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# Perceptions of Risk, Control, and Responsibility Regarding Food Safety among Consumers in Lebanon

## ABSTRACT

The political situation in Lebanon has reportedly impacted the implementation of food safety law. Although responsibility is placed upon the food industry to ensure food safety, consumers should also take responsibility. To date, no studies have explored the perceptions of risk, control, and responsibility of consumers regarding food safety in the region. Consequently, this study explored the food safety perceptions of consumers in Lebanon by using quantitative researcher measures. Lebanese consumers ($n$ = 95) responded to a self-complete questionnaire to determine perceptions of risk, control, responsibility, and hygiene consciousness regarding food safety. Correlations were determined between personal perceptions of risk, control, responsibility, and hygiene consciousness ($P$ < 0.001), whereby low levels of risk were correlated with high levels of control, responsibility, and hygiene consciousness. Statistically significant differences were determined between perceived risk, control, responsibility, and hygiene consciousness for "self" compared with other people ("others") ($P$ < 0.005), suggesting consumers in Lebanon exhibit perceptions of invulnerability, optimistic bias, illusion of control, and superiority bias. The most notable finding was that experiencing foodborne illness had a negative impact upon perceptions of risk, control, and responsibility to prevent foodborne illness. The perceptions and biases identified among study respondents are of great importance to help inform the development of future food safety interventions.

## INTRODUCTION

### Food safety in Lebanon

It is suggested that the current political situation in Lebanon may present challenges to the food supply chain and may not ensure the safety of food for consumers. The food safety regulatory framework throughout the food supply chain in Lebanon is not effectively developed *(36)*, and it is reported that food safety practices in Lebanon do not conform to international standards and do not ensure the safety of Lebanese consumers *(27)*. The political situation in Lebanon has reportedly had a significant impact upon the implementation of food safety law. Indeed, the long

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overdue Food Safety Law was not approved until 2016, the provisions of which were intended to improve public health *(22)*. To date, Gemayel *(42)* surmised that it is impossible to determine whether the Food Safety Law has been successful because it has yet to succeed in its main objective. Furthermore, foodborne pathogens have been isolated from food products available for sale in Lebanon *(47, 48, 58)*. Foodborne diseases are still a major health issue in Lebanon; however, outbreaks of foodborne illness are only detected if spaciotemporal clusters are confirmed to identify a common food source; sporadic incidences are seldom reported *(35)*.

Despite the development and implementation of food safety systems and regulations in the food industry to control food safety hazards, minimize risks, and protect the consumer, the consumer is considered to be the final line of defense for food safety *(30, 69)*. Although the food industry has a legal responsibility to ensure food safety throughout production, distribution, and retail, the ultimate responsibility to ensure that food consumed by the consumer is safe is upon the consumer. Therefore, appropriate awareness of, and positive attitudes toward, recommended food safety practices is particularly important among consumers when purchasing, storing, and preparing food in the domestic kitchen. Although cleanliness and hygiene are strong cultural values and are of utmost importance to women in Lebanon *(46)*, consumer food safety research studies have identified areas that require improvement and suggest the need for education interventions.

**Consumer food safety research from Lebanon**

Consumer attitudes, knowledge, and practices regarding food safety in the Middle East and North Africa, including Lebanon, are understudied *(19)*. Similarly, Grace *(44)* discussed that data detailing foodborne illness in low-income and middle-income countries are limited, whereas other studies have suggested that consumers in developing countries are concerned about food safety *(56)*.

In recent years, a small number of food safety research studies have been conducted with Lebanese consumers. For example, food safety research with Lebanese university students proposed that low awareness of food safety among students contributed to greater consumption of risk-associated food products and thus increased the risk of foodborne illness *(49)*. Such research revealed the need for food safety education in Lebanon on topics related to food temperature control, proper food preparation practices, prevention of cross-contamination, suitable cleaning and hygiene procedures, high-risk groups, and other contributing factors to foodborne diseases and prevention strategies *(49)*.

Hassan et al. *(52)* explored the knowledge and self-reported practices of food handlers in Lebanese households in terms of food handling, storage, use of kitchen facilities, and personal hygiene and concluded that there is a need for ongoing educational initiatives to improve the low food safety knowledge and practices among food handlers in Lebanese households. The need for information campaigns to educate consumers on efficient use of domestic refrigerators was suggested as a result of research that identified that the majority of domestic refrigerators in Lebanon had an average temperature of 8°C *(51)*, exceeding the recommended refrigeration temperature of 5°C *(89)*. It has also been suggested that there is a need to educate consumers in Lebanon on how to read and use food labels *(50)*; this is essential to support adherence of use-by dates on food products.

Cumulatively, previous consumer food safety studies with Lebanese consumers have identified the need for food safety education interventions to reduce the risk of foodborne illness. Research suggests that Lebanese consumers are reportedly willing to pay higher premiums for safer foods and transparent risk communication *(19, 20)*; thus, consumers in Lebanon may also be receptive to receiving food safety-related information.

