Food safety knowledge and behaviour among food handlers in catering establishments: a case study

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Abstract

Purpose – The main objective of this study is to find out how food handlers in catering establishments perceive ensuring food safety and which problems they meet along the way.
Design/methodology/approach – Using a qualitative approach, ten food handlers in Slovenian catering facilities were included in the case study. A semi-structured approach was applied to provide a deeper insight into food safety barriers perceived by respondents. Participants first read short fictitious newspaper news about a foodborne disease at a tourist farm, which served as a starting point.
Findings – The results demonstrate barriers which most often originate in a lack of knowledge (e.g. improper food safety training, incorrect food safety knowledge testing, knowledge and maintaining of CCPs), shortage of food hygiene skills (e.g. handwashing, food defrosting) and weak work satisfaction (e.g. insufficient payment, poor interpersonal relationships and weak motivation). Food safety knowledge and consequently training methods were found to be the biggest barrier for the efficiency of the HACCP system in practice.
Research limitations/implications – Due to the small sample, the results cannot be generalised to the entire population of food handlers in Slovenia.
Practical implications – The results indicate weaknesses in food safety knowledge among professional food handlers.
Originality/value – The study provides a deeper insight into implicit opinions of ten food handlers in catering facilities regarding barriers in providing food safety, their knowledge and behaviour in their work with food.

Keywords Food safety, Food hygiene, Food handler, Catering, Interview
Paper type Research paper

1. Introduction

Food handlers have a crucial role in the transmission of foodborne pathogens (Mastrantonio *et al.*, 2014). The results of meta-analyses showed that almost half of the barriers regarding the effectiveness of the HACCP system belong to a human factor (Jevšnik *et al.*, 2006). The food handlers represent a significant risk factor for foodborne diseases (FBD) in food establishments (Jevšnik *et al.*, 2008). In EFSA and ECDC report (2021) the factors contributing to food contamination and outbreaks in catering establishments were contamination by food handlers (mainly associated with norovirus and *Salmonella*), cross-contamination (mainly caused by *Salmonella*, *Campylobacter* and *L. monocytogenes*), inadequate heat treatment, time/temperature storage abuse and inadequate chilling. Behind the domestic setting in 2019 restaurants, pubs, street vendors, take-aways, etc. are in second place in terms of the number of

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outbreaks (205 outbreaks, 28,6% of total strong-evidence outbreaks) (EFSA and ECDC, 2021).

Food handlers in the food supply chain are recognised as the heart of food safety systems; consequently, their management including their training and education is fundamental to food safety management (Motarjemi and Lelieveld, 2014). According to many researches, regular staff training in food safety does not always influence appropriate attitudes and behaviour among food handlers in their food hygiene practice (da Cunha *et al.*, 2014; Smigic *et al.*, 2016; Young *et al.*, 2019; Zanin *et al.*, 2017) therefore, it is necessary to introduce different training techniques and methods for food handlers. Yu *et al.* (2018) pointed out that behaviour-based training was indeed effective in changing hygiene behaviour over time. By using different cues that affect our senses or emotions according to Pellegrino *et al.* (2015), behaviour change can be achieved. Nudge tools for desired hygiene behaviour can be an important contribution to improved hygiene behaviour. The research of Štefančič and Jevšnik (2020) found that nudging can be an important tool for improving hygiene behaviour in food establishments, but should be used in conjunction with targeted education and training of food handlers. York *et al.* (2009) and Parry-Hanson Kunadu *et al.* (2016) have found that attitude to foodstuffs is the most important food safety factor that influences appropriate food handling practices. The food handlers with a positive attitude to foodstuffs will better observe food safety instructions. Some authors (Jevšnik *et al.*, 2008; Ansari-Lari *et al.*, 2010; Osaili *et al.*, 2013; Mclntyre *et al.*, 2013) emphasise how important it is to plan staff training, to take account of it and to control and assess employees at work. Several studies (da Cunha *et al.*, 2014, 2019; Pragle *et al.*, 2007) have established that theoretical training of food handlers is not always related to their views and attitudes to food safety as well as their own daily practice. Soon *et al.* (2012) have found that periodical trainings are needed to achieve the desired knowledge and to maintain it. In the long run, we would thus reach improved conscious handling and behaviour of the employees linked to food safety at work. Opolski Medeiros *et al.* (2011) have found that most effective trainings include audiovisual contents, video recordings and practical exercises. Practical exercises, included in trainings, are most often connected to washing hands.

