**DOI 10.7251/VETJEN2001036K** **UDK 640.4:658.562.47]:614.31**

**Review scientific paper**

# HOSPITALITY – OPERATING IN ACCORDANCE WITH THE PRINCIPLES OF GOOD PRACTICE AND HAZARD ANALYSIS AND CRITICAL CONTROL POINTS

**Nataša KILIBARDA[1]*, Neđeljko KARABASIL[2], Slaven GRBIĆ[3], Dušan BOROVČANIN[1], Filip ĐOKOVIĆ[1]**

[1] Faculty of Tourism and Hospitality Management, Singidunum University, Belgrade, Republic of Serbia
[2] Faculty of Veterinary medicine, University of Belgrade, Belgrade, Republic of Serbia
[3] Veterinary institute "Slaven", Banja Luka, Bosna i Hercegovina
* Corresponding author: Nataša Kilibarda, e-mail: nkilibarda@singidunum.ac.rs

**Abstract:**
A hospitality sector is an important place when it comes to the occurrence of foodborne diseases in the world. Restaurants within hospitality represent the last line of defense of food before it reaches the consumer. Hospitality facilities are obliged to establish a system for ensuring food safety in accordance with the principles of good manufacturing and hygiene practice and hazard analysis and critical control points (HACCP). However, the specifics of the hospitality sector often represent barriers to the successful implementation of the HACCP system. To a large extent, the successful implementation of the food safety management system can be influenced by the management of hospitality facilities. Proper management of human resources could play the most important role in the prevention of foodborne diseases in the hospitality industry. In addition, it is especially important to carefully consider the entire production process and its specifics, which should result in the application of appropriate control measures that will eliminate potential hazards or reduce them to an acceptable level. Food safety is imperative when it comes to consumer health, but also the effectiveness of the HACCP system will depend on how much a certain entity in the food business has managed to overcome all barriers that carry the specifics of the hospitality business and also motivate its employees.
**Keywords:** hospitality, specifics, barriers, HACCP

## INTRODUCTION

Foodborne disease or food poisoning is a broad term that encompasses all conditions or diseasses that result from the consumption of food that is contaminated with pathogenic microorganisms and/or their toxins and parasites or contaminated with toxins that may be of natural or artificial origin. The causative agents of most foodborne diseases are pathogenic bacteria and/or their toxins or viruses (Kilibarda, 2019). Some of these hazards

are of concern to the entire community when it comes to public health, some of these hazards are common to certain regions, i.e. underdeveloped or developing countries. However, one thing is for sure, and that is that in the age of globalization, all these hazards can spread very quickly along the food chain, regardless of borders. Therefore, it is necessary to keep in mind that foodborne diseases can be prevented and that everyone has a role in the prevention in their domain (WHO, 2015).

World organizations dealing with public health published data on the number of people suffering from foodborne diseases, although it should be emphasized that these are estimated, and not absolutely accurate numbers. The reason for this is that a significant number of cases of foodborne diseases remain unrecorded. The absence of records of these cases is a consequence of the fact that patients usually do not ask for medical help, and when they ask for it, samples are not taken for laboratory analysis. Also, due to a large number of causes, it is not possible to identify the right one. Usually, in cases when a diagnosis is established, competent institutions are not informed about it (Zanin et al., 2017; Kilibarda*,* 2019). The first report on the assessment of the incidence of foodborne diseases and mortality rates at the global level was made by the World Health Organization. According to their estimates, foodborne hazards were the cause of 600 million cases (that is, one in ten inhabitants) and 420 000 cases were fatal, on a global level, in 2010. As many as one-third of deaths from foodborne diseases were children (WHO*,* 2015).

In the United States, it is estimated that 9.4 million people get foodborne disease caused by pathogenic microorganisms and parasites each year, of which 56 000 are hospitalized and 1 300 dies (Scallan et al*.,* 2011). Of this number, more than half of the foodborne diseases that are reported are related to eating outside the household, i.e. in restaurants (Angulo et al*.,* 2006). In America, for many years, the largest number of cases of foodborne diseases has been recorded in restaurants (CDC, 2019).

However, unlike in America, in the European Union, there has been a trend for years that one of three foodborne diseases occurs in households, which is understandable considering that the largest percentage of meals is realized at home. In the second place, immeidiately behind the household in terms of frequency of foodborne diseases, there are facilities that provide food and beverage services (restaurants, bars, canteens, catering, etc) (EFSA, 2018).

