

ARTICLE

DOI: 10.22239/2317-269X.00581

# Risk perception by food handlers in the tourism sector

## Percepção de risco por manipuladores de alimentos do setor de turismo

**Marcel Levy de Andrade\*****Gilma Lucazechi Sturion****Natalie Verónika Rondinel  
Mendoza**

### ABSTRACT

The objective of this study was to evaluate the perception of risk by food handlers in the food services of the tourism sector. One structured methodological instrument was used to analyze the risk perception of 108 food handlers from 19 establishments in a tourist region in the State of São Paulo, Brazil. The highest score was related to the subject “Integrated pest control” and the lowest level was related to “Eating soft-cooked eggs”. Differences ( $p < 0.05$ ) were observed among the levels of risk perception, making it possible to form three sub-groups concerning the questions. The central topic of the first sub-group was safety aspects in food production (I), the second related to sanitation operations (II) and the third to integrated pest control (III). Sub-groups II and III presented the greatest level of perceived risk. Differences ( $p < 0.05$ ) between the level of risk perception and the socio-demographic variables were identified. Women showed greater risk perception compared to men. The results can provide important information for public and private programs, improving development of institutional strategies directed at food safety.

**KEYWORDS:** Perception; Risk; Food Services; Tourism; Food Handlers; Sanitary Surveillance

### RESUMO

O objetivo deste estudo foi avaliar a percepção de risco de manipuladores de alimentos em serviços de alimentação do setor de turismo. Um instrumento metodológico estruturado foi aplicado para avaliar a percepção de risco de 108 manipuladores em 19 estabelecimentos de uma região turística no Estado de São Paulo, Brasil. O maior escore médio entre os níveis de risco percebido foi relacionado ao tema “Controle Integrado de Pragas” e o menor nível a “Comer ovos de gema mole”. Diferenças ( $p < 0,05$ ) foram observadas entre os níveis de percepção de risco, possibilitando a formação de três subgrupos em relação ao conjunto de questões. O tema central do primeiro subgrupo está relacionado aos aspectos de segurança na produção de alimentos (I), o segundo, as operações de higiene (II) e o terceiro ao controle integrado de pragas (III). Os subgrupos II e III apresentaram maior nível de risco percebido. Foram identificadas diferenças ( $p < 0,05$ ) entre o nível de risco percebido e as variáveis sociodemográficas. As mulheres apresentaram maior nível de risco percebido do que os homens. Os resultados podem fornecer informações importantes para programas públicos e privados, visando o desenvolvimento de estratégias institucionais direcionadas à segurança dos alimentos.

**PALAVRAS-CHAVE:** Percepção; Risco; Serviços de Saúde; Turismo; Manipuladores de Alimentos; Vigilância Sanitária

Universidade de São Paulo (USP),  
Piracicaba, SP, Brasil

\* E-mail: [ml\\_andrade@yahoo.com.br](mailto:ml_andrade@yahoo.com.br)

Received: May 07, 2015

Approved: Aug 04, 2016



## INTRODUCTION

The number of meals eaten away from home is expanding in Brazil<sup>1</sup>, increasing from 24.0% to 31.0% in the period between 2002 and 2010<sup>2,3</sup>. The tendency observed in Brazil is still below the European and North American indexes, where this sector is responsible for 50.0% to 60.0% of food consumption<sup>1</sup>.

Currently eating away from home in Brazil has reached indexes of 34.0%, and the sector consists of production units of different organizational sizes and types including commercial, industrial and institutional restaurants, fast-foods and other food services<sup>1</sup>.

In Brazil the participation of tourism in the national Gross Internal Product (GIP) triplicated from 2003 to 2012, and in 2013 the billing grew 4.8% in this sector, twice that of the GIP of the services sector<sup>4</sup>. This growth can be justified by the insertion of the country in the international agenda for great events, such as the FIFA World Cup in 2014 and the Olympic Games in 2016<sup>5</sup>.

The majority of the food services in the country are micro and small sized, including those involved with tourism<sup>6</sup>. These companies have difficulties in developing food security directed programs due to deficiencies in financial, human and infrastructure resources<sup>7,8</sup> and such conditions give rise to problems related to inadequate sanitation practices. Studies show that food poisoning outbreaks are associated with unsatisfactory knowledge of food handlers concerning adequate hygiene practices<sup>7,9,10,11,12</sup> in the food services of hotels<sup>8,13</sup> and in the tourism sector in general<sup>14,15</sup>.

The World Health Organization (WHO) estimates that foodborne diseases (FBD) constitute one of the most widespread sanitation problems in the world<sup>16</sup>. In the USA and Europe the majority of food poisoning outbreaks occur in food services<sup>17,18</sup>. In Brazil the majority occurred in residences, followed by restaurants, involving predominantly mixed foods and egg-based formulations<sup>19</sup>.

*Codex Alimentarius* defines risk as the probability of danger occurring and its severity<sup>20</sup>. Thus, the evaluation of risk perception by food handlers in the food service is important in order to elucidate behavior that could favor food contamination. Perception can be defined as the result of the interaction of two types of data: the physical stimuli of the external environment and the internal stimuli, which constitute predispositions based on previous experience. The perception of risk suggests that individuals are subject to cognitive biases such that the risks perceived are frequently incompatible with the information concerning the objective risk<sup>21</sup>.

The majority of the personality behaviors and traces of an individual are culturally evaluated, and hence some types of behavioral conduct can be considered more desirable than others<sup>22</sup>. Methods have been developed to quantify the degree of a socially desirable response, which allows one to identify and minimize measurement biases in self-reported surveys<sup>23,24</sup>, such as the Marlowe-Crowne scale<sup>25</sup>.

Studies related to risk perception by food handlers in food services in the tourism sector represent a gap in the literature. Considering the above, the objective of the present study was to evaluate the risk perception by agents involved in food safety in the tourism sector.

## METHOD

The research was carried out in meal producing units (MPU) of hotels located in the interior of the State of São Paulo in a region composed of two municipalities here designated as Municipality A and Municipality B, considered as tourist resorts according to the regulatory classification<sup>26</sup>.

This work was approved by the Ethics Committee for Research with Human Beings of the "Luiz de Queiroz" School of Agriculture of the University of São Paulo, Brazil (Protocol n° 123/2013).

### Survey instrument

A questionnaire was elaborated as methodological instrument based on the one used by Frewer et al.<sup>27</sup> and Cunha et al.<sup>28</sup>, who considered the five keys of the WHO<sup>20</sup> and National normative acts<sup>29,30</sup> (federal and state). They also considered the main non-conformities found in food services as registered by the Food and Drug Administration<sup>31</sup> report and by surveys carried out by other authors working in this sector<sup>10,13,32,33,34,35,36,37,38</sup>.

