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Food safety perceptions, knowledge, and behavior of hospitality workers on food safety: A small case study from Ljubljana, Slovenia

Mojca Šetina and Mojca Jevšnik Podlesnik

ABSTRACT

Foodborne diseases are prevalent in the hospitality industry, highlighting the need for food handlers to be well-trained in food safety, with adequate knowledge, attitudes, and practices. This study aims to assess these factors among hospitality employees globally, with a specific focus on restaurant food handlers in Ljubljana. A systematic literature review was conducted, along with semi-structured interviews with eight food handlers in restaurants, to explore their knowledge, attitudes and practices regarding food safety. The results reveal that interpersonal relationships, communication, working conditions, and salary are key motivators. However, food safety knowledge gaps persist, particularly concerning microbiological risks and temperature control in food handling. Despite existing training, the transfer of knowledge to practice remains limited, primarily due to motivational and organizational barriers. Improved food safety training, enhanced communication, and a stronger commitment from management are needed to address these challenges and support good practices.

Keywords: food safety, catering, behavior, attitude, food handlers

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University of Ljubljana
Faculty of Health Sciences
Zdravstvena pot 5
1000 Ljubljana, Slovenia

**Corresponding author*:
Assoc. Prof. Mojca Jevšnik Podlesnik, PhD
University of Ljubljana
Faculty of Health Sciences
Zdravstvena pot 5
1000 Ljubljana, Slovenia
Email: mojca.jevsnik@zf.uni-lj.si

INTRODUCTION

Factors such as changing food consumption, consumer awareness and preferences, the increase in international travel, climate change, adaptations and changes in microbial behaviour contribute to the spread of foodborne disease outbreaks (FBOs) [1, 2]. Foodborne diseases have a major impact on the economy and public health as they can cause infections and intoxications that can affect thousands to millions of people at the same time. Therefore, billions of people around the world are at risk from potentially unsafe food [3, 4, 5]. Food contamination can occur at all stages of food production, including slaughter, harvesting, processing, transport, preparation, distribution, storage, handling and consumption [6].

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Key elements in ensuring food safety are the development and integration of prevention, safety and quality programmes such as good practices (GP) in food supply chain, the Hazard Analysis and Critical Control Point (HACCP) system, educational and training programmes (for food handlers and food business operators), public and private food standards, with some systems being mandatory by law and others voluntary. All stakeholders in the food supply chain are responsible for food safety: food business operators are obliged to establish and maintain a HACCP system that ensures food safety; the government is obliged to provide food safety laws/regulations and a system of official inspection; and consumers, who are the last link in the food supply chain, must handle food according to the principles of good household practice [4, 7, 8, 9].

Despite a high level of awareness, established prevention programmes and safety systems, FBOs continue to occur. Food safety issues have not decreased. According to the European Food Safety Authority (EFSA) report in 2022, for the first time since the collection of FBO data began, the number of strong-evidence FBOs in restaurants, pubs, street vendors, takeaway etc. exceeded that of FBOs in a domestic setting [10]. The number of strong-evidence FBOs occurring in restaurant or cafe or pub or bar or hotel or catering service was higher than in 2021.

Many studies highlights the most common food handling mistakes among food handlers: insufficient heat treatment, insufficient temperature/time during heat treatment, insufficient storage of food, contaminated equipment/utensils, contaminated food, cross-contamination and insufficient/poor personal hygiene.

Regarding EFSA FBOs report from 2023 significant share of FBOs occur in restaurants due to unprocessed contaminated ingredient, inadequate chilling and inadequate heat treatment, time storage/temperature abuse, cross-contamination, water treatment failure and untreated drinking water [10]. Many studies [11 - 27] highlights the most common food handling mistakes among food handlers: insufficient heat treatment, insufficient temperature/time during heat treatment, insufficient storage of food, contaminated equipment/utensils, contaminated food, cross-contamination and insufficient/poor personal hygiene. Visiting restaurants and eating out has become a new normal for most people living a fast-paced lifestyle as it is a convenient way of eating. Therefore, food handlers must be properly food safety educated and trained. They have to develop a positive attitude and correct behaviour to ensure food safety in order to reduce the possibility of food contamination [20 - 23].