If we want to improve consumers' food safety knowledge, it is important to start introducing knowledge in kindergartens and primary schools. Ovca *et al.* (2014) demonstrate that the systematic teaching of basic food safety principles as early as primary school remains necessary. One of the main problems is that food safety training is not provided in appropriate way to motivate food handlers (Jevšnik *et al.*, 2008; Howton *et al.*, 2016; Griffith *et al.*, 2017; Ovca *et al.*, 2018). Jevšnik *et al.* (2018) estimated poor food safety knowledge among food handlers in catering establishments, concerning the optimal temperatures for handwashing, cooling and cooking temperatures, proper thawing of frozen food, measuring internal temperatures of food, etc. They pointed out that 5.8% respondents who works in catering establishments have never attended food safety training courses (Jevšnik *et al.*, 2018). Among Slovenian street food vendors Prevolšek *et al.* (2021) found out some of the major inconsistencies: lack of suitably located washbasins, improper hand-washing technique, improper waste management, working surfaces that were inadequately separated from consumers and inconsistent maintenance of the cold chain. The findings confirm that human factor is a key element in the process of ensuring food safety.

Some food handlers have adopted a negative attitude to correct food handling practice and are not interested in food safety programmes, therefore training is one of the biggest challenges in food safety (da Cunha *et al.*, 2014; Howton *et al.*, 2016; Jevšnik and Raspor, 2020). It is also necessary to emphasise the differences between the identified food safety knowledge of food handlers and the application of this knowledge into daily practice. In their extensive research, da Cunha *et al.* (2019) emphasised that self-reported practices and observed practices differ from each other and should be used and discussed properly.

The well-organised organisational climate in the food establishments also contributes to better behaviour towards food safety. Constant supporting and encouraging employees by managers positively influence their motivation (Guchait *et al.*, 2016; Faour-Klingbeil *et al.*, 2015). Griffith *et al.* (2017) emphasised the responsibility of managers who have to ensure that all employees are able to perform necessary food safety practices. According to findings by Opolski Medeiros *et al.* (2011), employee trainings organised by the management can have the motivational nature (e.g. additional pay, rewards, paid hours, using overtime), since they can improve the attitude and motivation, and the resulting positive attitude to work. Linking employee motivation (Guchait *et al.*, 2016) with new concepts for food safety training (da Cunha *et al.*, 2014; Young *et al.*, 2019; Štefančič and Jevšnik, 2020) and food safety culture including behavioural sciences (Griffith *et al.*, 2010; Yiannas, 2015) could be the solution for improving food safety from farm to table.

Food handlers working in catering establishments are a frequent source of FBD) (Pichiler *et al.*, 2014; Angelo *et al.*, 2017). Inadequate personal hygiene with emphasis on handwashing, cross-contamination, inappropriate hot/cold chain of food are main problems reported in catering establishments (Liz Martins and Rocha, 2014; Tavakkoli *et al.*, 2015; Jevšnik *et al.*, 2018) that can contribute to FBD. Thus, the promotion of good hygiene practice among food handlers is the most important food safety preventive action for eliminating pathogen transmission from food handler to the final consumer (Smigic *et al.*, 2016; de Souza *et al.*, 2018) and in particular, adherence to proper hand hygiene is crucial for reducing FBD (Pragle *et al.*, 2007). As explained and illustrated in De Boeck *et al.* (2015, 2017) human behaviour of all employees, regardless of their hierarchical position in the company, is believed to be influenced by the food safety climate prevailing in the company.

The main objective of this study is to find out how food handlers in catering establishments perceive ensuring food safety and which problems and challenges they meet in their working day. To obtain an in-depth insight into implicit ideas of food handlers we prepared short fictitious newspaper news of FBD and examined the following research questions: (1) Do food handlers know food safety requirements and do they observe them in their work?; (2) Are food handlers insufficiently or improperly trained and thus breach food safety requirements?; (3) Are barriers in ensuring food safety connected to weak motivation for work?; (4) Do food handlers find HACCP system useful and how do they know and manage critical control points?

2. Material and methods

2.1 Research protocol

Research was conducted in July and August 2018 among ten cooks and cook assistants (six men and four women), employed in catering establishments. Data regarding registered catering establishments in Slovenia was gained from The Chamber of Craft and Small Business of Slovenia. We randomly selected every twentieth establishment from the register and included it in the invited list. When we called them on the phone, some telephone numbers were no longer valid, or the establishment was no longer operational. In the end we got 20 catering establishments in Slovenia's capital – Ljubljana and its surroundings and contacted the responsible person by phone. Because the number of employees in small food establishments is small, we decided that one person participates in each establishment. We asked the responsible person or the owner to designate one food handler (cook or cook assistant) who could take some time to participate in the research. Sixteen of them responded to our request and ten catering establishments agreed to participate in semi-structured interviews. Interviews were carried out in peaceful surroundings, usually it was the resting room at the location of an individual catering facility. Respondents participated on a voluntary basis. The purpose and objectives of the study, and the manner of conducting the

interview were explained to them. We obtained their written consent or approval that the interviews can be recorded and the results presented in an anonymous form. All participants were guaranteed full personal data protection.