Nowadays, by changing lifestyles and habits, humanity is exposed to a chronic lack of time. Due to that, people are increasingly focused on eating outside the home, i.e. in restaurants (*de A*ndrade et al., 2019; Kilibarda, 2019). Whether it`s a canteen in a work organization, or a fast-food restaurant, on a lunch break, a family lunch in a *fine dining* restaurant, food and beverage service providers become places where people are more likely to come into contact with food hazards. Today, food production is centralized and hospitality facilities can order food produced in different and distant geographical areas. In that case, if the purchased raw material contains some hazards (biological, chemical, physical), it is clear that it can be a potential source of danger for ready-to-eat meals. In addition, the occurrence

of foodborne diseases, in this case, can be extremely serious, when we can talk about the globalization of (un)safe food (Zanin et al., 2017; Kilibarda, 2019; Nayak and Waterson, 2019; Kilibarda, 2020). Increasing the number of international trips (for work or pleasure) affects the occurrence of certain foodborne diseases, because in this way people come into contact with pathogenic microorganisms they have not encountered before, and it is known that the first contact with "new" pathogens makes a person susceptible to disease development (Alberer and Löscher, 2014). This is especially supported by the fact that most travelers are actually unaware of the risks that exist when consuming, for the first time, traditional and exotic dishes when traveling to a destination (Robertson et al., 2014; Kilibarda, 2020). It is clear that the health of guests is imperative, but the fact is that the occurrence of foodborne diseases represents a significant financial loss, which is reflected in the reduced number of guests, "poor marketing" and loss of loyalty of visitors. In addition, the occurrence of foodborne diseases affects economic development, especially tourism, agriculture, and food exports.

The supply of food through the hospitality sector makes a significant contribution to the overall supply of food at the national level, employs a large number of workers, which altogether affect the development of the local economy. The term hospitality means accommodation and food services, i.e. activities that do not include food preparation (accommodation services), but also includes activities related to the service of food and beverage for current use, which implies the existence of spaces in which the food is prepared (Al Yousuf et al., 2015). In this regard, food and beverage services are defined as activities that provide complete meals or beverages prepared for immediate use, whether in conventional (traditional) restaurants, self-service or takeaway restaurants, with or without seating (UN, 2008). Thus, the foodservice, defined in this way, represents over 60% of all entities that operate in the food industry, because it includes restaurants and food in hospitals, hotels, prisons, schools, companies, etc., and includes both institutional and commercial restaurants. Entities providing food and beverage services are represented from street salesman to restaurants that are part of large corporate chains, but most of them are represented through small businesses run by the owners themselves (Al Yousuf et al., 2015).

## Who is responsible for production/offering safe food?

The obligation of every producer, i.e. all those who deal with food, is to provide the market with quality food with certain nutritional and sensory properties that the consumer expects, but also hygienically correct and safe food, which will be harmless to consumer health (Kilibarda, 2019). Essentially and using common sense, it must be said that every link in the food chain, from the farm to the table, has a certain degree of responsibility when it comes to food safety. When it comes to food in restaurants, it is said that they are the last line of food defense before food reaches the consumer. The goal of the food safety management system is to identify potential hazards and identify places in the production process where they can pose a significant risk to food safety, but also places where they

can be controlled (reduced to an acceptable level or eliminated) (Bunčić, 2009). According to the Regulation (2019), "Food business entities are obliged to establish a system for ensuring food safety in all phases of food production, processing and trade, except at the level of primary production, in each facility under their control, in accordance with the principles of good manufacturing and hygiene practice and hazard analysis and critical control points (HACCP)". Hospitality facilities that provide food and beverage services, in terms of this law are "food business entities", and are obliged to conduct regular self-checks of hygienic conditions of food preparation in accordance with the established HACCP system, i.e. Principles of hazard analysis system and critical control points. Thus, the hospitality facility ensures food safety, while at the same time guests have the opportunity to enjoy quality prepared and offered dishes (Kilibarda, 2019).

In order for the HACCP system to be implemented and conduct in an adequate manner in food business entities, it is necessary that the preconditions for good manufacturing and good hygiene practice (*Good Manufacturing Practice (GMP) and Good Hygiene Practice (GHP)*) are fully developed and implemented (Bunčić, 2009; Al Yousuf et al., 2015). The implementation of precondition programs ensures respect for general hygiene principles and adequate procedures and organization in all activities related to food. The basic elements of good manufacturing and hygiene practice, among other things, are applied through various areas, and some of them are the structure of the plant and its maintenance, i.e. in this case, the structure of restaurant food storage rooms and their cleaning and sanitation, as well as handling raw materials, from their transport, reception, preparation to storage of finished food (Kilibarda, 2019). In this sense, the prerequisite programs and HACCP are inseparable and compatible parts of one whole, i.e. food safety management.

The main goal of the HACCP system application is the production of safe food, with the most economical and efficient production, that can be realized through reducing food losses, improving quality, providing better control of raw material stocks, increasing profits, and engaging and awareness of employees in matters related to food safety.

