficiency and hesitance in food safety knowledge, will generate a negative attitude and subsequently affect safe food handling practices.

4.6.1. Practices score

The participants' mean practices score was good (86.9%), on the other hand, 54% and 73.7% of nurses working in Nigerian and Italian hospitals respectively demonstrated a good food handling practice (Oludare et al., 2016; Buccheri et al., 2007). In Lebanon, 254 food handlers working in Lebanese hospitals scored 83.2% on the practices' questions (Bou-Mitri et al., 2018), 80 food handlers working in different types of food business management scored 61.3 % (Faour-Klingbeil et al., 2015), and 1172 Lebanese university students scored 44.7% (Hassan & Dimassi, 2014). Hence, Lebanese oncology nurses recorded the highest practices scores among other populations working in Lebanon. It is suggested that food safety practices could be affected by lack of continuous education and training.

5. Concluding remarks

This study supplies valuable data regarding the level of knowledge, attitude and practices in food safety of oncology nurses working in Lebanese private hospitals located in Beirut and Mount Lebanon. Overall, participating oncology nurses showed interesting scores in both attitudes and practices parts towards food safety, however their knowledge scores were less satisfactory. This type of study has some limitations in term of bias in false reporting good practices. The study population represents mainly Lebanese oncology nurses working in private hospitals located in Beirut and Mount Lebanon. Moreover, public hospitals were not included in the study because the hospital IRB approval was lengthy and complicated. Accordingly, it is suggested that the figures are better than the reality. On the other hand, the knowledge deficit is attributed to lack of training for oncology nurses

regarding food safety measures for patients receiving chemotherapy and could be a risk for this category of patients. Hence, routine and frequent interventions are required for the prevention and reduction of foodborne illnesses. Nurses' knowledge could be improved through the implementation of standardized food safety training courses especially those working with vulnerable populations. This educational intervention will help them in having more confidence in their knowledge, making them a reliable source of information for patients, as well as generating a positive attitude and improving safe food handling practices. Moreover, a special food safety committee in each hospital governed by the Ministry of public health could be formed, to enforce food safety protocols based on the Ministry's standards, monitor and evaluate staff performance, and keep the staff up to date with new standards.

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Appendix A

Dear Registered Nurses,

I, the undersigned, Angy Al Mallah a Masters student from the Faculty of Nursing & Health Sciences (FNHS) at NDU, am conducting an MS research titled “Food Safety in Lebanese Hospitals: Knowledge, Attitude, Practices among Oncology Nurses”.

Your participation in this study does not include any risk, and all the information collected will be used only for research purposes, anonymity is guaranteed. Your consent to participate in this study is highly appreciated. For any information about the study, you can contact the researcher (Mobile line: 76/596766, E-mail: agmallah01@ndu.edu.lb).

STATEMENT OF CONSENT

Since I have been informed that any examination or procedure may pose unforeseen risks at this time, I, ----------, confirm that my participation in this research study is optional, that there would be no penalty and no benefit if I did not participate, and that I am entitled to cease participating without any penalty or loss of any of the benefits to which I am entitled.

Date: ---------- Respondent’s Signature: ----------

Researcher's Signature: ----------

Serial Number: …… **Hospital Number:** ……

I. Demographic variables

1.1) Gender: □ Male □ Female

1.2) Age ---------- years

1.3) Marital Status: □ Single □ Married □ Divorced □ Widowed

1.4) Highest educational/professional qualification

□ BT □ TS □LT □ Bachelor in Nursing

□ Graduate degree: Master's or Doctorate degree □ Other; specify: …….

II. Professional Data

2.1) Number of years of experience in the oncology unit: ……years

2.2) Did you attend a course on food hygiene and foodborne diseases for chemotherapy patients? □ No □ Yes

2.3) What are your sources of information about food safety?

□ Media □ TV □ Audio □ Brochures □ Conferences □other; specify: ……...