The questionnaire contemplated aspects related to safety during production and during the sanitation and storage operations of the foods. Each question (Q) started with the phrase "What is the risk of a client contracting a foodborne disease" followed by the subsequent: Q1 - if the food handler stores raw or cooked meats at room temperature; Q2 - if the handler takes advantage of leftovers from one meal in a later meal; Q3 - if one consumes non-sanitized raw vegetables; Q4 - if one consumes incompletely cooked meat; Q5 - if one consumes soft-cooked egg-white or egg-yolk; Q6 - when a sick worker handles the food; Q7 - when a worker responsible for preparing meals does not sanitize his/her hands; Q8 - when raw foods are in contact with prepared foods; Q9 - when there is no quality control of the water used in the preparations; Q10 - when there is no sanitization of the environment, equipment and utensils; Q11 - when rodents, cockroaches and flies, amongst others, are found in the installations.

The responses were given using a structured scale with values from 1 = "no risk" to 7 = "very high risk". The handlers placed an "X" on the scale to indicate the degree of risk considered for each situation.

Another questionnaire, together with a version of the Marlowe-Crowne scale<sup>25</sup>, adapted and validated for the Brazilian reality by Gouveia et al.<sup>39</sup>, was used to evaluate social desirability. The questionnaire was composed of 20 (score from 0 to 20)<sup>40</sup> items involving both behavior considered socially desirable but



with little probability of occurring, and undesirable, more probable behavior<sup>39</sup>. For each question, the agents were requested to mark either “true” or “false”, according to their normal behavior. The questionnaire also included items for the socio-demographic characterization of the population studied.

### Definition of the sample

The definition of the survey universe was based on the number of accommodation companies in the region studied, extracted from documents made available by the Municipal Secretariats of Tourism of the municipalities involved. The companies were classified according to the typologies of the hotels and inns. The size was defined by the number of employees, according to the *Serviço de Apoio às Micro e Pequenas Empresas*<sup>41</sup> classification for services companies, as follows: up to 9 employees is a micro-company; from 10 to 49 is a small company; from 50 to 99 is a medium company; and with more than 100 employees is a large company.

Municipality A was composed of 11 hotels and 6 inns; municipality B of 6 hotels and 14 inns; all the companies were invited to take part in the survey. Of the hotels and inns in Municipality A, 72.3% and 16.6%, respectively, opted to take part; in Municipality B, 85.7% and 35.7%, respectively, for the same typologies, opted to take part. This gave a grand total of 108 food handlers in 19 meal producing units.

### Data collection

Data were collected and tabulated for the statistical analysis using the Statistical Package for the Social Sciences - SPSS Statistics (version 2013.22.0). The questionnaires were applied during previously programmed visits to the establishments between the months of July and December, 2013, this being the period of greatest tourist demand in the region.

The questions were responded by the handler in the presence of a researcher, so that the latter could clear up any doubts.

### Statistical analysis of the data

The perception data did not follow a normal distribution (Kolmogorov-Smirnov test). The Friedman test, followed by the Nemenyi paired multiple comparison test were applied to examine the differences between the risk perception questions. The Mann-Whitney U test (for 2 groups of independent variables) and the Kruskal-Wallis test (for more than 3 groups of independent variables) followed by Dunn's multiple paired comparison test were used to check for differences between the risk level perceived in relation to the socio-demographic variables

In order to identify the tendencies of the individuals for social desirability as a function of the socio-demographic variables, the following parametric tests were carried out (based on the fact that the desirability data followed a normal distribution according to the Kolmogorov-Smirnov test): the student t test for independent samples for the variables of gender, education in the food area and training in hygiene; and ANOVA,

followed by the Tukey multiple comparisons test for the other socio-demographic variables. The non-parametric Spearman correlation coefficient test was also used. A 5% significance level was used in all the tests.

## RESULTS AND DISCUSSION

The questionnaires used in the present study were considered satisfactory according to that explained by Hair et al.<sup>42</sup> in relation to the reliability of the groups of questions, using Cronbach's Alpha ( $\alpha$ ) coefficient for the items of risk perception evaluated (Cronbach's  $\alpha = 0.774$ ) and social desirability (Cronbach's  $\alpha = 0.644$ ), with indices above 0.6 for these variables.

### Population characterization and social desirability

With respect to the socio-demographic characterization, the female gender (63.9%) predominated, aged between 26 and 40 years old (34.3%) in the sample of 19 companies in the tourist area. The predominance of females amongst the food handlers can possibly be justified by social inheritance in work relationships. Kahne<sup>43</sup> reported that women are more easily employed in work similar to domestic activities, such as cooking, for example. With respect to function, the following took part in the survey: 36.1% kitchen helpers, 32.4% cooks and confectioners, 26.8% waiters and butlers and 4.7% of individuals with technical-administrative functions, who had predominantly (58.3%) worked for more than 1 year in the companies and whose educational level was below that of complete middle school (51.9%), family income between one and two minimum salaries (35.2%), not educated in the food area (73.1%), but who had taken part in food hygiene training (54.6%) in the previous year. The majority of the employees who took part in this survey worked in small or large companies, and only 22.3% in micro-companies. A total of 56.5% were from Municipality A and 43.5% from Municipality B (Table 1).

Studies concerning food services in Brazil have shown a low educational level amongst food handlers<sup>9</sup>, as in other developing<sup>32,44</sup> and developed<sup>45</sup> countries.

The tendencies for social desirability, the means obtained were within normality<sup>25</sup>. The values found for the socio-demographic variables of the handlers were not statistically different ( $p < 0.05$ ).

### Risk perception

Social desirability did not influence the responses of the interviewees with respect to risk perception, since no correlation ( $p < 0.05$ ) was found between the two variables.

A mean score of 6 to 7, considered as high or very high risk according to the scale used, was attributed by most of the respondents (Figure).

Based on Figure it can be seen that almost half of the handlers (49.1%) considered “eating soft-cooked eggs” (Q5) to represent



a high risk in spreading foodborne diseases to the clients, and more than half considered the same for the questions concerning “making use of leftovers” (Q2), “cooking temperature” (Q4) and

“cross contamination” (Q8). For the subjects “storage at room temperature” (Q1) and “eating non-sanitized vegetables”, the percentages were relatively higher (about 65.0%).

**Table 1.** Distribution of the population surveyed as a function of socio-demographic characteristics and tendency for social desirability.