## Specific of food hospitality business

When it comes to the application of the HACCP system in the hospitality and in the foodservice sector in general, problems are often encountered in practice. There are a number of specifics of these entities in relation to the food industry. Some of them are a large number of input raw materials and finished products, numerous recipes, and the complexity of ready-to-eat meals, but also mostly a small space where the production of different products takes place at the same time (Eves and Dervisi, 2005; Taylor and Forte, 2008; Garayoa et al., 2011). In addition, another specificity is the activity related to serving food; hospitality facilities produce and serve food at the same time, and there are differences between the ways of serving food (*a la carte*, buffet, or serving in hotel rooms) (Savović and Ćurčić, 2008; Taylor and Forte, 2008). The long period of time that elapses from the preparation of food to its serving is a risk of food spoilage, especially in those situations when the so-called "hot chain" is not provided (keeping food warm until serving).

Some of the specifics of hospitality when it comes to the application of HACCP, i.e barriers to its implementation, are uneven production, poor application or insufficient application of science, poor equipment, or equipment that does not achieve or does not have the required performance (Wandolo et al*.,* 2018), then poorly and insufficiently detailed described product, but also constant changes in the offer of food due to adaptation to the requirements of guests, but also competitiveness in the market (Savović and Ćurčić*,* 2008).

What has already been pointed out is that hospitality is represented by a large number of small companies, which operate without the support and advantages that entities that operate within large corporations have. Therefore, it can be concluded that they often have a relatively low-profit rate, which means that they have less financial resources to invest in food quality policy (Eves and Dervisi, 2005; FDA, 2006; Taylor and Forte, 2008). Therefore, problems such as lack of money, time, and knowledge related to the implementation of HACCP are often cited as the reason, as well as the cost of external consulting services to which entities are most often referred (Taylor*,* 2008).

The most common reasons for a significant percentage of foodborne diseases in hospitality are: raw materials from unsafe and untested sources, inadequate heat treatment of food, inadequate food storage temperature, as well as improper procedures for defrosting food, contaminated equipment, poor hygiene, and/or employee illness, improper handling of food leading to cross-contamination, sponges and cloths used in the kitchen for multiple purposes, meals prepared long before being served (due to poor planning) (Bolton and Maunsell, 2004; Bolton et al., 2008; Adesokan et al*.,* 2015). Employees in this industry have different levels of education and different communication skills. Given that the business of the hospitality is mainly seasonal, staff changes frequently, which is one of the problems in terms of their training, and in addition, nonexistent knowledge of the language in which internal training is conducted can be an obstacle to successful training (Panisello and Quantick, 2001; Taylor and Forte, 2008; Taylor, 2008; Casolani and Del Signore, 2016). In restaurants of large hotel chains, where financial and infrastructural resources are not a problem, untrained staff and lack of training can be a weak point in the food production process, leading to an increased risk of unsafe food (Matias et al., 2013; Casolani and Del Signore, 2016). The human factor, when it comes to cross-contamination of food in hospitality, is a significant risk to food safety (McIntyre et al., 2013). Therefore, training of food handlers when it comes to the application of good hygiene practice is the most widespread strategy that effectively influences the improvement of food safety (Hislop and Shaw, 2009; Medeiros et al., 2011; Martins et al., 2012; Rossi et al., 2017; Zanin et al., 2017).

Since the staff can be a significant risk when it comes to food safety in hospitality, proper human resource management could play a key role in the prevention of foodborne diseases in hospitality *(*Eves and Dervisi, 2005; Bolton et al., 2008; Rossi et al., 2017). Their understanding of the activities performed to ensure safe food is essential when it comes to defining responsibilities and tasks for each employee who handles food, which includes

organizing training for each of them (Garayoa et al., 2011). Their task is to provide both time and other resources for the education and training of employees. However, in order for these activities to be effective and efficient, managers must be qualified, competent and have the appropriate knowledge in the field of food safety, which in practice is usually not the case, since they usually rely on their work experience (Ko, 2013; Rebouças et al., 2017), which is often an obstacle to the successful implementation of food safety policy.

## Application of the principles of good practice and hazard analysis systems and critical control points in hospitality

The stages of food production and service in hospitality include, but are not limited to: the reception of raw materials, storage, preparation, heat treatment, refrigeration, heating, cold and hot food treatment, serving, decoration/packaging, serving, sales (Popov-Raljić and Blešić, 2012). All of these phases can potentially be spots where food contamination can occur, which can affect the safety of the finished dish. It is clear that if food is handled in accordance with good production and good hygiene practice and in accordance with the principles of the hazard analysis system and critical control points, the risk of food contamination is reduced to a minimum, which will ensure a safe finished product (Kilibarda, 2019).