The aim of this study is to analyse the knowledge and attitudes of hospitality workers towards ensuring food safety, both at a global level through a systematic literature review and in practise through a semi-structured interview with a sample of Slovenian hospitality workers.

MATERIALS AND METHODS

Systematic literature search

A literature search was carried out to gain an insight into the topic of previously published research. The literature review was also used to develop and compile the list of interview questions. Scientific literature published in English language between 2008 and 2021 was included in the review. The literature was searched in the following databases: ScienceDirect, Scopus and Web of Science as well as on the relevant websites: EFSA, FDA and WHO. We performed an advanced search for titles, abstracts and keywords to retrieve the results. The following search terms were used: 'food safety', 'catering', 'food handler', 'food worker', 'employee', 'practise', 'behaviour', 'attitude' and 'knowledge'.

The inclusion criteria on the basis of which the relevant studies were included in the analysis were as follows: In all databases, we selected those scientific journals that were thematically relevant, accessible in full text and published in English. We excluded hits that were not thematically relevant and not written in English. The inclusion and exclusion criteria are listed below in Table 1.

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Papers published in English Papers published between 2008–2021 Full Text Available Thematic relevance	All papers published before 2008 Papers published in other languages Thematic inadequacy

Semi-structed interviews

On the basis of a systematic review of the literature, we first formulated questions for a semi-structured interview. The questions in this study were taken from previous surveys [12, 14, 15] and were designed to assess employees' attitudes and knowledge about ensuring food safety. Some questions were designed independently and related to topics such as: employee demographics (education level, gender, age, length of employment), food safety training, knowledge of microbiological risks, cross-contamination (e.g. use of colour- coded chopping boards and knives, separation of raw and cooked food, storage of different foods), cold/hot chain, defrosting of food, hand hygiene, and health status during work.

Before the interviews took place, the purpose and objectives of the study were presented to the interviewees. The interviews were conducted in a quiet room (e. g. break rooms). Each interview lasted 15-30 minutes. All respondents were asked the same questions, but we added questions and sub-questions to gain a deeper insight into the respondents ' knowledge and thinking. The order of the questions remained the same, the course of the interview changed depending on the information and knowledge of the respondents. The interviews were recorded using a mobile phone and then transcribed verbatim. Respondents took part in the interview voluntarily, and any information that could reveal the participant identity during the interview was deleted from the interview transcripts or made unrecognizable accordingly.

The questions in this study were taken from previous surveys and were designed to assess employees' attitudes and knowledge about ensuring food safety.

We ensured full data protection for the respondents. In addition, their written consent to participate was obtained in order to record the interviews and present the results in this paper.

Sample

The study was conducted in May and June 2022. As this is a pilot study, we used a purposive sample of participants. Interviewees were sought from a list of restaurants in Ljubljana and on the recommendation of a participant in the study. Respondents were also selected according to age groups (young, middle-aged and older). The data was collected in personal (face-to-face) interviews using a list of questions. A total of 8 employees (seven men and one woman) took part in the semi-structured interviews.

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The willingness of the food workers to participate in the study was satisfactory, but there were also workers who refused to participate. The unwillingness to participate was mainly due to a lack of time.

Data analysis

After we conducted the interviews, transcribed them and checked the transcripts. Following Vogrinec [28], we divided the data analysis into six steps: 1] processing the material, 2] determining the coding units, 3] coding, 4] selecting and defining relevant concepts and forming categories, 5] defining the categories and 6] forming the final theoretical formulation – theme design.