2.4) Do you think that nurses have a role in reducing the risk of foodborne infections among chemotherapy patients? □ No □ Yes □ I don't know

III. Indicate what food should be eaten or avoided for patients under chemotherapy

Item	Types of food	Foods to Eat	Foods to Avoid
3.1	Unwashed fresh fruit and vegetables		
3.2	Raw sprouts		
3.3	Raw or undercooked meat		
3.4	Raw or undercooked poultry		
3.5	Raw or undercooked seafood		
3.6	Cold hot dogs, other cold cuts like ham…		
3.7	Soft cheeses made from unpasteurized milk (Brie, Camembert, feta, goat cheese…)		
3.8	Unpasteurized beverages (fruit juices, raw milk, raw yogurt, or cider)		
3.9	Meat, poultry, seafood cooked to a safe internal temperature		
3.10	Pasteurized milk		
3.11	Cooked eggs with a firm yolk		
3.12	Washed fresh or cooked produce		
3.13	Hard cheese or soft cheese made from pasteurized milk		
3.14	Reheat hot dogs		
3.15	Cooked sprouts		

IV. Food safety knowledge: Indicate which statement is correct/ not correct

Item	Description	agree	don't agree	Don't know
4.1	Preparation of food in advance is likely to contribute to food poisoning			
4.2	Reheating of food is likely to contribute to food contamination			
4.3	Incorrect application of cleaning/sanitizing procedures on equipment (refrigerator, slicing machine) can increase the risk of foodborne disease to inpatients			
4.4	Hand washing before handling food can reduce the risk of food contamination			
4.5	Wearing hand gloves while handling food reduces the risk of transmitting foodborne infection to patients' food			
4.6	Awareness about standard operating procedure for food safety and hygiene in this hospital			
4.7	People with skin infections/diseases can contaminate food			
4.8	Nose picking habit is dangerous and can contaminate food			
4.9	Mouth, nose, and hair should be covered before handling food+spoon using?			
4.10	Hands should be washed after defecation and urination			
4.11	Licking fingers could contaminate food during handling			
4.12	Talking to patients and colleagues while serving food could contaminate it			
4.13	Foodborne diseases could be transmitted through contaminated fruits			
4.14	Proper washing of fruits could reduce transmission of foodborne illnesses			
4.15	The correct temperature for a refrigerator is (<5°C)			
4.16	Hot ready to eat foods should be maintained at (>60°C)			
4.17	Cold ready to eat foods should be maintained at (<5°C)			
4.18	Hepatitis B can be transmitted by food			
4.19	Cholera can be transmitted by food			
4.20	Food items are associated to the transmission of *Vibrio cholerae*			
4.21	Food items are associated to the transmission of gastroenteritis			

V. Food safety attitudes: Answer by NO or YES

Item	Description	No	Yes	Uncertain
5.1	Raw foods should be kept separated from cooked foods			
5.2	Defrosted food should not be refrozen			
5.3	It is necessary to check the refrigerator/freezer operating conditions periodically to reduce the risk of food spoilage			
5.4	The risk of food contamination will reduce if we wear personal protective equipment before handling food			
5.5	Improper storage of foods may cause health hazard to consumers			
5.6	Hand washing at critical times contributes to food safety and hygiene			
5.7	Nurses with respiratory/diarrhea diseases should be excluded from food handling until full recovery			
5.8	Food-service staff with abrasions or cuts on hands should not touch unwrapped Food			

VI. Food safety practices: Determine how many times you do these practices

Item	Description	Always	Often	Rarely	Never
6.1	Do you wash your hands before touching unwrapped raw food?				
6.2	Do you wash your hands after touching unwrapped raw food?				
6.3	Do you wash your hands before touching unwrapped cooked food?				
6.4	Do you wash your hands after touching unwrapped cooked food?				
6.5	Do you use separate kitchen utensils to prepare cooked and raw food?				
6.6	Do you thaw frozen food at room temperature?				
6.7	Do you wear personal protective equipment before handling food?				
6.8	Do you check and certify external food items before consumption by patients?				
6.9	Do you check integrity of hospital wheeler-bin foods before packaging to patients?				

VII. Opinion Questions:

7.1) Do you think that food safety is a concern for cancerous patients?

□ No □ Yes □ I do not know

7.2) Do you agree that food safety is a concern for cancerous patients?

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

7.3) Do you think that food safety is a concern for oncology nurses?

□ No □ Yes □ I do not know

7.4) Do you agree that food safety is a concern for oncology nurses?

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

Thank you!