As a general rule of application of the principles of good practice and hazard analysis systems and critical control points in hospitality, it is considered that prerequisite programs should be used to control hazards related to environmental conditions (facilities and structures, services, staff, plant, and equipment), and the HACCP system should be used to control hazards directly related to food processes (storage, processing and preparation process) (Bolton and Maunsell, 2004). Basically, the prerequisite programs are universal principles that focus on space, equipment, and personnel, while HACCP is specific and focuses on raw materials, production, and the finished product.

The basic elements of good manufacturing and good hygiene practice should primarily provide adequate working space (i.e. infrastructure requirements), protection of food from contamination caused by biological, chemical, and physical hazards, control of microorganism growth, and correctness of equipment, especially that equipment that should provide appropriate temperature conditions in which food is stored (refrigerators, freezers), in which food is thermally processed (ovens) or in which it is served and displayed (warm cabinets and tables). Also, prerequisite programs in hospitality can include allergen management, order specification, development of detailed recipes, staff training programs, as well as standard operating procedures related to cleaning and sanitation of equipment and space (FDA, 2006).

Implementation of prerequisite programs, which are related to the structure of space, i.e. infrastructure requirements, space, and premises, can often be a problem for small businesses, which cannot be said when it comes to large corporate chains and restaurants and/or hotels franchises. In hospitality, taking into account the specifics, the problem is the

simultaneous preparation of different types of dishes and the serving process, and often the problem is to provide a special space for storage, processing, and preparation of food, or to separate these activities in time. This can be a significant risk for cross-contamination in hospitality. Also, poor staff hygiene, insufficient staff training, and lack of awareness of employees about food safety in hospitality, given its specifics, can be a significant risk when it comes to food safety in hospitality (Martins et al., 2012; Serafim et al., 2018), given that most foodborne diseases in hospitality occur as a consequence of inadequate food handling (Zanin et al., 2017; Barjaktarović-Labović et al., 2018).

After the establishment of prerequisite programs, the introduction of HACCP is implemented through twelve steps, i.e. through five steps and seven principles 1. training and formation of a team for HACCP; 2. detailed product description; 3. description of the purpose of the product and identification of food users; 4. making flow diagrams of the production process; verification of the flow diagram of the production process on-site, while the seven principles include: Principle 1. Risk analysis, which is the basis for the development of the HACCP plan and the basis for defining all further steps; Principle 2. Determination of critical control points - a step in the production process in which control is applied in order to eliminate the hazard or reduce that hazard to an acceptable level; Principle 3. Determination of critical limits, i.e. minimum and maximum values for each control point, for biological, chemical, and physical hazards; Principle 4. Establishment of a system for monitoring, i.e. monitoring critical points; Principle 5. Defining and implementing corrective measures; Principle 6. Verification of system functioning and Principle 7. Establishment of HACCP system documentation (Bunčić*,* 2009).

Although the Regulation (2019) request that "a food business operator is obliged to have a permanently responsible person with appropriate education for the implementation of good manufacturing and hygiene practices and the application of HACCP" in hospitality facilities, this represents a potential place for concern. It often happens that the owners of the facility are also managers, who are not qualified and do not have the appropriate level of education. Consequently, they rely on their experience or managerial skills in activities related to food safety. Small facilities are not able to appoint a HACCP team due to insufficient staff and are therefore focused on hiring external consultants. Such services generally represent financial costs that are not justified for them, as it is often the case that management does not value the importance of food safety sufficiently (they give preference to the ambiance, taste, and presentation of food, attractive location) (Taylor, 2008; Wallace et al., 2018).

A detailed description of each ready-to-eat meal, but also making a flow chart of each prepared product is a big job, especially for restaurants that have a wide range of dishes. Due to a large number of combinations of production processes, processing, preparation, and serving of food, in hospitality, it is recommended to group production processes in relation to the same activities during the preparation and serving of food. Thus, observing the production processes in this way there is no approach to each dish separately and

consequently, both time and resources can be saved. It is clear that although there are differences in the production processes of different dishes classified in this way, it can be generally said that the control measures applied to eliminate or reduce hazards will be the same in each process and will be based on how many times food passes through the danger zone. A danger zone means a temperature zone between 5°C and 60°C. This is the temperature range that is most conducive to the growth and multiplication of bacteria (FDA*,* 2006). There are three groups of production processes that are based on how many times food passes through the danger zone (FDA, 2001). The first group of production processes includes the following phases: reception - preparation - serving (without heat treatment). The first production process includes raw dishes such as sushi, sashimi, fresh shellfish and salads, and other ready-to-eat foods such as cheeses, then pasteurized milk products (sour cream, yogurt), etc. The second group of production processes includes reception - preparation - heat treatment - food display - serving (food passes once through the danger zone). This production process is applied for the preparation of, for example, grilled chicken, which is served hot immediately after heat treatment. The third group of production processes includes the following phases: reception - preparation - heat treatment - cooling - heating - hot storage - serving (food passes through the danger zone several times). Examples would be complex dishes such as dishes that are prepared in larger quantities and stored for serving the next day (soups, stews, etc.) (Seward, 2000; FDA, 2001).