Socio-demographic characteristics	n	%	Social desirability (n = 108) <sup>a</sup>	
			Mean <sup>b,c</sup>	p-value
<b>Municipalities</b>				
Employees in municipality A	61	56.5	13.13A	0.447
Employees in municipality B	47	43.3	13.51A	
<b>Company size</b>				
Micro-company	24	22.2	12.92A	0.261
Small company	46	42.5	13.00A	
Large company	38	35.1	13.89A	
<b>Age range (years)</b>				
18 to 25	28	25.9	13.21A	0.872
26 to 40	37	34.3	13.21A	
41 to 55	29	26.8	13.24A	
over 55	14	13.0	13.78A	
<b>Gender</b>				
Male	39	36.1	13.56A	0.415
Female	69	63.9	13.14A	
<b>Function/Position</b>				
Cook	32	29.6	13.25A	0.075
Kitchen helper	39	36.1	13.71A	
Butler	4	3.7	12.00A	
Waiter	24	23.1	13.40A	
Stock keeper	3	2.8	13.66A	
Buyer	2	1.9	9.00A	
Confectioner	3	2.8	11.66A	
<b>Service time in company (years)</b>				
Up to 1	45	41.7	13.57A	0.810
1 to 3	32	29.6	12.87A	
3 to 5	12	11.1	13.00A	
More than 5	19	17.6	13.52A	
<b>Education</b>				
Incomplete basic education	26	24.1	13.42A	0.534
Complete basic education	16	14.8	12.87A	
Incomplete middle education	14	13.0	13.35A	
Complete middle education	34	31.1	13.70A	
Incomplete higher education	7	6.5	13.14A	
Complete higher education	8	7.4	11.75A	
Post-graduation	3	2.8	14.00A	
<b>Salary range (minimum salaries)<sup>d</sup></b>				
1 to 2	38	35.2	13.68A	0.672
2 to 3	27	25.0	14.11A	
3 to 6	33	30.6	12.33A	
6 to 10	2	1.9	14.00A	
Does not know/does not want to say	8	7.4	12.50A	
<b>Education in the food area</b>				
No	79	73.1	13.31A	0.893
Yes	29	26.9	13.24A	
<b>Training in hygiene</b>				
No	49	45.4	13.16A	0.625
Yes	59	54.6	13.40A	
<b>When took training in hygiene</b>				
Never	49	45.4	13.16A	0.382
6 months to a year ago	38	35.2	13.71A	
Over a year ago	21	19.4	12.85A	

<sup>a</sup>Analyses carried out based on information obtained from 108 food handlers. <sup>b</sup>Values vary from 0 to 20. <sup>c</sup>Means with the same letters do not differ for each socio-demographic variable. <sup>d</sup>Minimum salary of R\$ 678,00 (US\$ 289.74) at time survey took place.

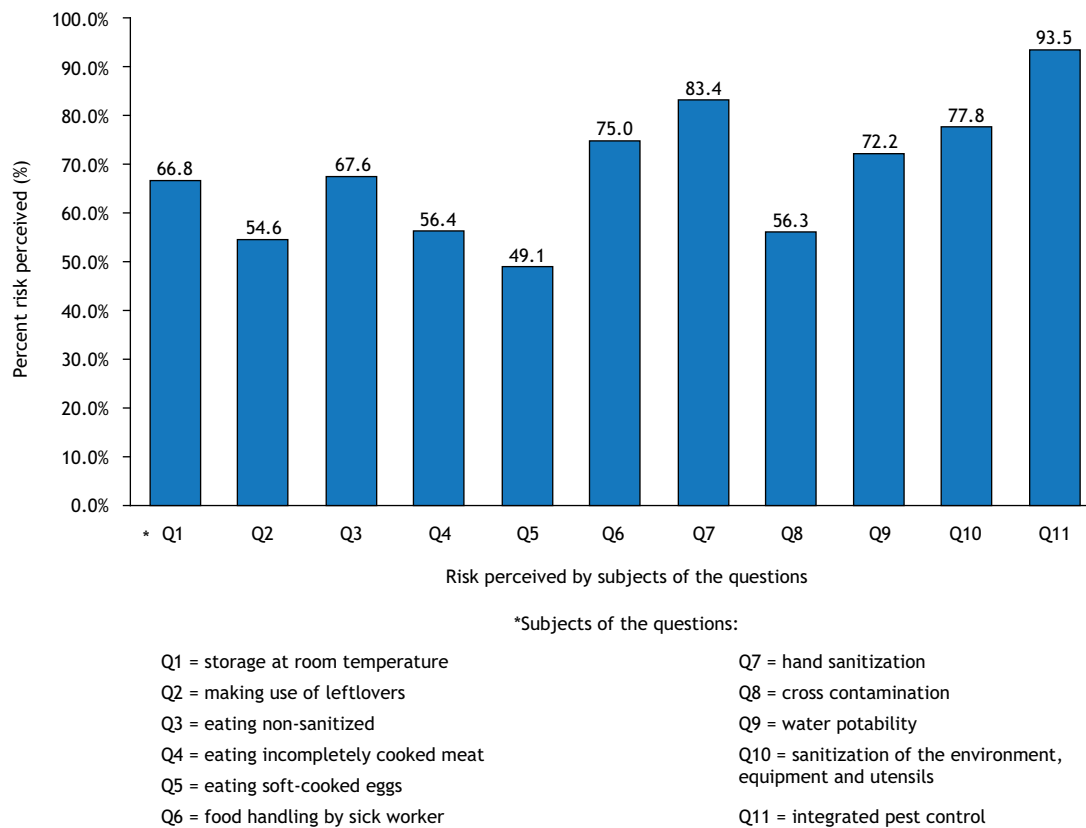


Figure. Percent frequency of the respondents who perceived risk levels between high and very high according to the questions studied.

On evaluating food handlers in state schools, Cunha et al.<sup>28</sup> showed that the highest percentages of perceived risk were related to “consumption of soft-cooked eggs” (64.8%), “making use of leftovers” (68.2%), “cooking temperature” (81.8%) and “cross contamination” (75.0%), values superior to those found in the present study. In this same study by Cunha et al.<sup>28</sup>, the lowest percentages were related to “eating non-sanitized raw vegetables” (34.1%) and “serving food at room temperature” (44.3%). These results demonstrate that differences in the level of risk perception can occur as related to food safety, depending on the type of service analyzed and on the history of occurrences in the sector, highlighting the importance of continuous training of the handlers as a factor that is also conditioning.

In the present study, the lower percentages of respondents perceiving high risk in relation to questions involving eggs, cross contamination, leftovers and cooking temperatures could indicate a lack of knowledge and training in the area. The reports of various handlers concerning the preference of clients for soft-cooked eggs and the habit and family belief that this procedure represents no health risk, could explain the lower level of perception in relation to this type of risk.

There is a variety of evidence in the literature both in Brazil and other countries, showing that the main food poisoning outbreaks are more associated with eggs and egg-based products (salmonellosis outbreaks)<sup>19,46,47</sup>. According to estimates by the Centers for Disease Control and Prevention (CDC), *Salmonella* is the main

pathogen in terms of deaths and hospitalizations, being one of the few foodborne pathogens that has not decreased over the last 10 years<sup>47</sup>. When the presence of any serotype of *Salmonella* is observed in the reproductive tract of chickens during egg formation in the oviduct or on the eggshell, this can subsequently contaminate the interior of the egg<sup>48</sup>. A study reviewing work carried out in various countries<sup>34</sup> demonstrated that the percent contaminated with *Salmonella* varied between 0.04% and 9.0% on the shell and between 0.5% and 1.8% on the inside. Despite the high incidence of this microorganism in batches of laying birds, the occurrence of contaminated eggs (shell and inside) was relatively low, but its presence can represent health risks if preventative measures are not adopted<sup>49</sup>.