To facilitate the development of effective, targeted consumer food safety education, there is a need to identify, consider, and address perception among consumers such as perceived invulnerability *(76)*, optimistic bias *(87)*, and illusion of control *(59, 83)* that may undermine food safety education attempts *(31)*. Therefore, future food safety educational messages for the target audience must be tailored to overcome such perceptions *(31)*.

Despite several consumer food safety research studies involving consumers from Lebanon, to date, none have conducted a quantitative analysis to explore the perceptions of risk, control, and responsibility of consumers regarding food safety in the region. The majority of research has focused upon the food safety knowledge and self-reported food safety practices of consumers in Lebanon *(19, 20, 49, 51, 52)*. Research regarding the risk perceptions of consumers conducted in Lebanon relates to levels of concern regarding contracting coronavirus disease 2019 from food sources *(37)*; however such research does not encompass perceptions of control and responsibility in relation to the risk.

**Perceptions of risk, control, and responsibility**

A great deal of consumer food safety research has been conducted in recent years. Reviews of such studies suggest that the majority use survey-based methods such as interviews and questionnaires to capture cognitive data such as knowledge and self-reported practices *(30, 69)*. Data from low- and middle-income countries and data detailing consumer attitudes and particularly consumer perceptions of risk, control, and responsibility for food safety are lacking. Such data are important because they can provide insight into how consumer perceptions may prevent engagement with food safety education interventions *(33)*.

### Perceptions of risk

"Risk" is the possibility of something bad or undesirable happening *(17)*. The perception of risk includes the perceived likelihood of a risk occurring, the individual's perceived susceptibility to the risk, and the perceived severity that the risk could cause *(10)*. Several studies have examined the concept of risk perception as an important antecedent to purchasing food or enacting food safety behavior *(43)*. Risk, as a feeling, may influence individual judgments and decisions in preventative behavior and control *(80)*. Perception of risk is an important component of changing consumer food safety behavior *(84, 85)*, and data detailing consumer perceptions of risk in middle- or low-income countries are lacking *(43)*. There is a need to consider differences in risk perceptions to obtain greater insight into the cognitive representation of risk *(79)*. It has been reported that improving consumers' risk perception of foodborne illness is critical to assist in prevention of foodborne illness *(78)*. It is also suggested that to enable the creation of effective consumer food safety education interventions in the future, there is a need to use theory-based approaches and frame messages to enhance emotion and relate to pre-existing risk perceptions among consumers *(32, 43)*.

In relation to risk, misconceptions and biases can exist that may result from an individual's experience with a given risk *(87)*. Risk misconceptions may prevent the implementation of effective food safety practices *(40)* and may have consequences for domestic food safety. Underestimating the potential occurrence or severity of risk to "self" compared with other people ("others") is known as an optimistic bias *(87)*, and optimistic bias gives individuals the perception of invulnerability *(76)*.

### Perceptions of control

"Control" is the ability or power to influence an outcome, action, or behavior *(15)*. The perception of control is an individual's perceived ability to control an outcome *(7, 13, 62)*, the locus of which can be internal (whereby an individual believes they can control the specific outcome) or external (whereby an individual believes they cannot control the specific outcome) *(75)*. It is suggested that an internal locus of control will result in desirable behavior; however, in terms of consumer food safety research, disagreement exists about the relationship between the locus of control and food safety behaviors *(1, 38)*. Misconceptions and overestimation of control, known as "illusion of control," can also occur, whereby individuals perceive themselves to have greater levels of control than others *(59, 83)*. It is suggested that the illusion of control can result in consumers overlooking food safety education initiatives *(67)*.

### Perceptions of responsibility

"Responsibility" relates to being accountable or having a duty to take care of or deal with something *(16)*. Perceiving a sense of personal responsibility may encourage desirable behaviors, particularly if individuals believe that they are accountable for the consequences of their actions *(12)*. There is limited research on how consumers perceive their own responsibility for ensuring food safety and locate this within a broader perspective on responsibility along the food chain as a whole *(29)*. Redmond *(68)* and Redmond and Griffith *(71)* surmise that multiple food safety responsibilities are required by the consumer during domestic food preparation and that failure to assume or accept personal responsibility for food safety in the home may increase the risks of foodborne illness due to unsafe food handling behaviors.

### Perceptions of hygiene consciousness

"Consciousness" is the state of being aware of and responsive to situations *(14)*. In terms of food safety research, hygiene consciousness relates to an individual's perception of personal knowledge/awareness, interest, and concern for food safety. Generally, consumers perceive themselves to know a great deal about food safety. Studies have determined high levels of food safety knowledge among consumers; however, food safety knowledge does not translate into food safety behavior *(4, 24, 28, 39, 60, 63, 64, 74, 81)*. Perceptions of hygiene consciousness are seldom explored in consumer food safety research studies; however, such studies suggest vulnerable consumers perceive themselves to be more hygiene conscious than others *(33)*.