Also, the grouping of dishes can be done in relation to the method of preparation in several groups, such as heat treatment of food/hot serving; heat treatment of food/cold serving; cold food preparation/cold serving and in relation to the method of serving (Popov-Raljić and Blešić, 2012).

Basically, no matter which grouping method is applied, it is important to make the job easier, as well as to relieve the system of documentation. The goal of this grouping of dishes is that, regardless of the variety of finished products, the applied control measures can be the same. Thus, for example, a certain restaurant can prepare dozens of dishes, which are produced by the same production process, that is, for example, dishes pass through the danger zone once. Each of these dishes can be a source of different dangers, but the control measure, i.e. adequate heat treatment, eliminates or reduces all these hazards to an acceptable level. For example, *Salmonella* and *Campylobacter* are important biological hazards for grilled chicken, while *Salmonella*, *E. coli O157: H7*, *Bacillus cereus,* and *Clostridium perfringens* are important biological hazards for minced meat roll, however, the control measure, which is heat treatment, will for both dishes be the same. Additionally, if these dishes are not served immediately, their proper warm storage over a period of time may also be the same control measure, which will prevent the growth and production of toxins of sporulating microorganisms, which have survived the heat treatment process (Bolton and Maunsell, 2004*;* FDA*,* 2006).

## Potential critical control and control points in the production process in the hospitality

When establishing critical control and control points, entities that prepare and serve food should always take into account their own needs, i.e. they should be in accordance with the size and type of facility, production capacity, and type of production process, the properties of raw materials and finished products which they prepare, so that the system does not overload the production process itself, losing its purpose (Wallace et al., 2018).

Some examples of critical control points in hospitality could be:

*Receipt of raw materials*. Receipt of raw materials is an important stage in the process of food production in hospitality. At admission, the risk may be a raw material contaminated with pathogenic bacteria and/or their toxins. First of all, it is important for that reason that the procurement of raw materials is done exclusively from verified suppliers. At this stage, the application of two types of control measures is recommended. Raw materials that require a temperature regime should be stored in a cold chain mode immediately upon receipt. Special care should be taken at the reception when it comes to ready-to-eat food, but also food that will not be thermally processed before serving. A control measure that would ensure temperature monitoring at the reception of such raw materials, would be an adequate measure to control the presence of danger in such food. It is especially important to apply this measure when it comes to the intake of certain species of marine fish, due to the possibility of the appearance of scromboid toxin, i.e. histamine. Also, at the reception of fish that is intended to be consumed raw, and originates from a climate where there is a risk of the appearance of certain pathogenic parasites in it, it is very important to freeze it immediately. Some of the control measures could be the verification of declarations of conformity of raw materials issued by accredited laboratories, then visual control of raw materials, shelf life, packaging integrity and cleanliness, and hygiene of the transport vehicle (FDA, 2006; Bolton and Maunsell, 2004).

*Storage*. When food is stored cold in the refrigerator before preparation, the food safety system should be focused on providing a temperature that will prevent the growth and multiplication of pathogenic microorganisms in the food, which is especially important for ready-to-eat products. It is also important to take care that food is stored in a way to prevent cross-contamination (food must be covered, it is necessary to store raw and heat-treated food separately, etc.), and then to allow air circulation in the refrigeration unit itself. Storing food in a frozen state, in freezers, at temperatures below -12°C can also be considered as a potential critical control point. These temperatures prevent the growth, reproduction, and production of bacterial toxins, which is why it is important to provide and control the required temperature regime and store food in an adequate way to avoid cross-contamination (Bolton and Maunsell, 2004; FDA, 2006).

*Defrosting of raw materials*. Frozen food should be thawed in refrigerators or only if necessary in a microwave oven using an appropriate program. It is important to mention

that thawing at room temperature can allow bacteria to multiply and produce toxins if they are given enough time in addition to the optimal room temperature.