In general, food poisoning outbreaks are associated with unsatisfactory knowledge of food handlers concerning adequate hygiene practices in the different branches of food services such as restaurants<sup>9,36,37</sup>, catering<sup>7,38</sup>, institutions<sup>10,32,33,35</sup>, hotels<sup>8,13</sup> and consumers<sup>34</sup>. This fact denotes the need for continuous training in hygiene in the handling of foods for agents involved in the sector, and for public organs and sanitary authorities to offer actions involving education and awareness aimed at the preparation and consumption of safe foods, as a form of support to companies and consumers<sup>50,51</sup>.

In the present study the questions presenting the greatest percentages of risk perceived as between high and very high were the subjects “food handling by sick worker” (Q6), “hand sanitization”



(Q7), “water potability” (Q9), “sanitization of the environment, equipment and utensils” (Q10) and “integrated pest control” (Q11).

Studies evaluating food handlers with respect to their knowledge and practice of adequate hygiene in food services showed that, in general, the percentages in relation to aspects of hygiene were greater than those related to food preparation<sup>9,10,35,45,52</sup>. However, the authors highlighted the fact that in relation to hand sanitization, the handlers knew that the lack of this procedure could lead to risks, but part of the handlers had no knowledge of the need for a disinfection step<sup>53,54</sup> or of the correct technique and frequency to carry it out<sup>9</sup>, even though this was a subject always highlighted in training for this public concerning food safety<sup>50</sup>. In addition, Gomes-Neves et al.<sup>33</sup> and Martins et al.<sup>35</sup> showed a lack of knowledge by handlers about how microorganisms are transported to foods and also about the form of identification of possible contamination by sensory aspects such as appearance and odor. The survey carried out by these authors concerning handler knowledge was corroborated by the results found in the present study concerning the percentages in the levels of risk perception regarding food safety, principally for the questions related to production aspects (Q1, Q2, Q4, Q5 and Q8).

Another factor that could explain the lower percentage of risk perception amongst the questions concerning production is founded in the concept of perception itself, basically on three conditions: the conception of the object, and the belief and the immediacy of its existence<sup>55</sup>. The perception of the risk involved in eating soft cooked eggs could have been less evident than the question involving pests, since the presence of microorganisms is less perceptible to the sensory organs. The presence of pests is more perceptible to the sensory organs and their conception and the belief in their existence are immediate and can provide the conviction to the handlers that they present a greater risk of contaminating the food than eating soft cooked eggs, for example.

The results found by Hanson and Benedict<sup>56</sup> and by Meysenburg et al.<sup>57</sup> reinforce the idea that a lack of belief, of experience of food poisoning (personal or family) and of knowledge are factors relevant to low risk perception in questions of food handling.

In the present study, the fact that the individuals considered questions related to meal preparations to have a lower risk level, could presuppose a conviction that FBD rarely happen in their work environment. This situation is indicated in the literature as an “optimistic bias” and a cognitive error<sup>27,58</sup>. Weinstein<sup>58</sup>, and Lion et al.<sup>59</sup> believe that the discrepancy between risk perception and the behavior of an individual or of the collectivity could also be related to a sentiment of control over the reality perceived, due to a limited knowledge concerning the risks, as proven by Meysenburg et al.<sup>57</sup>.

From the statistical analysis, it is possible to notice a grouping of subjects of the questions and a random setting of 3 subgroups. The Table 2 presents differences ( $p < 0.05$ ) between the group of questions and the levels of risks perceived by the respondents, allowing for the formation of subgroups. The main subgroup is related to questions Q1, Q2, Q4, Q5 and Q8; the second to Q3, Q6, Q7, Q9 and Q10; and the third to Q11. The reason for the formation of subgroups seems to be inter-related with the perceived levels of risk and to the different subjects in question.

The central topic of the questions in subgroup I was related to aspects of safety in food preparation; in of subgroup II to aspects related to hygiene operations; and in subgroup III to integrated pest control. Q1 (aspects of food preparation) and Q3 (aspects of hygiene) were analyzed in different subgroups since, although both presented the same perception level (5.7), they did not present differences when compared to the other questions (with the exception of Q11).

On analyzing the categories of the means of the questions, it can be seen that subgroup I obtained a lower level of perceived risk than subgroup II. Thus one can infer that the aspects of preparation were less perceptible than those of hygiene to the handlers.

**Table 2.** Differences in the levels of risk perceived between the subgroups of questions by the respondents.

Risk perception questions	Differences in the levels of risk perceived by the respondents				
	Mean Rank <sup>a,b,c</sup>	p-value	Mean Rank <sup>b,c,d,e</sup>	p-value	
Subgroup I <sup>d</sup>	Q5	4.6A	< 0.000*	2.7A	0.039*
	Q2	4.7AB		2.8AB	
	Q4	5.2ABC		3.0AB	
	Q8	5.2ABCD		3.0AB	
	Q1	5.7ABCDE		3.2B	
Subgroup II <sup>e</sup>	Q3	5.7ABCDE		2.7A	0.002*
	Q9	6.0BCDE		2.8AB	
	Q10	6.4CDE		3.0AB	
	Q6	6.5DE		3.0AB	
	Q7	7.1E		3.3B	
Subgroup III	Q11	8.2F		f	f

<sup>a</sup>Values correspond to the Mean Rank of the levels of risk perceived for the group consisting of all the questions evaluated.

<sup>b</sup>The same letters do not present significant differences.

<sup>c</sup>Data analyzed by Friedman’s test and Nemenyi’s multiple comparison test.

<sup>d</sup>Values correspond to the Mean Rank of the levels of risk perceived for the group of questions Q5, Q2, Q4, Q8 and Q1 of subgroup I.

<sup>e</sup>Values correspond to the Mean Rank of the levels of risk perceived for the group of questions Q3, Q9, Q10, Q6 and Q7 of subgroup II.

<sup>f</sup>Data not calculated.

\*Significance level of 5% between the means of the risks.





Significant differences were observed between Q11 and the other questions. The subject “hand sanitization” (Q7) of subgroup II presented differences ( $p < 0.05$ ) with respect to the subjects “making use of leftovers” (Q2), “cooking of meat and eggs” (Q4 and Q5) and “cross contamination” (Q8) of subgroup I. The subjects concerning “food handling by sick worker” (Q6) and “sanitization of the environment, equipment and utensils” (Q10) of subgroup II presented differences when compared to Q2 and Q5 of subgroup I.

Corroborating with the information found in the present study, Osaili<sup>36</sup> evaluated food handlers with respect to knowledge concerning hygiene, and found that about 90.0% of the sample presented better results in relation to the subject “hand sanitization” when compared to “cross contamination” (72.9%), “making use of leftovers” and “cooking temperatures for foods” (52.6%). They also observed greater knowledge concerning health problems that affected food safety (60.4%) when compared to those related to the use of leftovers and the cooking temperatures of foods. It is important to take in consideration that the mentioned less known procedures have a fundamental importance to the food safety, once they are usually related to food poisoning outbreaks.