### Identified need for research

Given the importance of understanding consumer food safety perceptions and the lack of such data concerning consumers in Lebanon, the research question for this study was as follows: What are the perceptions of risk, control, responsibility, and consciousness regarding food safety among consumers in Lebanon? The objectives of this study were to obtain quantitative data from consumers in Lebanon regarding their perceptions of personal levels of food safety risk, control, responsibility, and hygiene consciousness and to compare personal perceptions with the levels they perceive others to have. Such data are required to understand consumer cognitions associated with food safety, and importantly, to enable targeting of effective food safety education strategies in the future to reduce the risk of foodborne infection.

## MATERIALS AND METHODS

### Ethical approval

Ethical approval for the research project and all associated documentation was sought and obtained from the Cardiff School of Sport and Health Sciences, Healthcare and Food Research and Ethics Committee at Cardiff Metropolitan University (Ethics reference: 9298) and the Ethics panel at the Modern University for Business and Science (Ethics reference: MU-20171104-1).

### Design and development of data capture tool

A paper-based, self-complete questionnaire was designed and developed for this study. Perceptions of personal risk, control, responsibility, and hygiene consciousness for food safety were determined using a 10-point variation of a visual analog scale whereby adjectives were included on the extreme ends of the numerical values on the scale to enable respondents to indicate the strength of their attitude toward the statements *(8)*. In this study, a rating scale was developed that involved a horizontal line, anchored at one end with 1 = the worst outcome, i.e., very high risk of food poisoning, and anchored at the other end with 10 = the best outcome, i.e., very low risk of food poisoning. A 10-point scale is a recognized and appropriate scale *(23)*. Respondents were required to make a judgment and indicate by selecting a number between 1 and 10 where on the scale they perceived themselves to be in response to questions regarding their perceived level of risk, control, responsibility, and consciousness. For example, "How much control do you think you have in preventing food poisoning?" Subsequent questions took the same format, but referred to others. The 10-point scale and question structure were used for each construct, namely, perceived level of risk, perceived level of control, perceived level of responsibility, and perceived level of hygiene consciousness, thereby giving eight questions regarding perceptions of risk, control, responsibility, and hygiene consciousness for self and for others. This scale has been used and validated in previous research *(31, 33, 34, 68, 70)* to determine perceptions of risk, control, and responsibility for foodborne illness. The scale considers two constructs of the Health Belief Model *(73)*: perceived susceptibility (i.e., a person's perception of the chance/likelihood of contracting a foodborne illness) and self-efficacy (i.e., a person's perception of their responsibility to control the risk and their confidence in their ability to perform the food safety practice). The reliability and validity of the scale were not determined for this study because these constructs were established in the previously mentioned studies.

### Recruitment of participants for data collection

Consumers (aged ≥18 years) who visited a Health Day information stall organized by the Modern University for Business and Science, School of Health Sciences, at a shopping mall in Beirut, Lebanon, were invited to participate in the study by being given a participant information sheet detailing the purpose of the study and the involvement required. Consumers interested in participating in the study informed a member of staff at the information stall of their desire to participate. A target sample size was not determined before data collection because all data collection had to take place during the Health Day at the shopping mall. Data detailing how many consumers were approached and invited to participate were not captured.

### Data collection

Consumers that indicated a desire to participate in the study were provided with the paper-based questionnaire and pen. Participants completed the questionnaire in a quiet area close to the information stall where they could sit. Participants had the option to have the questions read out to them in English or Arabic and provide verbal responses. When participants opted to participate verbally, a trained individual would read the questions verbatim. No incentives were given for participating in the study. Participants were informed that completion of the questionnaire was voluntary, and return of the completed questionnaire implied consent to participate in the study.

### Data analysis

Data captured in the completed paper-based questionnaires were manually entered into a specifically designed database (Qualtrics XM Platform™, Qualtrics, Provo, UT, USA). The data set was downloaded in appropriate formats for analysis. Descriptive statistics were conducted using an Excel 2016 spreadsheet (Microsoft Corporation, Redmond, WA, USA) to obtain information regarding the sample, giving an illustrative summary of the data. An analytic plan was pre-specified. Inferential statistics were conducted using SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA) to determine statistically significant differences or associations. For example, the Wilcoxon signed-rank test was conducted to determine significant differences in perceived levels of risk, control, responsibility, and hygiene consciousness between self and others. A Mann-Whitney U test was used to explore significant differences in perceived risk, control, and responsibility according to demographic characteristics, or a Spearman's rank correlation ($\rho$) was conducted to determine whether any relationship existed between perceptions of risk, control, and responsibility of respondents. The calculated mean and median values are presented to illustrate the average value of perceptions in this study because the mean value considers all values in the data set, whereas the median value only considers the most central value.

## RESULTS

### Participant demographic characteristics

As indicated in *Table 1*, 95 Lebanese consumers in total participated in the study: 45% were female, 24% were male, and 31% did not disclose their gender when completing the questionnaire (comparisons among gender were conducted between those who selected male and female only). The study included participants who were 18 to 79 years of age: the majority were 18 to 29 (41%) and 30 to 39 (32%) years old. One person did not disclose age (comparisons were conducted according to the age groups specified in *Table 1*). More than half (58%) reported preparing meals from raw ingredients in their kitchen on a weekly basis, or more often.