2.2 Research instrument

Because perception of food safety is a complex field and a quantity research with a questionnaire cannot reveal peoples' implicit conceptions, ten semi-structured interviews were carried out among food handlers in catering establishments. Previous Slovenian nation-wide quantitative survey (Jevšnik *et al.*, 2018) has shown considerable food safety knowledge weaknesses among food handlers in catering establishments. A contribution of qualitative methods is possibility of a deeper view in experience and comprehension of studied phenomenon. They enable inclusion of individual experiences. That could expose experience and comprehension of food safety among food handlers (Hollway and Jefferson, 2003).

Before the semi-structured interview, participants read short fictitious newspaper news about FBD at a tourist farm, which served as a starting point for the ensuing questions (Table 1). The semi-structured interview was carried out according to a predefined plan and included ten open-ended questions immediately after they digested fictitious news. Questions and subquestions referred to the news story, good hygiene practice, food safety requirements, and the respondent's food safety motivation, behaviour and knowledge regarding food handling (Table 2). They were slightly modified at the time of interview according to the course of conversation. The first question in Table 2 was directly related to the news story and it was the basis for analysing general food safety knowledge and behaviour of interviewers in their daily practice when working with food. Individual interviews lasted approximately half an hour.

2.3 Data analysis

Research materials were obtained with semi-structured interviews. An inductive approach was used in the coding process. During the coding process we recorded remarks, comparisons and all ideas obtained with brainstorming. Later, when we examined the whole text, we could use all the above-mentioned techniques of note taking to obtain the final formulation (individual categories, derived from content codes and the main theme) (Creswell, 2007). Interviews were recorded and subsequently transcribed word-by-word. In all recorded interviews, the personal data are anonymised. The names are invented or coded. Any information that might reveal the identity of speakers is omitted. All respondents have their

More than 90 out of total 132 guests suffered from food poisoning last week at the XY tourist farm. Soon after consuming food, most guests experienced severe digestive problems, resulting in twelve people being admitted in the isolation ward of University clinical centre in Ljubljana. The results of the analyses showed poisoning with *Salmonella enteritidis*. Twelve people are still being treated in the isolation ward
We managed to find out some details related by a guest, who was at the XY establishment on Friday, on the day of mass poisoning, as one in the group of 40 guests. He stated: "I had a meat plate, salad and a cake. The food was tasty. First troubles appeared on Saturday morning after breakfast. I had indigestion, high temperature, and a strong diarrhea. On Sunday the condition worsened. On Monday, my wife brought me antibiotics, but my condition got no better. So, I found myself in hospital, where I was given infusion. Now I'm slowly recovering"
The XY guest house has been in restaurant business for 15 years and until now has not have any problems of this type. It is well renowned among people. Four people worked in the kitchen on Friday and Saturday; meat and eggs (up to now probably the most problematic types of food) were purchased on a well-known poultry farm. Recently, they have also renovated the kitchen and thoroughly cleaned and disinfected it afterwards. Until all the results of health analyses are known, the guest house shall be closed. It is noteworthy that guests who only ate vegetables also got food poisoning

Table 1.
Front-page news in a newspaper entitled "More than 100 people suffer from food poisoning"

Main questions	Sub-questions
1. What do you think of the case story you have read regarding food safety issues?	a) Why do you think the outbreak occurred? b) What would you do if such a case happened at your workplace? c) In what way do you take care that no such infections/food poisonings occur at your workplace?
2. If you get new staff members (also students), how do you train them to work with food?	a) What are your food safety trainings like? b) What kind of food safety training would you like to have personally?
3. What motivates you most and what demotivates you in your work?	Give some examples
4. Have you heard of the following bacteria: *Salmonella, Escherichia coli, Listeria, Staphylococcus aureus*?	a) Which illnesses do they cause?
5. Do you know preventive measures so that no infections/food poisoning with these bacteria occur?	Name some preventive measures
6. How do you keep food in the fridge?	a) Where do you keep raw meat and where the prepared foods? b) What is the temperature for keeping foods in the fridge?
7. Do you have any critical control point in your work process?	How do you manage it?
8. When and how do you wash your hands?	Give a short description of your daily routine of washing hands
9. How do you thaw frozen foods?	10. If frozen fish (such as tuna, salmon, hake) is thawed at room temperature, e.g. on a counter overnight, and then prepared correctly, is it safe and can be consumed?
10. Do you find the HACCP system useful for food safety?	Shortly describe your opinion on HACCP system

Table 2.
Interview questions based on the front-page news in a newspaper which was the basis for analysing food safety knowledge and behaviour of interviewers in their daily practice when working with food

own codes (from G1 to G10; from the caterer number 1 to the caterer number 10; e.g.: quote (111G1) means a quote from theme 1, category 1, code 1 and person G1. When forming the selected quotes, we used an analytical technique of qualitative text analysis. The respondents' quotes are in italics and arranged according to the themes, categories and the caterer's code (Creswell, 2007).