RESULTS

Systematic literature search

A total of 1591 papers were found. By applying time criteria, the number of hits was reduced to 475. After reviewing the titles, abstracts and other information about the literature, we then eliminated a further 220 hits. After a further review of the remaining hits, we excluded another 136 of them due to inadequate content. In the final analysis, we therefore included 20 hits that met the purpose of the study.

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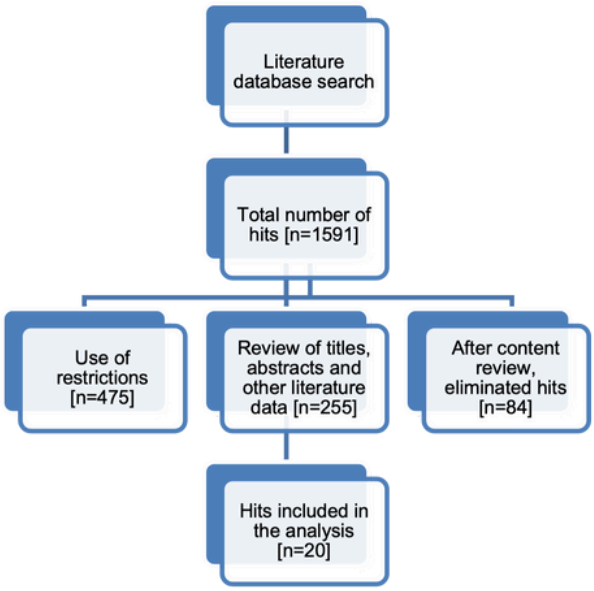

Figure 1: Diagram of the literature search and selection process

After systematically reviewing each transcript, six main themes emerged: personal food safety, employee satisfaction, cross-contamination, food storage, cold and hot chain and knowledge of microbiological hazards.

Demographic data

Table 2 contains a summarised profile of the respondents who took part in the study. All restaurants that participated in the study were privately owned. Eight selected individuals (seven men - M and one woman – F) took part in the interviews. According to their basic education and qualification structure, seven of the respondents came from the hospitality industry and one from the non-restaurant industry. All respondents had a high school education. Their mother tongue was Slovenian. In terms of work experience, three respondents had more than 30 years of work experience and five respondents had between 10 and 20 years. Due to the small size of the sample, the results cannot be generalised to the entire population of main and assistant chefs in Slovenia.

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Table 2: Demographic characteristics of the study respondents

Identification	Gender	Mother tongue	Length of employment [years]	The function of employees
I1	M	Slovenian	50	Assistant cook and facility owner
I2	M	Slovenian	20	Kitchen manager
I3	M	Slovenian	3 [as a full-time employee] 8 [as a student]	Assistant cook
I4	M	Slovenian	34	Assistant cook
I5	F	Slovenian	36	Assistant cook
I6	M	Slovenian	14	Head chef
I7	M	Slovenian	6	Head chef and facility owner
I8	M	Slovenian	29	Assistant cook

Qualitative analysis

In this section, the results are presented in more detail according to the most important themes developed.

Table 3: Developed themes

Personal food safety assurance		
Code	**Category**	**Theme 1**
Training frequency	Training	Personal food safety assurance
Training topics		
HACCP system		
Own evaluation of the usefulness of the trainings		
Disposable paper towel	Personal hygiene and hand hygiene	
Hand dryer		
Wiping hands on apron		
Usage of dedicated work clothes		
Presence in or absence from the workplace	Health status of employees	
Checking the expiration date	Food suitability	
Food that is not suitable for consumption; always changes in color, taste and/or smell		

Employee satisfaction		
Code	**Category**	**Theme 2**
Money	Motivation	Employee satisfaction
Working conditions		
Relations with colleagues		
Guest satisfaction		
Employees violate food safety rules	Demotivation	
Workplace tension		
Low salary		

Cross-contamination

Code	Category	Theme 3
Color system	Changing cutting boards	Cross-contamination
Spatial separation		
Color system	Changing knives	
Spatial separation		
Wearing gloves as an alternative to hand washing	Changing disposable gloves	
Changing gloves when switching to another task		