*Food preparation*. This phase in the process of food production includes a large number of activities that need to be supervised and controlled. Food preparation includes various processes such as combining different ingredients, chopping, grinding, kneading, etc. At this stage, it is important to develop procedures that will minimize the possibility of growth of microorganisms and food contamination by employees and/or equipment (Pop Raljić and Blešić, 2012). To prevent the growth of microorganisms, it is important to take care that the food is kept at ambient temperature for as little time as possible, i.e. in the danger zone. This can be achieved by preparing food in smaller quantities, which also means less time spent preparing. However, this is also a problem in hospitality since food preparation is unpredictable due to the nature of the business (except when it comes to restaurants with menus) (Kilibarda, 2020). To prevent cross-contamination of food by employees and equipment, utensils, and dishes in the food preparation phase, it is necessary to have implemented procedures related to employee hygiene and their behavior in the food area as well as a well-defined plan for cleaning and disinfection of surfaces, space, and equipment, and the separation of incompatible activities spatially and/or timely (Tešanović, 2017).

*Thermic processing*. Heat treatment of food of animal origin is the most efficient procedure used to eliminate or reduce biological hazards in ready-to-eat meals. Therefore, it is recommended to frequently monitor the heat treatment temperature and the time required to reach a certain critical value. Literature data suggest that the temperature in the center of the product should be at least 70ºC for at least two minutes or reach at least 75ºC in the food center. These temperatures are sufficient to destroy pathogenic bacteria such as *Salmonella, Campylobacter, L. monocytogenes,* and *Y. enterocolitica*. Lower heat treatment temperatures are allowed, but only for the preparation of special dishes or the preparation of dishes by certain techniques such as the *sous vide* food preparation technique (Kilibarda et al., 2018). However, in a production process, such as hospitality, it is almost unreasonable to measure the temperature of each hamburger in one entity that produces, for example, hundreds of hamburgers. In this case, it would be reasonable to confirm during routine work whether the heat treatment process itself and the equipment used can reach the required temperature in the product and/or in the equipment itself. Once it is determined whether the process itself meets the satisfactory criteria, the frequency of temperature measurements can be reduced. However, it is especially important to establish adequate critical limits during the heat treatment process, especially if it is the food of animal origin (Bolton and Maunsell, 2004).

*Cooling of heat-treated food*. Heat-treated food should be cooled immediately after the end of heat treatment using blast chiller equipment. If such a device is not available, the dish should be placed in the refrigerator within 90 minutes from the end of the processing process. The equipment should be able to lower the temperature in the center of the dish to

10ºC within 150 minutes. Prolonged cooling of food (longer than six hours) can lead to the creation of conditions in food that allow the growth of sporogenic bacteria, which have survived heat treatment and in such conditions can germinate and produce toxins. Since toxins are thermostable, a later phase in the process of food preparation, i.e. heating, will not lead to their elimination (Kilibarda, 2019).

*Reheating*. When heating food, that has previously been heat-treated and cooled, it has to reach a temperature of at least 73°C in the center of the product. Immediately after reheating the food, the food must be served within 30 minutes. The temperature of reheated food, if exposed to a hot table, must not fall below 65 C. These set temperatures must be controlled (Bolton and Maunsell, 2004; Kilibarda, 2019).

*Storing food during serving*. Food in restaurants can be exposed for sale in different ways (in the form of cold or hot buffet tables, cutting carts, dessert carts, display cases) and it is clear that in this way it is exposed to additional risks (Popov-Raljić and Blešić, 2012). Therefore, this phase can be considered a critical point and therefore must be controlled. Prevention of bacterial growth and reproduction can be ensured by limiting the time period in which food is exposed (this time should be shorter than what is needed to significantly increase the number of bacteria), or by storing food at temperatures that prevent bacterial growth (outside the danger zone). Heat-treated ready-to-eat food that is stored in a warm place must be at a temperature higher than 65°C, which can be achieved by exposing the food on a hot table (heat maintenance devices), and with a limited exposure time of a maximum of two hours. Lack of control over the established critical limits (temperature and/or time) could lead to the creation of conditions for the growth of pathogenic bacteria such as *S. aureus*, *C. perfringens,* and *B. cereus*. When it comes to cold food serving, food is allowed to be exposed during serving for a maximum of two hours after it has been removed from the refrigeration appliance (on refrigerated counters for up to four hours) (Bolton and Maunsell, 2004; FDA, 2006).

*Serving food*. Serving food is the last activity before the food reaches the consumer. In this phase of the food production process in hospitality, it is of great importance to prevent the possibility of cross-contamination of food by employees, which is achieved by maintaining personal hygiene of employees, their training and education, and developing awareness of responsibility for food safety. A specificity in hospitality is the hotel serving food in rooms, where additional risks may occur as the length of time of food transfer from portioning in the kitchen to delivery to the room, inadequate temperatures at which food is stored, inadequate food protection during delivery, etc. (Savović and Ćurčić, 2008; Tešanović, 2017).