3. Results and discussion

Due to extensive data obtained, the results present excerpts from interview transcripts with the most lucid, interesting and intriguing quotes to illustrate the wholeness of a particular interview. Complete transcripts of interviews are available at the authors of the study.

Six men and four women participated in the interviews. Five respondents were less than 30 years old. Four respondents' age was from 31 to 40 years. One respondent was over 40 years of age. Seven respondents' initial education was catering, while the other three had non-catering education. As for work experiences, five respondents had 5 years or less of professional experiences; two respondents had from 6 to 10 years of professional experiences; and two respondents from 10 to 20 years of professional experiences. One respondent had more than 20 years of professional experiences.

With the particular questions (Table 2) linked to the short fictitious newspaper news of FBD we want to obtain an in-depth insight into implicit ideas of respondents in order to determine whether they identify risk factors and how to act in such a case. By asking

questions that had a basis in the story, we wanted to find out as well if they knew pathogenic bacteria and preventive measures so that no FBD with these bacteria occur? With other questions we also wanted to determine if they are properly trained on the hygiene and food safety requirements.

In this way we wanted to encourage the respondents to consider and analyse their food handling practice and form opinions about mistakes or mishandling that might lead to FBD. An interview took about 30 min on average. According to the basic theoretic principles (Creswell, 2007) four key themes (T) with associated categories (C) were identified: Work satisfaction, Food handlers, Microbiological hazard and Work process (Figure 1), which combine individual factors influencing food safety knowledge and behaviour in interviewers practice daily. Themes have been formed based on the topics, in which the statements were combined, and represented constraints to achieve effective food safety assurance among ten food handlers in catering establishments.

3.1 Food safety climate (T1)

Theme 1 – Food safety climate consists of four categories (Payment (C1), Work conditions (C2), Interpersonal relationships (C3) and Motivation (C4)). All interviewees agreed that adequate payment is necessary for well-accomplished work. For improved motivation, the respondents would like to receive an additional pay or a higher salary. Most respondents said that they would be more motivated if they received a higher monthly income. Some even mentioned that an increase in wages would contribute to improve the employees' relationship to their food handling and to strict adherence to food hygiene practice. Respondent G2 likes to have enough time for preparing food and a possibility to be creative: "*I am motivated if I am free to cook, to have only a dish, hem, a salmon casserole, that's it, I prepare it my own way/. . . /" (133G2)*; his work conditions are good, although he mentions that the wages could be higher. Still, he emphasised that the boss is his good colleague, which again indicates that work is not measured only through wages, but also through well-being at work: "*By all means it would help to have higher wages, but at the moment it is not my priority, at this position I have a dream workday/. . . /Actually my boss is my secondary school mate, I have two older ladies who help me,*

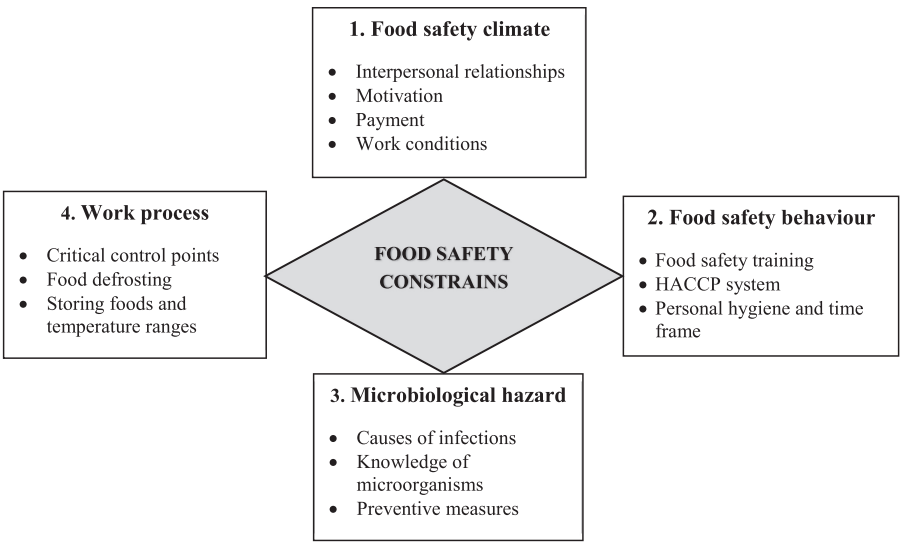

Figure 1.
Topics that have been recognised as constraints to achieve effective food safety assurance among ten food handlers in catering establishments

I mean us, we stick together, and also now when we are only two, since two are on leave . . ." *(114G2)*. Buccheri *et al.* (2007) also found out that good teamwork and mutual understanding is crucial in food handling procedures which contributed to a better attitude to food hygiene. Based on De Boeck *et al.* (2015) findings, it is obvious that a higher food safety motivation is related to a higher food safety compliance.