Food storage

Code	Category	Theme 4
Compliance with expiration dates, time and temperature	FIFO principle	Food storage
Time and temperature considerations	Raw foods [meat]	
Separation by food type		
Time and temperature considerations	Heat-treated foods	
Separation by food type		
Time and temperature considerations	Vegetables	
Separation by food type		

Cold and hot chain

Code	Category	Theme 5
Time and temperature considerations	Food defrosting	Cold and hot chain
Special room [e.g. refrigerator], containers, sink		

Time and temperature considerations	Heat treatment	Cold and hot chain
Steam convection oven		
Temperature check [stick thermometer]		
Time and temperature considerations	Cooling	
Rapid cooling		
Time and temperature considerations	Reheating	

Knowledge of microbiological hazards

Code	Category	Theme 6
Covid-19	Viruses	Knowledge of microbiological hazards
Salmonella spp.	Bacteria	
Campylobacter		

Respondents were aware that wiping hands on aprons was not an example of good practise and that bacteria and dirt accumulated on the aprons.

Personal food safety assurance

This topic consists of four categories in which 12 codes were identified. When discussing food safety training, respondents mostly mentioned the HACCP system. They had mixed opinions on whether the training was useful and whether it helped respondents to improve their food safety behaviour. Some of the interviewees felt that participating in training had greatly helped to improve their behaviour and attitude towards food safety and that it was useful to renew and expand their knowledge. However, they were not entirely sure about the frequency of training, as some attended every year, while others attended training every five years. Some did not attend at all as they felt it was no longer mandatory or employers did not provide training. Respondents rated the usefulness of the training as positive, as they felt that their school knowledge was insufficient, so the training was welcome, especially when it came to innovation.

On this topic, respondents also mentioned the importance of personal and hand hygiene, the state of health in the workplace and the suitability or safety of the food itself. All respondents were provided with disposable paper towels at their workplace to wipe their hands. Three respondents stated that they never wiped their hands with an apron, as aprons were only used as an aid when handling hot food and pans. Five respondents very rarely dried their hands with an apron and only did so out of bad habit, due to the increased workload and the fast pace of work. Respondents were aware that wiping hands on aprons was not an example of good practise and that bacteria and dirt accumulated on the aprons.

The respondents were unanimous with regard to personal hygiene [mainly hand washing] in the workplace. All agreed that ensuring and maintaining an appropriate level of personal hygiene is essential to protect food and consumer health. Restaurant owners required and expected their chefs and other food handlers to adhere to the prescribed instructions for personal hygiene in the workplace, including appropriate workwear. Appropriate work clothes were provided by employers, but beyond that it depended on the employer whether he or she was also responsible for washing and cleaning. For some respondents, employers took care of the work clothes, while for others, employers only provided the clothes and employees were responsible for cleaning and care.

The respondents were not unanimous when it came to their state of health at work. Some never came to work sick, others did, mainly to please their superiors, and some still came to work sick because of a lack of staff.

When it came to checking the usability of food, the respondents were unanimous. They regularly checked the expiration dates and paid particular attention to the appearance, smell and colour of the food. They also mentioned bacteria such as Clostridium botulinum and Salmonella. Food that they considered inedible and spoilt was disposed of as waste. Sometimes they did not always check the expiration dates, because it was mostly routine work.

All agreed that ensuring and maintaining an appropriate level of personal hygiene is essential to protect food and consumer health.

Employee satisfaction

This theme consists of two categories in which 7 codes were identified. The respondents were mostly satisfied and enjoyed coming to work. Most of them felt that money, working conditions, relationships with colleagues and guest satisfaction as well as restaurant utilisation were important factors that contributed to their motivation. The superiors also took care of motivation by organising some kind of celebration or gathering several times a year [depending on circumstances and possibilities] [e.g. New Year's party for employees, etc.]. At work, the employees were most demotivated by unruly, demanding customers and colleagues who did not follow the rules to ensure food safety. Such employees were admonished by their colleagues for their behaviour, only rarely were their superiors involved.