**TABLE 1. Demographic characteristics and food safety information of study participants (n = 95)**

| Participant demographic characteristics and information regarding food safety | % |
|---|---|
| **Gender** | |
| Male | 24 |
| Female | 45 |
| Not disclosed/captured | 31 |
| **Age (years)** | |
| 18–29 | 41 |
| 30–39 | 32 |
| 40–49 | 12 |
| 50–59 | 8 |
| 60–69 | 4 |
| 70–79 | 2 |
| 80+ | 0 |
| No response | 1 |
| **Have you experienced foodborne illness in the last 5 years?** | |
| Yes | 60 |
| No | 40 |
| **Has anyone in your family experienced foodborne illness in the last 5 years?** | |
| Yes | 63 |
| No | 37 |
| **How often do you prepare, or help to prepare, meals from raw ingredients in your kitchen?** | |
| Twice or more a day | 9 |
| Once a day | 14 |
| Every other day | 12 |
| 2–3 times a week | 23 |
| Once a fortnight | 7 |
| Once a month | 14 |
| Never | 15 |
| No response | 6 |

Sixty percent reported that themselves or someone in their family had experienced foodborne illness in the last 5 years.

**Perceived risk of foodborne illness**

The home kitchen was not perceived to be associated with causing illness: 49% of consumers perceived food prepared in the home to be the least likely to result in foodborne illness *(Table 2)*, whereas food prepared away from the home was perceived to be more likely to result in foodborne illness. For example, only 4 to 8% perceived it unlikely to very unlikely that food prepared in retail outlets and catering establishments would result in foodborne illness *(Table 2)*. Indeed, 44% perceived that food from retail outlets such as shops and supermarkets was likely to very likely to result in foodborne illness *(Table 2)*.

Many participants in this study (49%) perceived themselves to have a low to very low risk of becoming ill with a foodborne illness *(Table 3)*. No significant differences were determined in perceived risk of foodborne illness according to gender ($P > 0.05$). Similarly, no significant differences existed in perceived risk of foodborne illness according to the age group of participants ($P > 0.05$). In addition, statistical analysis established that no significant differences ($P > 0.05$) existed in risk perceptions according to the self-reported cooking frequency by participants.

**TABLE 2. Perceived likelihood of acquiring foodborne illness resulting from foods prepared in different locations among consumers in Lebanon (*n* = 95)**

| Likelihood of foodborne illness to be from consuming … | Proportion (%) of respondents who stated[a] | | Mean | SD | Median |
|---|---|---|---|---|---|
| | 1–3 | 8–10 | | | |
| food you have prepared in your own home | 23 | 49 | 6.4 | 3.2 | 7 |
| food prepared by other people (family/friends) in their own homes | 20 | 19 | 5.9 | 2.4 | 6 |
| food prepared in catering establishments | 21 | 8 | 5.2 | 2.2 | 5 |
| food prepared in a retail outlet (shops/supermarkets) | 44 | 4 | 4.3 | 2.4 | 4 |

[a]1–3, 1 = very likely to 3 = likely of acquiring foodborne illness; 8–10, 8 = unlikely to 10 = very unlikely of acquiring foodborne illness.

Statistical analysis using the Wilcoxon signed-rank test determined that the participants in this study perceived themselves to be significantly less likely of contracting foodborne illness than others ($P = 0.002$). As indicated in *Table 3*, the perceived risk of foodborne illness was considered to be low to very low by 49% of respondents for themselves, whereas only 19% of respondents believed that others had the same low to very low level of risk of foodborne illness.

A Mann-Whitney U test revealed a significant difference ($P = 0.003$) in the perceived risk of foodborne illness between respondents who reported experiencing foodborne illness during the last 5 years and those who had not experienced foodborne illness *(Table 4)*. Further exploration established that a third (33%) of those who reported having experienced foodborne illness perceived themselves to be at a high to very high risk of foodborne illness, whereas only 8% those who had not reported experiencing foodborne illness perceived themselves to be at a similar level of risk.

**Perceived control for food safety**

The majority (60%) of respondents perceived themselves to have high to very high levels of control, whereas only 21% perceived others to have the same level of control as themselves *(Table 3)*. Statistical analysis determined that no significant differences were determined in perceived control of foodborne illness according to gender or age group of self-reported cooking frequency ($P > 0.05$). Participants in this study perceived themselves to have greater levels of control for food safety than others ($P < 0.001$; *Table 3*).

A significant difference ($P = 0.006$) in the perception of control of foodborne illness was determined between respondents who reported experiencing foodborne illness and those who had not experienced foodborne illness during the last 5 years *(Table 4)*. It was confirmed that just over half (53%) of those who had experienced foodborne illness perceived themselves to have close to total control, whereas 71% of those who had not experienced foodborne illness perceived themselves to have the same level of control. Indeed, 29% of those experiencing foodborne illness perceived having little or no control of food safety, whereas only 5% of those who had not experienced foodborne illness reported the same level of perceived control *(Table 4)*.