Appendix B

NOTRE DAME UNIVERSITY
LOUAIZE

NOTICE OF INSTITUTIONAL REVIEW BOARD APPROVAL

To : Dr Najwa El Gerges

From : Jocelyne Matar Boumosleh, PhD

Chair, IRB

Date: June 5th, 2019

RE: Protocol Ref #: IRBSP2019_7_FNHS

Protocol Title: " Food Safety in Lebanese Hospitals: knowledge, Attitudes, practices among Oncology Nurses..?"

The above-mentioned research proposal was APPROVED following IRB Review for the duration of the protocol

- All changes or amendments to your protocol or consent form require review and approval by the IRB BEFORE Implementation.
- If the research has been completed or if you wish to terminate the study, please notify the IRB via email at jboumosleh@ndu.edu.lb.

Sincerely,

Jocelyne Matar Boumosleh, IRB Chair

Ghazi Asmar, AVPRGS

Jocelyne Boumosleh

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Appendix C

This table represents all the contacted private hospitals located in Beirut and Mount Lebanon.

x	Hospital Name	Location	Oncology unit	Status
1.	Hotel Dieu De France	Beirut	Yes	accepted
2.	Saint George Hospital	Beirut	Yes	accepted
3.	Sahel General Hospital	Beirut	Yes	accepted
4.	Hospital Libanais Getaoui	Beirut	Yes	accepted
5.	Bikhazi Medical Group	Beirut	Yes	accepted
6.	Bahman Hospital	Beirut	Yes	accepted
7.	Al Zahraa Hospital	Beirut	Yes	accepted
8.	Notre Dame Maritime	Mount Lebanon	Yes	accepted
9.	Notre Dame de Secours	Mount Lebanon	Yes	accepted
10.	Saint Georges-Ajaltoun	Mount Lebanon	Yes	accepted
11.	Mount Lebanon Hospital	Mount Lebanon	Yes	accepted
12.	Sacre Coeur	Mount Lebanon	Yes	accepted
13.	Al Hayat	Mount Lebanon	Yes	accepted
14.	Saint Charles	Mount Lebanon	Yes	accepted
15.	Hospital Hayek	Mount Lebanon	Yes	accepted
16.	Clinique du Levant	Mount Lebanon	Yes	accepted
17.	Belle Vue Medical Center	Mount Lebanon	Yes	accepted
18.	Keserwan Medical Center	Mount Lebanon	Yes	accepted
19.	American University Hospital	Beirut	Yes	rejected
20.	Haddad Hospital for the Rosary Sisters	Beirut	Yes	rejected
21.	LAU Medical Center	Beirut	Yes	rejected
22.	Al Makassed Hospital	Beirut	Yes	No answer
23.	Saint Joseph	Mount Lebanon	Yes	rejected
24.	Middle East Institute of Health	Mount Lebanon	Yes	rejected
25.	CMC	Beirut	Yes	No answer
26.	Arz Hospital	Mount Lebanon	Unknown	No answer
27.	Al Rassoul Al Aazam	Beirut	No	NA
28.	Fouad Khoury hospital	Beirut	No	NA
29.	Najjar Hospital	Beirut	No	NA
30.	Hopital Dr. Adnan Haidar	Beirut	No	NA
31.	Saint. Antoine	Beirut	No	NA
32.	Khalidy hospital	Beirut	No	NA
33.	Hospital Libanais	Beirut	No	NA
34.	Trad Hospital	Beirut	No	NA

35.	Dar El Sahel	Beirut	No	NA
36.	Bourj Hospital	Beirut	No	NA
37.	Saint Michel	Mount Lebanon	No	NA
38.	Saint Louis	Mount Lebanon	No	NA
39.	Hajj	Mount Lebanon	No	NA
40.	Notre Dame du Liban	Mount Lebanon	No	NA
41.	Bitar	Mount Lebanon	No	NA
42.	Libano Canadien	Mount Lebanon	No	NA
43.	Maarbes	Mount Lebanon	No	NA
44.	Haroun	Mount Lebanon	No	NA
45.	Beit chabab	Mount Lebanon	No	NA
46.	Serhal	Mount Lebanon	No	NA
47.	Saideh	Mount Lebanon	No	NA
48.	Abou Jaoude	Mount Lebanon	No	NA
49.	Sainte Therese	Mount Lebanon	No	NA