Respondents were consistent in their work so that knives and chopping boards for meat and vegetables were not changed as they were aware of the significant risk of cross contamination.

Cross-contamination

This theme consists of three categories in which 6 codes were identified. Respondents were consistent in their work so that knives and chopping boards for meat and vegetables were not changed as they were aware of the significant risk of cross contamination. They were fairly consistent. To avoid cross-contamination, they used a system of spatial separation and a colour system for knives and chopping boards [yellow boards were used for chicken, red for beef and pork, blue boards for the preparation of fish and other aquatic - seafood dishes].

They were also consistent in their use of gloves. They reported to use disposable gloves, which they changed regularly. When moving from one workplace to another, the respondents reported to wash their hands thoroughly with soap and water and then used a fresh pair of gloves. They also felt that replacing them was a cost to the restaurant and a burden on the environment.

When moving from one workplace to another, the respondents reported to wash their hands thoroughly with soap and water and then used a fresh pair of gloves.

All respondents agreed on gloves and believed that the use of gloves was not a sufficient measure to ensure hand hygiene. Gloves are used for intermediate or step cleaning of kitchen surfaces and for dirty work [e.g. cutting onions because of the smell, cutting beetroot because the colour of the beetroot is difficult to wash off hands, and preparing breadcrumbs because they are difficult to remove from hands and nails, etc.].

All respondents agreed on gloves and believed that the use of gloves was not a sufficient measure to ensure hand hygiene.

One of respondents pointed out that he dislikes the use of disinfectants as they have a harmful effect on the skin. The remaining respondents had no concerns about disinfectants and said that they had become accustomed to them during the Covid pandemic.

Food storage

This theme consists of four categories in which 7 codes were identified. The respondents were unanimous on theme 4. They were clear about the importance of separating different types of food. All of them reported to store meat separately from other foods. Vegetables also had their own place where only vegetables were stored. Food was reported to be stored separately in special refrigerators and freezers. They also reported that refrigerators and freezers were equipped with thermometers, which were regularly checked and the temperature monitored. Respondents were not very consistent in their knowledge of the temperatures in the cold rooms, giving values of 0° to 5°C and around -18°C for the freezers. Most of the respondents had never heard of the "First In, First Out" (FIFO) storage method. After the meaning of the abbreviation was explained to them, all respondents stated that they always stored their food in this way. Some (especially the younger population) had heard of FIFO in educational institutions.

Most of the respondents had never heard of the "First In, First Out" (FIFO) storage method.

Cold and hot chain

This theme consists of four categories in which 8 codes were identified. Respondents were largely in agreement about defrosting food. Respondents defrosted meat in portions, meaning that they only defrosted as much meat as they expected to be consumed that day. Most respondents did not freeze meat as they received fresh meat every day. Defrosted food was protected by foil or a cover on work surfaces in containers and in refrigerators or cold rooms. Most thawed the food in hot running water and overnight. They tried to avoid the temperature zone between 5 °C and 60 °C.

They regularly monitored the temperature and tried not to let the temperature fall below 60 °C.

Respondents were also quite unanimous when it came to the heat treatment of food. They regularly monitored the temperature and tried not to let the temperature fall below 60 °C. They checked the temperature with the help of measuring devices and displays (e.g. displays on ovens etc.), but they also relied on their experience (i.e. they knew approximately how long and at what temperature a particular food should be processed to be safe for consumption), and cuts of meat were checked using penetration thermometers.

Respondents approached food cooling in different ways, depending on the available equipment resources. Some heat-treated foods were cooled with water/a water bath or rapid cooling units (so-called cooling shockers) were used. Then the food was stored in refrigerators.

Respondents were unanimous about the time interval for cooling food – this should be as short as possible (e.g. a piece of meat cools down to 5 °C in 120 minutes, etc.).