**Perceived responsibility for food safety**

More than half of respondents perceived themselves to have high levels of responsibility for ensuring food safety *(Table 3)*. The personal responsibility for food safety was perceived to be greater for self than for others in this study ($P < 0.001$), with 54% perceiving themselves as having high to very high levels of responsibility compared with less than a quarter (24%) perceiving others to have the same level of responsibility for food safety *(Table 3)*. No significant differences were determined for perceived responsibility for foodborne illness according to the gender, age group, or self-reported cooking frequency of participants ($P > 0.05$). Significantly lower levels of perceived responsibility were determined among those who had experienced foodborne illness ($P = 0.027$), with 48% perceiving high levels of responsibility compared with 71% of those who had not experienced *(Table 4)*.

**TABLE 3. Perceptions of risk, control, and responsibility of foodborne illness for self and others, with significant differences determined using the Wilcoxon signed-rank test**

| Perception | For self | | | | | | For others | | | | | | Significant differences |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | Responses (%) | | Mean | SD | Median | *n* | Responses (%) | | Mean | SD | Median | |
| | | 1–3 | 8–10 | | | | | 1–3 | 8–10 | | | | |
| Perceived risk of food poisoning (1 = very high risk to 10 = very low risk) | 95 | 23 | 49 | 6.4 | 3.2 | 7 | 95 | 20 | 19 | 5.9 | 2.4 | 6 | $Z = -3.152$<br>$P = 0.002$<br>$r = 0.23$ |
| Perceived control of food safety (1 = no control to 10 = total control) | 93 | 19 | 60 | 6.9 | 3.0 | 8 | 93 | 15 | 21 | 6.0 | 2.3 | 6 | $Z = -4.040$<br>$P < 0.001$<br>$r = 0.30$ |
| Perceived responsibility for food safety (1 = no responsibility to 10 = complete responsibility) | 94 | 19 | 54 | 6.8 | 3.2 | 8 | 91 | 12 | 24 | 6.2 | 2.4 | 7 | $Z = -4.202$<br>$P < 0.001$<br>$r = 0.31$ |
| Perceived level of hygiene consciousness (1 = not at all conscious to 10 = very conscious) | 94 | 20 | 60 | 6.9 | 3.2 | 9 | 90 | 17 | 28 | 6.1 | 2.5 | 7 | $Z = -3.686$<br>$P < 0.001$<br>$r = 0.27$ |

**Perceptions of hygiene consciousness**

Participants in this study perceived themselves to have high levels of hygiene consciousness, with 60% perceiving themselves as being very conscious of food safety *(Table 3)*. As indicated in *Table 3*, hygiene consciousness was perceived to be significantly greater for self than the perceived hygiene consciousness of others ($P < 0.001$). Only 28% believed others to have the same level of hygiene consciousness as themselves. It was determined in this study that no significant differences existed in perceived levels of hygiene consciousness according to the gender, age group, or self-reported cooking frequency of participants ($P > 0.05$). Significantly lower levels of hygiene consciousness were determined among those who had experienced foodborne illness ($P = 0.026$), with 52% reporting high levels of hygiene consciousness compared with 71% of those who had not experienced foodborne illness *(Table 4)*.

**Relationships between perceptions of risk, control, and responsibility**

The relationship between perceived risk, control, responsibility, and hygiene consciousness was investigated using the Spearman rank order correlation. Preliminary analyses were performed to ensure no violations. As illustrated in *Table 5*, the statistical analyses identified that there were strong positive correlations ($r = 0.50$ to $1.0$) between each of the variables ($P < 0.001$), with 57 to 69% shared variance. Findings indicate that low levels of perceived risk were associated with high levels of perceived control, high levels of responsibility, and high levels of hygiene consciousness, whereas high levels of perceived risk were associated with low levels of perceived control, low levels of responsibility, and low levels of hygiene consciousness.

**TABLE 4. Perceptions of risk, control, responsibility, and hygiene consciousness regarding foodborne illness according to those who reported having had and not having had foodborne illness during the last 5 years, with significant differences determined using the Mann-Whitney U test**

| Perception | Those who reported experiencing foodborne illness in the last 5 years | | | | | | Those who did not report experiencing foodborne illness in the last 5 years | | | | | | Significant differences |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | Responses (%) | | Mean | SD | Median | *n* | Responses (%) | | Mean | SD | Median | |
| | | 1–3 | 8–10 | | | | | 1–3 | 8–10 | | | | |
| Perceived risk of food poisoning (1 = very high risk to 10 = very low risk) | 57 | 33 | 39 | 5.6 | 3.4 | 7 | 38 | 8 | 66 | 7.6 | 2.5 | 9 | $U = 692$, $z = -3.015$ $P = 0.003$ $r = 0.31$ |
| Perceived control of food safety (1 = no control to 10 = total control) | 55 | 29 | 53 | 6.1 | 3.3 | 8 | 38 | 5 | 71 | 8.0 | 2.1 | 8 | $U = 696$, $z = -2.771$ $P = 0.006$ $r = 0.29$ |
| Perceived responsibility for food safety (1 = no responsibility to 10 = complete responsibility) | 56 | 29 | 48 | 6.2 | 3.5 | 7 | 38 | 8 | 71 | 7.8 | 2.5 | 9 | $U = 781.5$, $z = -2.211$ $P = 0.027$ $r = 0.23$ |
| Perceived level of hygiene consciousness (1 = not at all conscious to 10 = very conscious) | 56 | 30 | 52 | 6.2 | 3.5 | 8 | 38 | 5 | 71 | 8.0 | 2.4 | 9 | $U = 743.5$, $z = -2.520$ $P = 0.012$ $r = 0.26$ |