Meysenburg et al.<sup>57</sup> showed that hand washing was reported as the most common practice to prevent foodborne diseases (96.0%) when compared to other aspects of food hygiene. McIntyre et al.<sup>45</sup>

showed greater knowledge by trained and non-trained food handlers of both sexes in the evaluation of questions involving sanitization of the hands and utensils when compared to those related to use of leftovers, adequate cooling and heating of foods, control of cooking time and temperature and distribution.

The subgroups were also analyzed in an independent way, observing differences ( $p < 0.05$ ) between Q5 and Q1 ( $p = 0.039$ ) of subgroup I and between Q3 and Q7 ( $p = 0.002$ ) of subgroup II. Thus it can be seen that the perception of risk concerning “eating soft cooked eggs” was less than that for “storing foods at room temperature”. Similarly, the perception of risk for “eating non-sanitized salads” was less than that for “lack of hand sanitization”.

When the socio-demographic variables of the respondents were correlated with the level of risk perception, it was observed that individuals educated in the food area presented higher levels for the questions concerning “storing meat at room temperature” (Q1) and “eating soft cooked eggs” (Q5). Women presented greater risk perception than men for the questions “making use of leftovers” (Q2) and “eating raw salads without sanitization” (Q3). Women and individuals educated in the food area perceived the risks related to water potability (Q9) more than men, corroborating the findings of Lazou<sup>10</sup> and Gomes-Neves<sup>33</sup>. Contracted employees educated in the food area presented a

**Table 3.** Comparison between the groups of socio-demographic variables of the agents involved, as a function of the levels of risk perception for questions 1, 2, 3 and 5.

Variables	Risk levels perceived <sup>a,b</sup>							
	Q1		Q2		Q3		Q5	
	Mean scale	p-value	Mean scale	p-value	Mean scale	p-value	Mean scale	p-value
<b>Employees</b>								
Municipality A (n = 61)	5.7A	0.440	4.8A	0.117	5.5A	0.906	5.0A	0.542
Municipality B (n = 47)	5.4A		4.3A		5.8A		4.9A	
<b>Gender</b>								
Male (n = 39)	5.4A	0.772	4.6A	0.010*	5.1A	0.022*	5.0A	0.932
Female (n = 69)	5.7A		5.5B		5.9B		5.0A	
<b>Age (years)</b>								
18 to 25 (n = 28)	5.3A	0.266	4.9A	0.713	5.4A	0.797	4.8A	0.590
26 to 40 (n = 37)	5.7A		5.3A		5.6A		5.3A	
41 to 55 (n = 29)	5.8A		5.1A		5.6A		4.9A	
over 55 (n = 14)	5.3A		5.3A		6.0A		4.7A	
<b>Time of service in company (years)</b>								
Up to 1 (n = 45)	5.4A	0.475	5.2A	0.888	5.5A	0.749	5.3A	0.554
1 to 3 (n = 32)	6.0A		5.3A		5.8A		5.0A	
3 to 5 (n = 12)	5.3A		5.2A		5.1A		4.5A	
Over 5 (n = 19)	5.4A		4.8A		5.9A		4.5A	
<b>Type of contract</b>								
Contracted (n = 103)	5.6A	0.579	5.2A	0.057*	5.7A	0.343	5.0A	0.697
Temporary <sup>c</sup> (n = 5)	5.2A		3.2B		4.6A		5.0A	
<b>Educated in food area</b>								
No (n = 79)	5.3A	0.001*	5.0A	0.473	5.5A	0.228	4.7A	0.003*
Yes (n = 29)	6.3B		5.4A		6.0A		5.8B	
<b>Carried out training in hygiene</b>								
Never or over a year ago (n = 70)	5.5A	0.074	5.1A	0.413	5.5A	0.319	4.8A	0.170
From 6 months to a year ago (n = 38)	5.8A		5.2A		5.9A		5.3A	

<sup>a</sup>Results expressed on a 7-point scale where 1 = no risk and 7 = very high risk.

<sup>b</sup>Means with the same letters between each risk perception question and the socio-demographic variables, means they do not present significant differences at 5%.

<sup>c</sup>Temporary work. \*Significance level of 5% between the means scale of the risks.



higher level of risk perception than employees with temporary contracts (Tables 3 and 4) with respect to a lack of environmental, equipment and utensil hygiene (Q10). Cho<sup>52</sup> reported that in general temporary employees had no training in hygiene and were not trained before starting to work there, which could explain the lower levels of risk perceived by these workers. No differences were observed ( $p < 0.05$ ) between the socio-demographic variables and the perception of risks related to “eating incompletely cooked meat” (Q4), “handling by sick worker” (Q6) and “integrated pest control” (Q11) (data not shown).

For the risk “food contamination due to a lack of hand sanitization” (Q7) there were differences with respect to gender and time of service in the company, that is, men and individuals with up to 1 year of service perceived a lower level of risk when compared to women and individuals with 3 to 5 years of service, similar to that found by McIntyre et al.<sup>45</sup> and Gomes-Neves et al.<sup>33</sup>. However, Cunha et al.<sup>9</sup> found insufficient knowledge by both genders with respect to the practice and frequency of sanitizing the hands. In addition, Green et al.<sup>60</sup> reported that frequently the techniques are not correctly carried out due to: the low risk perception by the handlers concerning sanitization of the hands; a lack of a place to carry out this procedure; or an overload of work.

The variables of gender, age and training in hygiene were significant for cross contamination (Q8). Women, individuals aged between 26 and 40 and recently trained in hygiene showed greater levels of risk perception when compared to individuals between 18 and 25 who were never trained in hygiene or were but more than a year ago, similar to results found by Cunha et al.<sup>9</sup>, Martins et al.<sup>35</sup> and Pichler et al.<sup>38</sup>.

Gomes-Neves et al.<sup>33</sup> pointed out that programs for education in hygiene will only have a positive effect on individual and organizational performance if knowledge, attitudes and practices (KAP) are stimulated together, a fact also verified by Cunha et al.<sup>9</sup>. In addition, McIntyre et al.<sup>61</sup> reported that training should be carried out with established periodicity (every 6 months or up to once a year) since the KAP decrease with time and could represent a risk to consumers. National normative acts (federal and state) do not consider such periodicity<sup>29,30</sup>.

No difference was observed between the educational and income levels and the risk perception questions. Only Q1 showed a weak positive correlation ( $r = 0.223$ ) in relation to scholastic level, indicating that individuals with a higher level of education showed greater perception of the risks involved in “storing foods

**Table 4.** Comparison between the groups of socio-demographic variables of the agents involved, as a function of the levels of risk perception for questions 7, 8, 9 and 10.