When reheating food, they emphasised that food (with the exception of soups, which are heated to boiling) is generally not reheated and that they adhered to the portion system. They regularly checked the temperature [which they said should be between 60 °C and 85 °C), just as with the primary heat treatment. They used a probe thermometer, which all respondents reported to correctly insert into the thickest part of the meat or right next to the bone.

When it comes to knowledge of microbiological contaminants, respondents were not consistent and had insufficient knowledge of what they themselves were aware of.

Knowledge of microbiological hazards

This topic consists of two categories in which 3 codes have been identified. When it comes to knowledge of microbiological contaminants, respondents were not consistent and had insufficient knowledge of what they themselves were aware of. Most of the respondents had heard of Salmonella and it was also their first choice when listing bacteria. Fewer respondents also mentioned Staphylococcus aureus, Clostridium botulinum, coronavirus and mould.

DISCUSSION

Food safety continues to be a pressing public health issue, with thousands of people still falling ill from foodborne diseases every year. In the EU, the number of reported foodborne outbreaks and cases, hospitalisations and deaths were higher in 2022 than in 2021. The number of deaths from outbreaks was the highest ever reported in the EU in the last 10 years, mainly caused by L. monocytogenes and to a lesser degree by Salmonella. In 2022, for the first time since the collection of foodborne outbreaks (FBO) data began, the number of strong-evidence FBOs in restaurants, pubs, street vendors, takeaway etc. exceeded that of FBOs in a domestic setting [15]. Although there are many factors that can cause food contamination, improper food handling and inadequate knowledge of food workers are the main source of foodborne illness [22, 23, 29, 30].

The number of deaths from outbreaks was the highest ever reported in the EU in the last 10 years, mainly caused by L. monocytogenes and to a lesser degree by Salmonella.

A systematic literature review shows differences between the USA and the EU, particularly in the area of salary as a motivating factor. While EU countries have guaranteed funding to ensure that employees who are absent from work due to illness are paid for sick leave, the US has no such system. In a system where employees do not have paid sick leave, they will come to work sick for fear of a financial crisis and fear of losing their jobs. However, in both EU and non-EU member states and the US, workers are still pressurised by their managers to come to work without regard for their health and well-being due to staff shortages [19, 17, 20, 21, 22, 25, 16]. We came to similar conclusions in our study. Most of the interviewees stayed home when sick, but some also stated that they went to work out of a sense of responsibility to their superiors and because of the pressure they were under due to staff shortages. The employees were aware that their behaviour was not in line with good practise. They believed that they were not alone in this practise, but they did it anyway to avoid ill-will and bad relations in the workplace. Respondents were most motivated by good relationships with colleagues, followed by appropriate working conditions, job satisfaction, salary, positive superiors, deepening teamwork [team building], social events [e.g. New Year celebrations, etc.] and guest satisfaction. Respondents were most demotivated by colleagues who did not follow food safety rules, the work schedule and demanding customers.

Research has shown that many disease outbreaks are due to cross-contamination because employees do not change their work equipment, including gloves, when moving from one task to another. Personal beliefs, work overload, long working hours, salary satisfaction, motivation and an appropriate working environment are the reasons for selective abandonment of good practises [16, 31, 21, 20, 24, 25, 30]. In the interviews, we concluded that respondents used gloves less frequently, that they were aware that using gloves is not a substitute for hand washing, and that they washed their hands thoroughly before each task. Regarding the importance of cross-contamination, all [n=8] agreed and consistently changed disposable gloves and utensils [chopping boards, knives] when switching between tasks.

In the interviews, we concluded that respondents used gloves less frequently, that they were aware that using gloves is not a substitute for hand washing, and that they washed their hands thoroughly before each task.