## DISCUSSION

### Perceived risk of foodborne illness

This study identified that respondents perceived that the home kitchen is the location least likely of resulting in foodborne illness and that the risk of foodborne illness to them was low. Likewise, the perceived personal risk from foodborne illness in the home was perceived to be low among consumers in the United Kingdom *(67, 70)*.

Risk perceptions relate to the likelihood, susceptibility, and severity of the risk *(10)*. Respondents perceived themselves to have a low risk of acquiring a foodborne illness. Underestimating the potential risk to self is known as optimistic bias *(87)*. This underestimation of personal risk can result in the perception of invulnerability, where the risk is expected to occur among others as opposed to themselves *(76)*. Indeed, as part of this study, risk perceptions were significantly lower for self than for others. Such discoveries concur with previous research suggesting that consumers perceive personal invulnerability and indicate perceptions of optimistic bias in relation to food safety risks *(21, 41, 70)*. Recent research regarding a food safety campaign by the Partnership for Food Safety Education reported that U.S. consumers perceived that they were less likely than others to contract a foodborne illness; however, they did perceive that the severity of illness would be similar to that experienced by others *(6)*.

Frewer et al. *(40)* suggest that misconceptions among consumers regarding risk may prevent implementation of effective food safety practices, the implication of which can have severe consequences for food safety in the domestic setting. It is also suggested that perceived invulnerability may undermine food safety information attempts as consumers perceived other people to be at greater risk *(33)*. To inform the development of future food safety education in Lebanon, there is a need to consider and specifically target food safety-related misconceptions such as optimistic bias and perceived invulnerability. To enable this, there is a need for in-depth qualitative research with consumers from Lebanon to identify specific factors that influence risk perceptions.

**TABLE 5. Correlations between perceptions of risk, control, responsibility, and hygiene consciousness**

| | Perceived risk of foodborne illness | Perceived control of food safety | Perceived responsibility for food safety | Perceived hygiene consciousness |
|---|---|---|---|---|
| Perceived risk of foodborne illness | N/A[a] | $r = 0.831$, $n = 93$, $P < 0.001$ | $r = 0.799$, $n = 94$, $P < 0.001$ | $r = 0.777$, $n = 94$, $P < 0.001$ |
| Perceived control of food safety | $r = 0.831$, $n = 93$, $P < 0.001$ | N/A | $r = 0.759$, $n = 92$, $P < 0.001$ | $r = 0.758$, $n = 92$, $P < 0.001$ |
| Perceived responsibility for food safety | $r = 0.799$, $n = 94$, $P < 0.001$ | $r = 0.759$, $n = 92$, $P < 0.001$ | N/A | $r = 0.851$, $n = 94$, $P < 0.001$ |
| Perceived hygiene consciousness | $r = 0.777$, $n = 94$, $P < 0.001$ | $r = 0.758$, $n = 92$, $P < 0.001$ | $r = 0.851$, $n = 94$, $P < 0.001$ | N/A |

[a]N/A, not applicable.

Previously, risk perceptions and optimistic biases have been determined to vary according to age, gender, and ethnicity *(9, 77)*. For example, females have indicated higher perceptions of personal risk than males *(6)*. However, in the present study, no significant differences in risk perceptions were determined according to the demographic characteristics of respondents. The only factor that had an impact upon the perceived risk was previous experience of foodborne illness. Indeed, Parry et al. *(67)* hypothesized and established that experience of foodborne illness would impact risk perceptions and reduce optimistic bias. Although both those who had and those who had not experienced foodborne illness were said to exhibit optimistic bias, experience with foodborne illness was suggested to reduce optimistic bias *(67)*. Certainly, in the present study, the perceived risk of foodborne illness was significantly greater among respondents who reported experiencing foodborne illness than those who had not experienced foodborne illness, thus agreeing that experience of foodborne illness reduces optimistic bias among the respondents of this study.

**Perceived control for food safety**

The perception of control is an individual's perceived ability to control an outcome as a direct result of their own behavior *(7, 13, 62)*. This study has determined that participants perceived themselves to have high levels of control for foodborne illness, indicating confidence in their food safety behaviors. Perceptions of personal control were significantly higher than the control others were perceived to have. Similar findings have been reported previously wherein the majority of consumers perceived themselves to have greater levels of control than others *(31, 33, 70)*.