Majority of respondents found good relationships among coworkers, relaxed atmosphere in the kitchen and trust at workplace very important, since this is why they like to come to work: "*That we have good relationships.*" *(116G4)*; "*I am very motivated by my coworkers, we make a great team, we cooperate well, the atmosphere is always positive, and this is actually my biggest motivation, when I wake up in the morning, I know that I'm going to work in a very good team.*" *(131G6)*; "*My best motivation is to have good colleagues. In my previous job, there were bad relationships, that's why I changed, now they are much better, the atmosphere in the kitchen is completely different, we all like to come to work and we cooperate well. It seems very important to me, how we cooperate.*" *(132G8)*. Study results by Guchait *et al.* (2016) indicate that the constant support and encouragement of employees positively influences their motivation and knowledge, while reducing food safety-related errors and breaches. According to findings by Buccheri *et al.* (2007), the employee motivation and the creation of positive attitude have the biggest impact on the employees' attitude to food handling and preventing infections associated with improper food handling.

3.2 Food safety behaviour (T2)

Theme 2 – Food safety behaviour consists of two categories (Personal hygiene and time frame (C1), Food safety training (C2) and HACCP system (C3). Category 1 was described with very few words by respondents, they mainly mentioned wearing working clothes and washing hands. Respondents state that their personal hygiene is maintained by changing clothes during work if they get dirty and they often wash hands as graphically described by G6: "*Hands as often as possible, I don't know, every time when it's possible you wash them a little bit at least.*"*(211G6)*.

Answers to the question how many seconds interviewers wash their hands show the time is too short because they state 5–10 s, e.g. by G4: "*Some ten seconds, or a little less.*" *(215G4)*; "*I don't know, it depends, I don't know, maybe four seconds.*" *(214G3)*; "*Some five seconds, I think.*" *(218G10)*. Conover and Gibson (2016) notice that 20 s handwashing is considered sufficient to reduce microorganisms on hands, generally. Other studies (Osimani *et al.*, 2016; Zanin *et al.*, 2017) confirmed that poor personal hygiene, primarily ineffective handwashing, has been recognised as a significant risk factor of food contamination that leads to FBD (Jevšnik *et al.*, 2018).

Respondents generally consider that HACCP system is useful for food safety, however they have developed they own opinion on HACCP what is clear form their comments. As told by G9: "*Yeah, this must be, otherwise nothing would work. In this way, at least some things have to be in proper order. But it could be done better, couldn't it.*" *(228G9)*. But in their opinion, it is conceived too narrowly without enough stress on practice, it is too boring, not instructive enough, not practical and more of a formality, an end in itself. G9 also explained why the HACCP system's concept is too narrow: "*You actually have to really learn something, not only what you need at work. But maybe it should be broader, like, why you have to wash your hands so much and why you mustn't work when you are ill. We only know that you mustn't because you can transmit something, but I reckon nobody knows exactly why. . .*" *(229G9)*. In the problem, clearly highlighted by G10, HACCP is defined as useless bureaucracy and points out misunderstanding of requirements: "*Yes, it is helpful, but there are so many papers to fill in. This takes up our time, then you don't concentrate on this, but in reality, you quickly jot something down. It would be better if there were not so many forms,*

then we might have learned more from trainings, instead of writing this. But this is a sort of order. So, I believe it must be this way, otherwise nobody would check fridges and freezer chests and similar." (2212G10).

Our study among others (Pragle *et al.*, 2007; Opolski Medeiros *et al.*, 2011; York *et al.*, 2009), also stressed the need for more practical trainings that guide employees towards correct personal hygiene with emphasis on consistent and correct handwashing and teach them preventive measures to avoid FBD. Da Cunha *et al.* (2014) established the importance of management in staff trainings, in their setting an example for other employees, in providing proper work equipment (e.g. suitably arranged and equipped sinks). In our study, the respondents pointed out that the time of trainings is not appropriate because it is outside working hours. They suggested organised week-end education to combine pleasant and useful ("team building"), but they were aware of the costs related to organisation. Respondents stressed that food safety trainings are mainly expenses for the owners, who do not dedicate enough time to train them properly even when employing new people. Some stressed their luck of being helped by coworkers at the beginning. In reference to induction, interviewee G4 told that they have too much work and not enough staff to be able to pay concrete attention to new staff members, so it is to be expected that the employees are less than 100% precise and sticking to the rules: "*Often we are in full rush, then you have no time to take care of all the details. And we are too few to do everything according to the rules. Actually, you show up and the first day you already work, you're looking for things, but you soon figure out. By all means, if your coworkers are OK." (225G4).* It is worrying that G4 mentioned how there is no training, not even mentioned (which is, as referred to several times, an investment in an employee, and not just a "cost"). It seems that the respondent wanted to have some training on food hygiene and food safety according to the statement: "*But I think it would do us no harm." (226G4)* G4 emphasised that not only recurrent trainings about the same things are necessary but also about novelties in catering sector.