Variables	Risk levels perceived <sup>a,b</sup>							
	Q7		Q8		Q9		Q10	
	Mean scale	p-value	Mean scale	p-value	Mean scale	p-value	Mean scale	p-value
<b>Employees</b>								
Municipality A (n = 61)	5.7A	0.928	5.2A	0.076	5.9A	0.384	6.0A	0.635
Municipality B (n = 47)	6.3A		5.8A		5.7A		6.1A	
<b>Gender</b>								
Male (n = 39)	5.8A	0.010*	5.1A	0.033*	5.2A	0.009*	5.7A	0.075
Female (n = 69)	6.4B		5.7B		6.1B		6.2A	
<b>Age (years)</b>								
18 to 25 (n = 28)	5.8A	0.069	5.0A	0.010*	5.5A	0.180	5.8A	0.415
26 to 40 (n = 37)	6.1A		5.8B		5.8A		6.0A	
41 to 55 (n = 29)	6.6A		5.8AB		6.3A		6.3A	
over 55 (n = 14)	6.3A		5.1AB		5.7A		6.0A	
<b>Time of service in company (years)</b>								
Up to 1 (n = 45)	5.9A	0.047*	5.2A	0.360	5.7A	0.245	5.8A	0.405
1 to 3 (n = 32)	6.4AB		5.7A		6.3A		6.4A	
3 to 5 (n = 12)	6.5B		5.7A		5.4A		5.9A	
Over 5 (n = 19)	6.4AB		5.7A		5.6A		6.1A	
<b>Type of contract</b>								
Contracted (n = 103)	6.3A	0.144	5.5A	0.190	5.9A	0.226	6.1B	0.050*
Temporary <sup>c</sup> (n = 5)	4.8A		4.6A		4.6A		4.6A	
<b>Education in food area</b>								
No (n = 79)	6.1A	0.109	5.4A	0.269	5.7A	0.040*	5.9A	0.015*
Yes (n = 29)	6.4A		5.7A		6.2B		6.4B	
<b>Carried out training in hygiene</b>								
Never or over a year ago (n = 70)	6.1A	0.103	5.1A	0.001*	5.7A	0.180	5.9A	0.356
From 6 months to a year ago (n = 38)	6.5A		6.2B		6.0A		6.2A	

<sup>a</sup>Results expressed on a 7-point scale where 1 = no risk and 7 = very high risk.

<sup>b</sup>Means with the same letters between each risk perception question and the socio-demographic variables, means they do not present significant differences at 5%.

<sup>c</sup>Temporary work.

\*Significance level of 5% between the means scale of the risks.





at room temperature” than those with lower levels, a fact also observed in school meals services<sup>28</sup>.

Women showed higher levels of risk perception than men. Lordelo et al.<sup>62</sup> explains the differences related to gender with respect to risks based on the human evolution theory, which predicts differences according to the domain evaluated (environmental challenge, mating and resources, intergroup competition, fertility and reproduction). Similarly studies related to health found differences between the genders, and verified that women showed lower frequencies than men in risky behaviors<sup>63</sup>. Other study indicated greater involvement of men than of women in risky behaviors and situations, especially when considering age, history of the individual’s life and cultural particularities<sup>64</sup>. Lordelo et al.<sup>62</sup> affirmed that risk behavior is oriented by certain regularities and should be defined in relation to different ambiances, with consequences on the behavioral results.

## CONCLUSIONS

Based on the facts exposed by this survey, it can be inferred that the lowest levels of risk perception by food handlers concerned “eating soft-cooked eggs” (Q5), “making use of leftovers” (Q2), “cooking temperature” (Q4) and “cross contamination” (Q8), which represents important barriers to food safety and reinforces the lack of knowledge and consciousness about the subject. The formation

of subgroups amongst the risk perception questions could also be observed, with the conclusion that the respondents perceived less risks for the questions related to food preparation than for those related to operational hygiene and integrated pest control. In addition, women showed a greater level of risk perception than men.

The results indicate a worrying scenario related to food safety in the tourism sector. Moreover, they point to the need for a greater sanitary fiscalization and for the development of public policies that consider educational actions to adjust this sector, as realized in commercial and institutional restaurants around the country.

Despite the sample have been a non-probabilistic one and the survey have been conducted just in a touristic region of the São Paulo state - which limits the results generalization -, the compilation of several aspects can be considered in future studies to identify differences on risks of food safety in hotels between regions.

The authors hope that the methodological instruments for the analysis of risk perception by handlers in food services in the tourism sector presented and discussed in the present research, contribute to minimizing the lack of information concerning this subject. In addition, they hope the results contribute to the development of public programs aimed to help the sector have a better understanding of the behavior of handlers in the operations that represent health risks to the consumers.

## REFERENCES

1. Associação Brasileira das Indústrias de Alimentos - ABIA. Mercado de food service. In: 7º Congresso Internacional de Food Service; 2014[cited 2015 Mar 31] Sep 17, São Paulo, BR. Available from: <http://www.abia.org.br/cfs2014/mercado.aspx>
2. Instituto Brasileiro de Geografia e Estatística - IBGE. Pesquisa de orçamentos familiares 2008-2009: despesas, rendimentos e condições de vida. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística; 2010.
3. Instituto Brasileiro de Geografia e Estatística - IBGE. Pesquisa de Orçamentos Familiares 2002-2003: primeiros resultados. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística; 2004.
4. Ministério do Turismo (BR). Brasil comemora avanços no Dia Mundial do Turismo Brasília, DF: Ministério do Turismo; 2013[cited 2015 Mar 31]. Available from: [http://www.turismo.gov.br/turismo/noticias/todas\\_noticias/20130925-1.html](http://www.turismo.gov.br/turismo/noticias/todas_noticias/20130925-1.html)
5. Brasil. Portal da Copa. Brasil terá pelo menos 422 novos empreendimentos de hospedagem até 2016. Brasília, DF; 2014[cited 2015 Mar 31]. Available from: <http://www.copa2014.gov.br/pt-br/noticia/brasil-tera-pelo-menos-422-novos-empresendimentos-de-hospedagem-ate-2016>
6. Serviço de Apoio às Micro e Pequenas Empresas - Sebrae. Anuário do trabalho na micro e pequena empresa: 2013. 6a ed. São Paulo: Dieese; 2013.
7. Bolton DJ, Meally A, Blair IS, McDowell DA, Cowan C. Food safety knowledge of head chefs and catering managers in Ireland. *Food Contr.* 2008;19(3):291-300. doi:10.1016/j.foodcont.2007.04.006
8. Ko WH. The relationship among food safety knowledge, attitudes and self-reported HACCP practices in restaurant employees. *Food Contr.* 2013;29(1):192-7. doi: 10.1016/j.foodcont.2012.05.076
9. Cunha DT, Stedefeldt E, Rosso VV. The role of theoretical food safety training on Brazilian food handlers’ knowledge, attitude and practice. *Food Contr.* 2014;43:167-74. doi:10.1016/j.foodcont.2014.03.012
10. Lazou T, Georgiadis M, Pentieva K, McKeivitt A, Iossifidou E. Food safety knowledge and food-handling practices of Greek university students: a questionnaire-based survey. *Food Contr.* 2012;28(2):400-11. doi:10.1016/j.foodcont.2012.05.027
11. Abdullah Sani N, Siow ON. Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. *Food Contr.* 2014;37:210-7. doi:10.1016/j.foodcont.2013.09.036
12. Onyango AO, Kenya EU, Mbithi JJN, Ng’ayo MO. Pathogenic *Escherichia coli* and food handlers in luxury hotels in Nairobi, Kenya. *Travel Med Infect Dis.* 2009;7(6):359-66. doi:10.1016/j.tmaid.2009.07.005
13. Wu SL. Factors influencing the implementation of food safety control systems in Taiwanese international tourist hotels. *Food Contr.* 2012;28(2):265-72. doi:10.1016/j.foodcont.2012.05.038