Findings from this study suggest that participants may overestimate their own ability to control food safety. Such overestimation is known as the illusion of control *(59, 83)*. Recommended food safety practices may not be adhered to or food safety education initiatives may be overlooked as a result of the illusion of control. As consumers, they perceive such information to be aimed at those who are less able to control risks than themselves *(67)*. No significant differences were determined in perceived control in this study according to gender or age group, whereas Barrett et al. *(6)* discussed differences in perceived behavioral control according to gender and age group.

The locus of control is the extent that individuals perceive that they do or do not have control over specific outcomes. The locus (i.e., the location) of control can be perceived as being internal (i.e., an individual can control the specific outcome) or external (i.e., an individual cannot control the specific outcome) *(75)*. Regardless of the outcome being positive or negative to an individual, if individuals have a strong internal locus of control, they are likely to praise or blame themselves for the outcome, thus taking responsibility, whereas individuals with a strong external locus of control are likely to praise or blame external factors for the outcome, thus refusing to accept responsibility *(18,*

*75, 82)*. Consumer food safety research proposed that an internal locus of control leads to safer food preparation practices *(38)*; however, findings by Abbot et al. *(1)* suggested that internal locus of control for safe food handling and high levels of food safety self-efficacy do not translate into safe food handling practices.

The illusion of control suggested from the findings of this study indicates an internal locus of control among respondents. Furthermore, it has distinguished that those who had reported experiencing foodborne illness perceived lower levels of control for ensuring food safety than those who had not experienced foodborne illness. This suggests that as a result of previous experience, the locus of control has become more external than internal as those individuals perceive they are unable to control such outcomes.

**Perceived responsibility for food safety**

Perceived responsibility and associated attitudes may impact behavioral reactions *(86)*. It is suggested that an individual perceiving a sense of personal responsibility may implement a desirable behavior *(12)*. High levels of responsibility were perceived among participants of this study, suggesting personal attribution of responsibility. This discovery is consistent with previous research, wherein individuals perceived themselves as having high levels of responsibility that are perceived to be greater than those of others *(3, 31, 33, 53, 70)*. The pervasive tendency of individuals to perceive themselves in a favorable way and overestimate their own qualities is acknowledged as a form of self-enhancement and superiority bias that occurs in social comparison *(54)*.

As mentioned, participants in this study perceived themselves to have high levels of control for food safety, signifying an internal locus of control. It is suggested that an individual's locus of control can affect the perceived attribution of responsibility, which can impact behavior *(75)*. Previous food safety research reveals that perceptions of responsibility are associated with increased perception of control *(61, 66, 70)*. Although Saulo and Moskowitz *(77)* reported variations in perceptions of personal responsibility according to gender, Evans and Redmond *(33)* did not determine differences in perceived responsibility according to gender. In addition, the present study did not determine significant differences in perceived responsibility according to gender or age group.

Perceived responsibility was found to be significantly lower among those who had experienced foodborne illness. There is a need to consider how previous experience influenced perceptions of responsibility. If a previous experience of foodborne illness was associated with food consumed away from the home (i.e., the blame was due to an external factor), the outcome may be a perceived loss of control and associated responsibility.

**Perceptions of hygiene consciousness**

High levels of hygiene consciousness were perceived among the study participants and were significantly greater than those perceived for others. This may be attributed to previously discussed factors such as a superiority bias that occurs in social comparison *(54)* or to a social desirability bias wherein there is a tendency for an individual to present a favorable image of themselves by give socially desirable responses instead of choosing responses that are reflective of their true feelings *(45)*. Previous research has also determined that respondents perceive themselves as being more conscious of hygiene than others *(33)*. This study established that hygiene consciousness was significantly lower among those who had experienced foodborne illness. The authors anticipated that those who had experienced such outcomes would have been more conscious of hygiene. Therefore, there is a need for future research to further explore the food safety knowledge, attitudes, and self-reported practices of consumers in Lebanon who have experienced foodborne illness compared with those who have not experienced foodborne illness.

**Relationships between perceptions of risk, control, and responsibility**

It is suggested that increased perceptions of responsibility are associated with increased perceptions of control *(61, 66, 70, 82)*. In the present study, strong positive correlations were determined between all measured perceptions. High levels of control, responsibility, and hygiene consciousness were significantly associated with low levels of risk ($P < 0.001$). Similarly, previous research has established correlations between perceptions of risk, control, and responsibility among older adults *(31)*, people receiving chemotherapy treatment for cancer *(33)*, and consumers from the general population *(70)*. Houdi and Puttock *(55)* discussed how factors such as knowledge, concern, perceived ability to control, and understanding the source of a risk can be used to predict how an individual perceives risk.

**Impact of experiencing foodborne illness upon perceptions of risk, control, responsibility, and hygiene consciousness**

An interesting and noteworthy finding of this study is that significant differences were determined in food safety–related perceptions according to reported foodborne illness experiences ($P < 0.05$). Those who reported having experienced foodborne illness perceived themselves to be at significantly greater risk of foodborne illness, with lower levels of control and responsibility for food safety and lower levels of hygiene consciousness. Previous research has established that food safety perceptions vary according to those who have been affected by foodborne illness *(67)*. It is suggested that negative incidents, even those that are overcome, can have a residual effect upon individual

perceptions (88). Indeed, prior knowledge and experiences have been demonstrated to have an impact upon perceptions (5). Therefore, based on the findings of this study, it may be proposed that a negative food safety experience can have a negative impact upon an individual's personal perceptions of risk, control, and responsibility to prevent the negative experience from reoccurring. Such factors should be considered in the development of future targeted food safety education interventions.