The results of scientific publications [18, 24, 32] indicate that employees lack knowledge about defrosting food and the temperature ranges for heat treatment of food. In our research, we also came to similar conclusions regarding the "cold and hot chain". Respondents indicated the approximate temperature and time values that they must adhere to when heat treating, cooling food and reheating. Due to inadequate knowledge and equipment (e.g. equipment for rapid cooling of food), half of the respondents (n=4) thawed frozen food incorrectly by covering it with a lid and thawing it overnight on work surfaces. Based on the results, it is essential to educate employees about the temperature conditions to ensure the cold and hot chain. The focus is therefore on the need for staff training and education.

Based on the results, it is essential to educate employees about the temperature conditions to ensure the cold and hot chain.

In conclusion, we advocate that in order to avoid and prevent undesirable employee behaviour, management must create appropriate working conditions and relationships that have a positive influence, encourage desirable behaviour and discourage employees from violating good practises. It is also necessary to change management's attitude towards training, as they see it merely as a duty that means more administrative work.

CONCLUSION

A review of scientific publications on barriers to food safety shows that there is room for improvement, particularly in the areas of ensuring adequate personal hygiene, training employees in food safety, motivating workers and controlling temperatures during heat treatment of food.

The lack of knowledge about food safety was mainly reflected in the knowledge of microbiological risk factors, temperature parameters (they did not know the exact temperature values) for heat treatment, cooling, reheating and the correct way to defrost food.

In semi-structured interviews, we found that the employees carried out their work conscientiously. They adhered to the rules of personal and hand hygiene, did not wear jewelry on their hands, kept their nails short and unpainted, kept their work clothes and aprons clean and maintained the cold and hot chain as far as their premises allowed (e.g. some did not have shock devices for cooling food, etc.). They adhered to a portioning system to avoid excessive food waste and chilling and reheating of food. Employees were aware that they had to come to work healthy. However, they stated that they sometimes came to work sick due to staff shortages and pressure from superiors.

For respondents, the good relationships and good communication between employees were the greatest motivating factors. Despite training, employees' knowledge was insufficient. The lack of knowledge about food safety was mainly reflected in the knowledge of microbiological risk factors, temperature parameters (they did not know the exact temperature values) for heat treatment, cooling, reheating and the correct way to defrost food.

In view of the lack of knowledge, we conclude that the methods and frequency of training are unsatisfactory. Employees are trained by external contractors who usually only come with a PowerPoint presentation and do not provide job-specific training with practical examples. Food business operators do not have a proper food safety training plan or any training plan at all. Most employees also do not know if they are trained everyone, three, five or ten years as they have not received any training for some time.

Employees who are a risk factor because they do not follow the rules of food hygiene must understand why it is important to carry out certain activities. It is the responsibility of supervisors and external trainers to explain in an understandable and interesting way how certain behaviours (e.g. hand washing, maintaining temperature and time in hot and cold chains, etc.) can contribute to or prevent potential risks and thus the outbreak of foodborne diseases.

To avoid and prevent undesirable food safety behaviour by employees, managers must first and foremost create the right work environment and attitude to positively influence, encourage and discourage employees from improper food handling practices. Managers' attitudes towards training also need to change, as they see it as a mere obligation with more paperwork and administrative burden, which is not in line with the principles of a food safety culture.

Employees are trained by external contractors who usually only come with a PowerPoint presentation and do not provide job-specific training with practical examples.

RESEARCH LIMITATION

Due to the small and homogeneous sample located in Ljubljana, the results are not representative and cannot be generalized to the entire population of food handlers in hospitality sector in Slovenia. In the future, it would be useful to include a larger sample covering different regions and demographic groups, which would allow more representative and general conclusions on food safety practices in the hospitality sector in Slovenia. Further research with mixed methodology is needed, with a broader and more graphical presentation of the problems concerned that influence the food safety aspect in hospitality sector.

In the future, it would be useful to include a larger sample covering different regions and demographic groups, which would allow more representative and general conclusions on food safety practices in the hospitality sector in Slovenia.

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