## CONCLUSION

Consistent application of prerequisite programs and HACCP systems are crucial for food safety and are aimed to prevent the occurrence of cross-contamination and possible harmful consequences for human health. However, what needs to be accepted is that HACCP is not

just a product that someone has or does not have. The HACCP system is a process that takes several months to implement, in order to be able to say that the HACCP is documented, verified and that the system "lives" in a facility, i.e. that it is effective. When it comes to the application of the food safety management system, it is of great importance that the staff, and above all the management, show initiative and will to get involved in all activities, and above all to evaluate the importance of its consistent application. In this way, it is possible to effectively overcome all the specifics, i.e. barriers that characterize the hospitality sector, when it comes to the application of food safety management systems.

## REFERENCES

Adesokan H. K., Akinseye V. O., Adesokan G. A. (2015): Food Safety Training Is Associated with Improved Knowledge and Behaviours among Foodservice Establishments' Workers. Int J Food Sci., 2015:1-8.

Al Yousuf M., Taylor E., Taylor J. (2015): Developing a government strategy to meet international standards of food safety across the hospitality industry. Worldw Hosp Tour Themes, 7:4-16.

Alberer M., T. Löscher. (2014): Foodborne infections and intoxications associated with international travel. In Practical food safety: contemporary issues and future directions. Eds Bhat R., Gómez-López V. M.. Wiley Blackwell, 415–438

Angulo F. J., Jones T. F., Angulo F. J. (2006): Eating in Restaurants: A Risk Factor for Foodborne Disease? Clin Infect Dis., 43:1324-1328.

Barjaktarović-Labović S., Mugoša B., Andrejević V., Banjari I., Jovićević L., Djurović D., Martinović A., Radojlović J. (2018): Food hygiene awareness and practices before and after intervention in food services in Montenegro. Food Control, 85:466–471.

Bolton D. J, Meally A., Blair I. S., McDowell D. A., Cowan C. (2008): Food safety knowledge of head chefs and catering managers in Ireland. Food Control, 19:291-300.

Bolton D. J., Maunsell B. (2004): Guidelines for food safety control in european restaurants. Teagasc: The National Food Centre, European Union Risk Analysis Information Network.

Bunčić S. (2009). Vodič za razvoj i primenu preduslovnih programa i principa HACCP u proizvodnji hrane. Ministarstvo poljoprivrede, šumarstva i vodoprivrede, Uprava za veterinu, Republika Srbija.

Casolani N., Del Signore A. (2016): Managers' opinions of factors influencing HACCP applications in Italian hotel/restaurant/café (HoReCa) sector. Br Food J., 118:1195-1207.

CDC (2019): Surveillance for Foodborne Disease Outbreaks, United States, 2017, Annual Report. Centers for Disease Control and Prevention, U.S. Department of Health and

Human Services.

da Cunha D. T., Fiorotti R. M., Baldasso J. G., de Sousa M., Fontanezi N. M., Caivano S., Stedefeldt E., de Rosso V. V., Camargo M. C. R. (2013): Improvement of food safety in school meal service during a long-term intervention period: a strategy based on the knowledge, attitude and practice triad. Food Control, 34:662-667.

de Andrade M. L., Rodrigues R. R., Antongiovanni N., da Cunha D. T. (2019): Knowledge and risk perceptions of foodborne disease by consumers and food handlers at restaurants with different food safety profiles. Food Res Int., 121:845-853.

EFSA. (2018): The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2017. European Food Safety Authority and European Centre for Disease Prevention and Control, EFSA Journal, 16(12):5500.

Eves A., Dervisi P. (2005): Experiences of the implementation and operation of hazard analysis critical control points in the food service sector. Int J Hosp Manag., 24:3-19.

FDA (2001). Recommendations of the United States Public Health Service Food and Drug Administration. Food and Drug Administration, U. S. Department of Health and Human Services Public Health Service, Food Code.

FDA (2006): Managing Food Safety: A Manual for the Voluntary Use of HACCP Principles for Operators of Food Service and Retail Establishments. Food and Drug Administration, U.S. Department of Health and Human Services Food and Drug Administration Center for Food Safety and Applied Nutrition.

Garayoa R., Vitas A. I., Díez-Leturia M., García-Jalón I. (2011): Food safety and the contract catering companies: Food handlers, facilities and HACCP evaluation. Food Control, 22:2006-2012.

Hislop N. Shaw K. (2009): Food Safety Knowledge Retention Study. J Food Prot., 72:431-435.

Kilibarda N. (2019): Bezbednost hrane, Univerzitet Singidunum.

Kilibarda N. (2020). Food Safety and Waste in Hospitality. In Zero Hunger, Encyclopedia of the UN Sustainable Development Goals. Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. Springer.

Kilibarda N., Brdar I., Baltic B., Markovic V., Mahmutovic H., Karabasil N., Stanisic S. (2018): The safety and quality of sous vide food. Meat Technolog., 59(1):38-45.