14. Harris KJ, DiPietro RB, Murphy KS, Rivera G. Critical food safety violations in Florida: relationship to location and chain vs. non-chain restaurants. *Int J Hospit Manag.* 2014;38:57-64. doi:10.1016/j.ijhm.2013.12.005
15. Fletcher SM, Maharaj SR, James K. Description of the food safety system in hotels and how it compares with HACCP standards. *J Travel Med.* 2009;16(1):35-41. doi:10.1111/j.1708-8305.2008.00271.x
16. World Health Organization - WHO. Foodborne diseases. Geneva: World Health Organization; 2015[cited 2015 Mar 31]. Available from: [http://www.who.int/foodsafety/areas\\_work/foodborne-diseases/en/](http://www.who.int/foodsafety/areas_work/foodborne-diseases/en/)
17. Centers for Disease Control and Prevention - CDC. Surveillance for foodborne disease outbreaks United States, 2012: annual report. Atlanta: Department of Health and Human Services; 2014.
18. European Food Safety Authority - EFSA. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2012. *EFSA J.* 2014;12(2):312. doi:10.2903/j.efsa.2014.3547
19. Ministério da Saúde (BR). Vigilância Epidemiológica das Doenças Transmitidas por Alimentos - VE-DTA. Brasília, DF: Ministério da Saúde; 2014[cited 2015 Mar 31]. Available from: [http://www.anrbrasil.org.br/new/pdfs/2014/3\\_PAINEL\\_1\\_ApresentacaoRejaneAlvesVigilanciaEpidemiologica-VE-DTA-Agosto\\_2014\\_PDF.pdf](http://www.anrbrasil.org.br/new/pdfs/2014/3_PAINEL_1_ApresentacaoRejaneAlvesVigilanciaEpidemiologica-VE-DTA-Agosto_2014_PDF.pdf)
20. World Health Organization - WHO. Cinco chaves para uma alimentação mais segura. Geneva: WHO; 2015[cited 2015 Mar 31]. Available from: [http://www.who.int/foodsafety/publications/consumer/en/5keys\\_Portuguese.pdf](http://www.who.int/foodsafety/publications/consumer/en/5keys_Portuguese.pdf)
21. Slovic P. Perception of risk. *Science.* 1987;236(4799):280-5. doi:10.1126/science.3563507
22. Schmitt MJ, Steyer R. A latent state-trait model (not only) for social desirability. *Pers Individ Dif.* 1993;14(4):519-29. doi:10.1016/0191-8869(93)90144-R
23. Kurtz JE, Tarquini SJ, Iobst EA. Socially desirable responding in personality assessment: still more substance than style. *Pers Individ Dif.* 2008;45(1):22-7. doi:10.1016/j.paid.2008.02.01
24. McCrae RR. Well-being scales do not measure social desirability. *J Gerontol.* 1986;41(3):390-2. doi:10.1093/geronj/41.3.390
25. Crowne DP, Marlowe D. A new scale of social desirability independent of psychopathology. *J Consult Psychol.* 1960;24(4):349-54. doi:10.1037/h0047358
26. São Paulo (Estado). Assembléia Legislativa. Lei nº 10.426, de 8 de dezembro de 1971. Estabelece requisitos mínimos para a criação de estâncias. *Diário Oficial Estado São Paulo.* 1971 Dec 9.
27. Frewer LJ, Shepherd R, Sparks P. The interrelationship between perceived knowledge, control and risk associated with a range of food-related hazards targeted at the individual, other people and society. *J Food Saf.* 1994;14(1):19-40. doi:10.1111/j.1745-4565.1994.tb00581.x
28. Cunha DT, Stedefeldt E, Rosso VV. Perceived risk of foodborne disease by school food handlers and principals: the influence of frequent training. *J Food Saf.* 2012;32(2):219-25. doi:10.1111/j.1745-4565.2012.00371.x
29. Ministério da Saúde (BR). RDC nº 216, de 15 de setembro de 2004. Dispõe sobre Regulamento Técnico de Boas Práticas para Serviços de Alimentação. *Diário Oficial União.* 2004 Sep 16.
30. Secretária de Estado da Saúde (SP). Portaria CVS nº 5, de 9 de abril de 2013. Aprova o regulamento técnico sobre boas práticas para estabelecimentos comerciais de alimentos e para serviços de alimentação, e o roteiro de inspeção, anexo. *Diário Oficial Estado São Paulo.* 2013 Apr 19;Seção 1:32-5.
31. U. S. Food and Drug Administration - FDA. FDA Retail Food Program Steering Committee. Report of the FDA retail food program database of foodborne illness risk factors. Silver Spring: U. S. Food and Drug Administration; 2000.
32. Abdul-Mutalib NA, Abdul-Rashid MF, Mustafa S, Amin-Nordin S, Hamat RA, Osman M. Knowledge, attitude and practices regarding food hygiene and sanitation of food handlers in Kuala Pilah, Malaysia. *Food Contr.* 2012;27(2):289-93. doi:10.1016/j.foodcont.2012.04.001
33. Gomes-Neves E, Araújo AC, Ramos E, Cardoso CS. Food handling: comparative analysis of general knowledge and practice in three relevant groups in Portugal. *Food Contr.* 2007;18(6):707-12. doi:10.1016/j.foodcont.2006.03.005
34. Luber P. Cross-contamination versus undercooking of poultry meat or eggs - which risks need to be managed first? *Int J Food Microbiol.* 2009;134(1-2):21-8. doi:10.1016/j.ijfoodmicro.2009.02.012
35. Martins RB, Ferreira D, Moreira LM, Hogg T, Gestal J. Knowledge on food hygiene of food service staff working in nursing homes and kindergartens in Porto region - Portugal. *Food Contr.* 2014;42:54-62. doi:10.1016/j.foodcont.2014.01.037
36. Osaili TM, Abu Jamous DO, Obeidat BA, Bawadi HA, Tayyem RF, Subih HS. Food safety knowledge among food workers in restaurants in Jordan. *Food Contr.* 2013;31(1):145-50. doi:10.1016/j.foodcont.2012.09.037
37. Panchal PK, Bonhote P, Dworkin MS. Food safety knowledge among restaurant food handlers in Neuchâtel, Switzerland. *Food Prot Trends.* 2013;33(3):133-44.
38. Pichler J, Ziegler J, Aldrian U, Allerberger F. Evaluating levels of knowledge on food safety among food handlers from restaurants and various catering businesses in Vienna, Austria 2011/2012. *Food Contr.* 2014;35(1):34-40. doi:10.1016/j.foodcont.2013.06.034
39. Gouveia V V., Guerra VM, Sousa DMF, Santos WS, Costa JDM. Escala de desejabilidade social de Marlowe-Crowne: evidências de sua validade fatorial e consistência interna. *Aval Psicol.* 2009;8(1):87-98.
40. Scagliusi FB, Cordás TA, Polacow VO, Coelho D, Alvarenga M, Philippi ST et al. Tradução da escala de desejo de aceitação social de Marlowe & Crowne para a língua portuguesa. *Rev Psiquiatr Clin.* 2004;31(6):272-8. doi:10.1590/S0101-60832004000600001
41. Serviço de Apoio às Micro e Pequenas Empresas - Sebrae. Classificação MPE por empregado. São Paulo: SEBRAE; 2013[cited 2015 Apr 2]. Available from: [http://www.sebraesp.com.br/arquivos\\_site/biblioteca/EstudosPesquisas/mpes\\_numeros/classificacao\\_mpe\\_empregados.jpg](http://www.sebraesp.com.br/arquivos_site/biblioteca/EstudosPesquisas/mpes_numeros/classificacao_mpe_empregados.jpg)