Respondents exposed inefficient knowledge assessment of hygiene and food safety, since food safety tests are mostly completed jointly by employees. In this way, participants do not acquire sufficient knowledge, which has also been established previously (Pichler *et al.*, 2014; Zanin *et al.*, 2017; Jevšnik *et al.*, 2018). It was confirmed that employees working with food who have annual food safety trainings have better knowledge than the employees without such education (Jevšnik *et al.*, 2018; da Cunha *et al.*, 2015; Al-Shabib *et al.*, 2016; Pichler *et al.*, 2014; Opolski Medeiros *et al.*, 2011). In addition Yu *et al.* (2020) pointed out that foodservice operation managers and safety trainers should introduce fundamental microbiology and epidemiology knowledge before food safety training, which can lead to greater training effectiveness. Introducing food safety domain knowledge is a more affordable approach to significantly improving training effectiveness than changing current training delivery methods, such as by integrating technologies into training (Clark *et al.*, 2018; Yu *et al.*, 2018).

Managers should also go through food safety trainings (Ovca *et al.*, 2014; Jevšnik *et al.*, 2008; Pragle *et al.*, 2007), so that they would have more knowledge to educate new employees as required by the EU Regulation (2004). The worst case is if employees have no food safety trainings, which became evident in our study at two respondents. If the company's management does not organise the training, it violates the requirement of Regulation (2004), which states: "Food business operators are to ensure that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity". In Montenegro, half of the study participants (52.3%) passed HACCP training in food safety (Barjaktarović-Labovič *et al.*, 2018) while in Ireland the training among food handlers was even worse, while 28% of all respondents claimed they had never received any food safety training (Gruenfeldova *et al.*, 2019), in Slovenia this is claimed by 5% of respondents (Jevšnik *et al.*, 2018).

3.3 Microbiological hazard (T3)

Theme 3 – Microbiological hazard consists of three categories: Causes of infections (C1), Preventive measures (C2) and Knowledge of microorganisms (C3). All respondents but one had heard about *Salmonella enteritidis*, mentioned in the fictitious newspaper news, and all but three knew the signs of infection related to the consumption of contaminated food. The question: Why do you think the infection (in the text read by respondents) occurred, G5 stated: "*Well, I think, . . . I assume the outbreak occurred because of, hem . . . probably eggs or meat which are two of the most problematic foodstuffs.*" *(312G5)*; and G8 said: "*I think the outbreak primarily occurred because they did not pay enough attention to hygiene, maybe they didn't wash their hands or the chicken was not well done.*" *(317G8)*. G6 described the cause of the FBD more in detail: "*Well, eggs were the problem here, I don't know, but it could be that meat was not well done, probably that was it, the meat. Or, as they said they ate salad, they might have eaten Russian salad, which could have stayed there at room temperature the whole day, or it was even from the previous day.*" *(316G6)*. Since six respondents stated they had heard about the pathogenic microorganism mentioned in the news, but without knowing much more about possible causes of infections, it can be concluded that they lack knowledge in this field.

Improper food safety training results in lower level of knowledge and understanding of preventive measures, also confirmed by other studies (da Cunha *et al.*, 2014; Howton *et al.*, 2016; da Cunha *et al.*, 2019; Hollway and Jefferson, 2003). Most respondents consider that food safety knowledge is transferred by employees among themselves and that mostly they themselves convey the knowledge to new employees. Because some do not understand why particular preventive measures are necessary, they also mention their wish to have more knowledge and receive in-depth explanations at trainings. Among preventive measures, most respondents find it important to have clean hands during work and to take care of their personal hygiene. Most consider they wash their hands, but do not manage to dedicate as much time to handwashing as it would be necessary. Respondent G1 stated: "*. . . we all know how we should wash them, but in practice this is not feasible. In practice it is some 5 seconds, but we always use soap, it's not just rinsing with water, and paper towels are used.*" *(321G1)*. Yu *et al.* (2018) illustrate that knowledge alone is not sufficient to influence handwashing behaviour, and that food handlers need behaviour-based motivation. Nine respondents considered proper cleaning and disinfection of the kitchen to be the best preventive measure. Six answers referred to disinfecting hands and four to suitable heat treatment of food. Although all respondents were aware of the importance of good hygiene practice when working with food, they also indicated that practice does not always comply with rules, even if they are familiar with them. This was also established before and deficiencies in food safety knowledge and behaviour of food handlers were highlighted (Clayton and Griffith, 2004; da Cunha *et al.*, 2019; Parry-Hanson Kunadu *et al.*, 2016; Al-Shabib *et al.*, 2016; Jevšnik *et al.*, 2008; Soon *et al.*, 2012).