Ko W-H. (2013): The relationship among food safety knowledge, attitudes and self-reported HACCP practices in restaurant employees. Food Control, 29:192-197.

Martins R. B., Hogg T., Otero J. G. (2012): Food handlers' knowledge on food hygiene: The case of a catering company in Portugal. Food Control, 23:184-190.

Matias J. C. de O., Fonseca J. M. J., Barata I. G., Brojo F. M. R. P. (2013): HACCP and OHS: Can each one help improve the other in the catering sector? Food Control, 30:240-250.

McIntyre L., Vallaster L., Wilcott L., Henderson S. B., Kosatsky T. (2013): Evaluation of food safety knowledge, attitudes and self-reported hand washing practices in FOODSAFE trained and untrained food handlers in British Columbia, Canada. Food Control, 30:150-156.

Medeiros C. O., Cavalli S. B., Salay E., Proença R. P. C. (2011): Assessment of the methodological strategies adopted by food safety training programmes for food service workers: A systematic review. Food Control, 22:1136-1144.

Nayak R., Waterson P. (2019): Global food safety as a complex adaptive system: Key concepts and future prospects. Trends Food Sci Technol., 91:409-425.

Panisello P. J., Quantick P. C. (2001). Technical barriers to Hazard Analysis Critical Control Point (HACCP). Food Control, 12:165-173.

Popov-Raljić J., Blešić I. (2012): Bezbednost hrane – primena HACCP sistema u ugostiteljstvu i hotelijerstvu. Prirodno matematički fakultet Novi Sad, Departman za geografiju, turizam i hotelijerstvo.

Rebouças L. T., Santiago L. B., Martins L. S., Rios Menezes A. C., Araújo M. da P. N., Almeida R. C. de C. (2017): Food safety knowledge and practices of food handlers, head chefs and managers in hotels' restaurants of Salvador, Brazil. Food Control, 73:372-381.

Regulation. (2019): Law on Food Safety. Official Gazette of Republic of Serbia, 17/2019.

Robertson L. J., Sprong H., Ortega Y. R.., van der Giessen J. W. B., Fayer R. (2014): Impacts of globalisation on foodborne parasites. Trends Parasitol, 30:37-52.

Rossi M. de S. C., Stedefeldt E., da Cunha D. T., de Rosso V. V. (2017): Food safety knowledge, optimistic bias and risk perception among food handlers in institutional food services. Food Control, 73:681-688.

Savović I., Ćurčić S. (2008): Specifičnosti primene HACCP sistema u ugostiteljstvu. 35. Nacionalna konferencija o kvalitetu, Agencija za kvalitet i standardizaciju Srbije.

Scallan E., Hoekstra R. M., Angulo F. J., Tauxe R. V., Widdowson M-A., Roy S .L., Jones J. L., Griffin P. M. (2011): Foodborne Illness Acquired in the United States—Major Pathogens. Emerg Infect Dis., 17:7-15.

Seward S. (2000): Application of HACCP in Food Service. Ir J Agric Food Res., 39:221-227.

Soares L. S., Almeida R. C. C., Cerqueira E. S., Carvalho J. S., Nunes I. L. (2012):

Knowledge, attitudes and practices in food safety and the presence of coagulase-positive staphylococci on hands of food handlers in the schools of Camaçari, Brazil. Food Control, 27:206-213.

Taylor J. (2008): A new method of HACCP for hospitality: changing behaviour and proving success. Int J Contemp Hosp Manag., 20:542-560.

Taylor J., Forte J. (2008): HACCP for the hospitality industry: the chefs' perspective. Int J Contemp Hosp Manag., 20:494-507.

Tešanović D. (2017). Sanitarna zaštita i bezbednost u hotelijerstvu.Visoka hotelijerska škola strukovnih studija Beograd.

UN (2008): International Standard industrial classification of all economic activities (ISIC), Rev. 4. United Nations, Department od Economic and Social Affairs.

Wallace C. A., Sperber W. H., Mortimore S. E. (2018): Food Safety for the 21st Century. Managing HACCP and Food Safety Throughout the Global Supply Chain. Wiley Blackwell.

Wandolo M. A., Ndiritu D., Khayiya R., Mugendi B. W. (2018): Barriers to the Implementation of Food Safety and Hygiene Principles (HACCP) in TVET and University Hospitality Schools in Kenya. Int J Sci Res Manag., 6(7):544-556.

WHO (2015): WHO estimates of the global burden of foodborne diseases. World Health Organization.

Zanin L. M., da Cunha D. T., de Rosso V. V., Capriles V. D., Stedefeldt E. (2017): Knowledge, attitudes and practices of food handlers in food safety: An integrative review. Food Res Int., 100:53-62.

Paper received: 14.06.2020.
Paper accepted: 05.11.2020.