**Significant differences in perceptions for self and others**

In this study, statistically significant differences were ascertained for the perceptions of risk, control, responsibility, and hygiene consciousness between self and others. It was discovered that respondents perceived others to have a greater level of risk of foodborne illness and lower levels of control, responsibility, and hygiene consciousness ($P < 0.05$) than themselves. Such perceptions demonstrate that respondents exhibited perception of invulnerability by underestimating personal risk (76), optimistic bias by believing the risk is expected to occur among others (87), an illusion of control by overestimating their personal ability to control the risk (59, 83), and superiority bias by overrating their qualities and abilities compared with others (54). Comparable findings were unearthed in previous research that reported similar perceptions and biases (31, 33, 70).

**Significant differences according to gender, age, and cooking frequency**

Numerous consumer food safety research studies suggested differences in food safety cognition according to respondent gender and age group. Risk perceptions and optimistic biases have been determined to vary according to age, gender, and ethnicity (6, 9, 31, 33, 70, 77). In the present study, no significant differences ($P > 0.05$) in perceptions of risk, control, responsibility, or hygiene consciousness were determined according to the demographic characteristics of respondents, including gender, age group, and cooking frequency.

**Limitations**

Given that the sample size is small ($n = 95$), the data cannot be representative of the entire Lebanese population; similarly, it must be considered those who opted to participate in the study may have different perceptions relating to food safety than those who opted against participating in the study. Therefore, this scale should be used to capture data from a representative sample of the population in Lebanon.

**Identified need for future research**

Although comparisons in perceptions of risk, control, and responsibility can be made with previous research by Redmond and colleagues (31, 33, 71), existing research denotes the perceptions of consumers and vulnerable groups in the United Kingdom. There is a need to extend consumer food safety perception research to enable comparison of findings with consumers from other countries in the Middle East and North Africa region. There is a need to further consider the distinctive food safety risks that exist for consumers in Lebanon as a result of the unique political, economic, and energy challenges faced by that country. For example, Lebanon suffers from a chronic shortage of power supply: the national power grid does not generate sufficient electricity to meet the country's needs; therefore, many Lebanese consumers rely upon privately owned diesel-powered generators for power (2, 57). However, during 2021, extreme fuel shortages resulted in no centrally generated electricity and not enough fuel for private electricity generators, resulting in power blackouts throughout Lebanon (11, 72). In relation to this, previous research has reported that Lebanese consumers failed to ensure that refrigerators operate at recommended temperatures during power outages (51). However, there is a need to further explore the food safety perceptions and practices of Lebanese consumers when faced with power outages, because it is suggested that increased food poisoning and spoilage in Lebanon are the likely result of electricity shortages (65). There is also pivotal need to consider the perceptions and practices of Lebanese consumers in relation to potential issues associated with the unclean and inadequate drinking water supply in Lebanon (26). There is a further need to consider how factors such as food insecurity in Lebanon (25) can impact upon food safety perceptions and practices of consumers.

Considering the potential broad scope of food safety perceptions, the specific perceptions of risk, control, and responsibility should be explored among consumers for components of food safety such as personal hygiene, safe handling and preparation of food, prevention of cross-contamination, cleaning procedures, refrigerated storage, and cooking temperatures. Given the quantitative nature of the present study, subsequent qualitative exploration of risk, control, and responsibility perceptions is vital among Lebanese consumers. This is in agreement with other recent research in the area, suggesting a need for more research in the Arab region to understand the determinants of risk perceptions by considering psychological factors on the risk to health (37). Likewise, potential relationships between perceptions of risk and levels of trust and understanding of the food chain and how it is regulated should be considered and explored (43).

## CONCLUSIONS

This is the first study to explore the perceptions of risk, control, responsibility, and hygiene consciousness among a group of consumers in Lebanon. Participants in this study perceived themselves to have high levels of control and responsibility for food safety and high levels of hygiene

consciousness, all of which were significantly associated with low levels of risk. Completion of the study has demonstrated that the respondents exhibited perceptions of invulnerability, optimistic bias, illusion of control, and superiority bias. Such findings are of particular importance to food safety educators and policy makers in Lebanon: if such perceptions and biases exist among the wider population in Lebanon, these perceptions may undermine food safety education attempts; therefore, consideration to such perceptions must be given when developing future interventions to overcome and enhance food safety. The most important finding of this study is the discovery that negative food safety encounters, such as experiencing foodborne illness, can have a negative impact upon perceptions of risk, control, and responsibility to prevent reoccurrence of the negative experience. The cumulative findings from this study make recommendations for future research in the region and have important considerations for the future development of consumer food safety educational resources for consumers in Lebanon.

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