Four respondents stressed that one has to take care to avoid cross-contaminations when working with food. Other respondents stated to stay at home if you are ill as the first preventive measure, then to check food item expiration dates, to have suppliers whom you trust regarding food safety, to take care of the process hygiene and to store foods separately in fridges (e.g. G8: "*. . . to prevent FBD it is important to wash hands, not to come to work if you are ill, to wash hands after using toilet, that.*" *(324G8)*. According to Guchait *et al.* (2016), improper temperature requirements, inadequately cleaned equipment, poor hygiene practice, improper raw material input cause 97% of all FBD in restaurants.

The question whether they have heard of *Salmonella, Escherichia coli, Listeria and Staphylococcus aureus* was answered in the affirmative by respondents. However, they could not answer the question about diseases caused by them: "*I don't know the names of diseases, but you have diarrhea and you vomit, don't you.*" *(336G9)*. According to their answers, their knowledge of measures to prevent infections caused by these bacteria, varied a lot, as G1

states: "*Well, I think the first question is probably heat treatment, the second question, if you can transfer it (an infection) to a heat-treated dish with your hands, when you think it is not treated, and then you must have clean hands and handle clean cutlery.*" *(332G1)*; G8: "*Yes, yes, to wash hands, not to come to work if you are ill, to wash hands after using toilet, that.*". "*Yes, washing hands, and disinfection. And to keep it clean.*" *(331G8)*.

3.4 Work process (T4)

Theme 4 – Work process consists of three categories: Storing foods and temperature ranges (C1); Food defrosting (example fish) (C2) and Critical control points (C3). Most respondents think that appropriate devices or places for separate storing of foods must be available. In most cases, the respondents knew temperature ranges for storing perishable foods, but answers were inconsistent, since they quoted cold storage temperatures in the range from 1 to 6 °C. Interviews also suggested shifting the responsibility (e.g. G4: "*About 5 degrees or whatever it is inside. I don't know, my coworker measures this, she is the boss. She is in charge.*" *(414G4)*). Inappropriate food handling practices can cause FBD (da Cunha *et al.*, 2015; Zanin *et al.*, 2017). Pichler *et al.* (2014), Liz Martins and Rocha (2014), Tavakkoli *et al.* (2015) and Jevšnik *et al.* (2018) demonstrated a limited level of knowledge among food handlers in catering establishments, as regards optimal temperatures for cooking, holding and storing foods. de Souza *et al.* (2018) identified inadequate practices, such as absence of temperature control, meat defrosting at room temperature, and perishable foods exposed to room temperature for longer periods, which can directly influence the contamination of food. In our study we also found out that the question: "If frozen fish (such as tuna, salmon, hake) is defrosted at room temperature, e.g. on the kitchen counter overnight, and then prepared correctly, is it safe and can be consumed?" was not answered correctly by most respondents. Respondent G1's answers were spontaneous and direct, only in certain topics he could not express them immediately (e.g. critical control points, freezing, question whether fish defrosted the previous day is suitable for consumption the next day): "*Hum, in a special, well, we put them in, hem, a certain tray for thawing*", "*Hum, there we usually have a sink or a space where we thaw frozen foods* "; "*Yeah.*"; "*(a pause). It should be. But considering the question it isn't, I reckon.*" *(321G1)*.

No respondent is aware of the hazards due to incorrect food defrosting. The European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC) (EFSA and ECDC, 2021) have recently reported that catering establishments were identified as the most frequently reported setting for major FBD, such as salmonellosis, listeriosis and campylobacteriosis, which was confirmed also by Osimani *et al.* (2016). The promotion of good hygiene practice among food handlers is the most important food safety preventive action for reducing FBD (Smigic *et al.*, 2016; de Souza *et al.*, 2018).

The respondents' knowledge of critical control points (CCPs) differs a lot and they fail to understand its meaning. We can conclude from their answers that they mainly guess or they consider a CCP everything that can be hazardous. The question: "Do you have any CCP in your work process and how do you control it?" was answered by G8, "*A critical control point . . . you mean, hem, that we wash our hands and cook the meat well, isn't it, this is the most critical.*" *(436G8)*. G9 explained a CCP in a broader sense and we can conclude that under CCP G9 meant only cold storage of food: "*Yeah, we put cold starters immediately in the fridge, desserts are also portioned at once and put in display cases, and cakes are put in fridge as soon as they cool down, nicely cut and then only pieces are taken out. And a panna cotta first goes to the blast chiller and then directly to the fridge.*" *(437G9)*. Buccheri *et al.* (2007) stated that the general implementation of HACCP system among employees is adopted as an efficient method of preventing FBD. Team approach, understanding reasons for follow up procedures in food handling, and the need of constant training are necessary for success. According to

Jevšnik *et al.* (2008) it is very important that those performing a training have suitable food safety knowledge as well as skills in pedagogical – andragogical field. Those people have to be competent experts in their field so that adequate knowledge and skills can be passed on to the employees.