42. Hair JF, Anderson RE, Tatham RL, Black WC. *Análise multivariada de dados*. 6th ed. Porto Alegre: Bookman; 2009.
43. Kahne H. Economic perspectives on work and family issues. In: Notman MT, Nadelson CC, editors. *Women and men: new perspectives on gender differences*. Washington, DC: American Psychiatric; 1991. p. 9-22.
44. Baş M, Şafak Ersun A, Kıvanç G. The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food Contr*. 2006;17(4):317-22. doi:10.1016/j.foodcont.2004.11.006
45. McIntyre L, Vallaster L, Wilcott L, Henderson SB, Kosatsky T. Evaluation of food safety knowledge, attitudes and self-reported hand washing practices in FOODSAFE trained and untrained food handlers in British Columbia, Canada. *Food Contr*. 2013;30(1):150-6. doi:10.1016/j.foodcont.2012.06.034
46. Centers for Disease Control and Prevention - CDC. *Salmonella*. Atlanta: Centers for Disease Control and Prevention; 2015[cited 2015 Apr 2]. Available from: <http://www.cdc.gov/salmonella/index.html>
47. Batz MB, Hoffmann S, Morris Jr JG. *Ranking the risks: the 10 pathogen-food combinations with the greatest burden on public health*. Florida: Emerging Pathogens Institute; 2011.
48. Messens W, Grijspeerdt K, Herman L. Eggshell penetration by *Salmonella*: a review. *Worlds Poult Sci J*. 2013;61(1):71-86. doi:10.1079/WPS200443
49. Barancelli GV, Porto E, Analysis H, Security N. *Salmonella em ovos: relação entre produção e consumo seguro*. *Segur Aliment Nutr*. 2012;19(19):73-82. doi:10.20396/san.v19i2.8634612
50. Medeiros CO, Cavalli SB, Salay E, Proença RPC. Assessment of the methodological strategies adopted by food safety training programmes for food service workers: A systematic review. *Food Contr*. 2011;22(8):1136-44. doi:10.1016/j.foodcont.2011.02.008
51. Luning PA, Chinchilla AC, Jacxsens L, Kirezieva K, Rovira J. Performance of safety management systems in Spanish food service establishments in view of their context characteristics. *Food Contr*. 2013;30(1):331-40. doi:10.1016/j.foodcont.2012.06.040
52. Cho S, Woods RH, (Shawn) Jang S, Erdem M. Measuring the impact of human resource management practices on hospitality firms' performances. *Int J Hospit Manag*. 2006;25(2):262-77. doi:10.1016/j.ijhm.2005.04.001
53. Lucet JC, Rigaud MP, Mentre F, Kassiss N, Deblangy C, Andremont A et al. Hand contamination before and after different hand hygiene techniques: a randomized clinical trial. *J Hosp Infect*. 2002;50(4):276-80. doi:10.1053/jhin.2002.1202
54. Kac G, Podglajen I, Gueneret M, Vaupré S, Bissery A, Meyer G. Microbiological evaluation of two hand hygiene procedures achieved by healthcare workers during routine patient care: a randomized study. *J Hosp Infect*. 2005;60(1):32-9. doi:10.1016/j.jhin.2004.10.014
55. Ben-Zeev A. Reid's direct approach to perception. *Stud Hist Philos Sci*. 1986;17(1):99-114. doi:10.1016/0039-3681(86)90020-8
56. Hanson JA, Benedict JA. Use of the health belief model to examine older adults' food-handling behaviors. *J Nutr Educ Behav*. 2002;34 Suppl 1:S25-30. doi:10.1016/S1499-4046(06)60308-4
57. Meysenburg R, Albrecht JA, Litchfield R, Ritter-Gooder PK. Food safety knowledge, practices and beliefs of primary food preparers in families with young children. A mixed methods study. *Appetite*. 2014;73:121-31. doi:10.1016/j.appet.2013.10.015
58. Weinstein ND. Optimistic biases about personal risks. *Science*. 1989;246(4935):1232-3. doi:10.1126/science.2686031
59. Lion R, Meertens RM, Bot I. Priorities in information desire about unknown risks. *Risk Anal*. 2002;22(4):765-76. doi:10.1111/0272-4332.00067
60. Green LR, Radke V, Mason R, Bushnell L, Reimann DW, Mack JC et al. Factors related to food worker hand hygiene practices. *J Food Prot*. 2007;70(3):661-6.
61. McIntyre L, Peng D, Henderson SB. Retraining effectiveness in FOODSAFE trained food handlers in British Columbia, Canada. *Food Contr*. 2014;35(1):137-41. doi:10.1016/j.foodcont.2013.06.028
62. Lordelo R, Campos AF, Fiaes CS, Ripardo RC, Cunha SA, Barbosa SD. Percepção, atratividade e probabilidade de engajamento em situações de risco: diferenças de gênero. *Interação Psicol*. 2011;15(1):11-9.
63. Colares V, Franca C, Gonzalez E. Condutas de saúde entre universitários: diferenças entre gêneros. *Cad Saúde Pública*. 2009;25(3):521-8. doi:10.1590/S0102-311X2009000300007
64. Garcia ABBC. Comunicação interna como ferramenta de promoção da qualidade total para a satisfação do cliente. *Educ Cult Comun*. 2013;4(7):17-38.

#### Acknowledgments

The authors are grateful to CAPES/Brazil (Coordination for the Improvement of Higher Education Personnel) for providing a scholarship to the first author.

#### Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.



This publication is licensed under the Creative Commons Attribution 3.0 Unported license. To view a copy of this license, visit <http://creativecommons.org/licenses/by/3.0/deed.pt>.