4. Conclusion and implications

The case study with semi-structured interviews helped us find out that food safety barriers most often originate in a lack of knowledge (e.g. improper food safety training, incorrect food safety knowledge testing, knowledge and maintaining of CCPs), shortage of food hygiene skills (e.g. handwashing, food defrosting) and weak work satisfaction (e.g. insufficient payment, poor interpersonal relationships and weak motivation). The latter influences relationships and the way employees handle foods as well as their routine practice regarding food safety in the working area (e.g. kitchen, refrigerators, storage rooms, waste disposal). In the following text we summarise short conclusions of this study in reference to the questions asked in the research. We also highlighted key points that need to be revised in ensuring compliance to food safety by the food handlers.

Food safety knowledge, competent food safety training professionals and consequently training methods were found to be the biggest barrier to the efficiency of HACCP system in practice. Respondents emphasised that they would need more trainings, mainly practical ones and more topic centred. Irregularities found in food handling additionally underline the fact that the transfer of knowledge into practice is insufficient or even incorrect. Targeted food safety trainings should be organised for food handlers, adapted to the job complexity. As found out regarding respondents' knowledge, the most important critical areas are personal hygiene (washing hands), defrosting foods, and knowledge and management of CCPs. Although all respondents are well aware of the importance of personal and hand hygiene, the transfer of knowledge into practice is most often ineffective. On average, respondents soap their hands for approximately six seconds what corresponds to one third of time specified as sufficient to eliminate all contaminates from the hands. For them, it is the most disturbing that trainings are outside working hours; if the courses took place within working hours, they would be more receptive to new knowledge and to lectures. They suggested organised week-end education which would combine pleasant and useful (so-called team building), but they were aware of the costs related to its organisation. Results from the Howton *et al.* (2016) study show supervisors that front-line employees want clear, easy-to-follow instructions, the ability to check their progress, save their work and continue at a later time and include relevant examples and scenarios. It would be important to change the views and attitudes of managers towards trainings, to raise their awareness and constantly emphasise how truly important continued and quality food safety trainings are for food handlers. For managers, food safety training should be supplemented with contents regarding organisation climate and food safety culture (communicational and motivational techniques, team approach, mindfulness, etc.). Griffith *et al.* (2017) emphasised that strong leadership regarding priority of food safety and responsibility of corporate management to provide sufficient resources are the cornerstones in providing the time needed for implementation of an effective food safety system in daily practice.

Respondents pointed out they are overburdened at work and emphasised the necessity for additional pay or higher salary for improved motivation. Most respondents would be more motivated if they received a higher monthly income. Some of them even mentioned that increased salary would help improve the employee's attitude to food handling and to observing food safety hygiene principles.

Most respondents assess HACCP system as useful tool to ensure food safety. However, they think it is not well conceived in terms of user-friendliness (e.g. a too bureaucratic,

unresponsive system); some think it is not adequately presented at trainings. Because of these barriers, also knowing and managing CCPs is a problem among respondents.

The human factor in organisational and execution levels is the reason for intolerable deviations in HACCP system realisation in daily practice. Due to lack of knowledge and shortage of acquired routine skills, which is expressed in critical situations, we face FBD outbreaks. If we will not perform appropriate training, we cannot expect to have professional food handlers with necessary knowledge, which is an important foundation on which attitude towards food safety and later practices are developed. Thus, more attention has to be dedicated to HACCP supported by the laws of behavioural science. We suggest that the present food safety European legislation is upgraded with a precisely defined programme of regular and obligatory trainings for food handlers, according to workplace requirements and hierarchical structure. Special emphasis should be put on the new staff, particularly those without previous food-related education. In daily practice, most of the critical points are hanging on food handler. According to Ovca *et al.* (2017) the goal in terms of better food safety can be achieved only with co-operation of all who are involved in different kinds of food activities: government, teachers, food safety educators, food processors and consumers who stand at the end of FSC but are entering it also as professional food handlers on different levels.

Although this paper is based on very focused case study, it shows very clearly that even well-defined tool as HACCP is, needs regular and permanent education especially in time when hygiene concerns are permanently knocking on the door of human population around the globe.

4.1 Research limitation

Due to the small sample, the results cannot be generalised to the entire population of food handlers in catering establishments 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 catering establishments.

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