

Control of nutritive allergens in a hospitality kitchen

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Abstract: Provision of hospitality services is a complex operation from the aspect of safety of employees and consumers, which makes necessary the introduction of the safety system, hazard analysis of critical control points (HACCP). In order to get a safe gastronomic product in terms of nutritive allergens, in addition to analysis of ingredients and finished product, validated cleaning protocols in hospitality kitchens are required as a prerequisite for successful risk management and hazard analysis for allergens. The application of regular allergen control enables food business operators to implement appropriate cleaning and sanitation protocols to reduce the risk of cross-contamination with allergens. The aim of this study was to highlight the significance of applying validated regimes for cleaning and control finished product, in order to define control measurements for the presence of nutritive allergens. This contributes to good hygienic practice (GHP) and good manufacturing practice (GMP) in hospitality facilities.

Keywords: nutritive allergens, cleaning protocol, allergen control, hospitality.

Introduction

Under current European hygiene legislation (European Commission, 2008; 2009), food businesses are obliged to develop and implement food safety management systems (FSMS) including prerequisite programme (PRP) activities and hazard analysis and critical control point (HACCP) principles. This requirement is especially challenging for small food retail establishments, where a lack of expertise and other resources can limit the development and implementation of effective FSMS (EFSA, 2017). Therefore, the issue of food (gastronomic products/meals and beverages are hereafter termed food in this study) safety in hospitality is a complex field, where application of FSMS and, sometimes, simplified PRP activities is necessary in order to protect the consumer. PRPs are preventive actions and conditions which should be performed before and during HACCP implementation, and they are crucial for food safety.

Allergies and intolerances to food ingredients are a safety risk widely considered in the food industry. To prevent or minimize contamination and/or cross-contamination with allergens in hospitality businesses, all aspects of the processes used must be properly controlled. Food hygiene and safety is the result of the implementation of PRPs and procedures

based on HACCP principles. In the case of declared allergens, their presence is due to their use as a raw material, ingredient or component in a given food product. In this case, their presence must be declared on prepacked foods or in the case of non-prepacked foods, this information should be given to consumers. The latter communication is possible using notices in the shop, restaurants, web-page information, etc. (European Commission, 2011; Official Gazette of RS, 2016; 2018).

However, the main danger to allergic or sensitive consumers is the presence of undeclared allergens mainly in raw materials or ingredients, and cross-contamination during storage, processing, distribution and between different products. Cross-contamination with, for example, an allergenic ingredient can result in the presence of traces of allergens in food. In most circumstances, the food producer is unaware of the presence of the allergen (Cucu *et al.*, 2013), and a preventive 'may contain' notice is not always applied (EFSA, 2017).

Hygienic design

The production area, professional equipment and tools are, besides the human factor, among the most common causes of food cross-contamination in

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Table 1. The effect of detergents and water on common food residues (Nikoleiski, 2015).

Residue	Example	Reaction with water	Detergent
Carbohydrate	Sugar, starch	Soluble in water	Mild alkaline
Protein	Milk proteins or egg proteins	Some are soluble in water	Chlorinated or strong alkaline with peroxide
Fat	Oil	Emulsifies with water	Alkaline
Non-organic material	Salt	Soluble in water	Alkaline acid or phosphates

hospitality facilities. It is desirable that production areas in a facility have a physically separated area for the production of food products that are without allergens. If there are not such conditions, the HACCP plan must precisely define procedures for cleaning and sanitation of equipment and tools used directly in the process of allergen-free food products, and procedures for serving this type of product (Popov-Raljic et al., 2017). Hygienic design of food premises is basically conditioned by the EU directive (Commission Directive, 2006), which prescribes specific requirements for machines that come into contact with food. Also, in Serbia, the rulebook on conditions and manner of conducting hospitality business operations, manner of providing hospitality services, classification of hospitality facilities and minimum technical conditions for constructing and equipping hospitality facilities (Official Gazette of RS, 2016) prescribes requirements in accordance with the EU directive.

The elimination of food allergens involves the removal of proteins typically present in complex matrices of products, and which include fats, carbohydrates and salts that are often treated with high temperatures. Also, during high-temperature treatment, other non-organic residues can be present on surfaces which come into direct contact with food, and these must be removed from food, but if they are visible during visual control after cleaning, they must be removed.

Proteins are difficult to remove from surfaces, which is why the process of precleaning with cold water and cleaning with warm washing regimes is recommended. Enhanced cleaning regimes to hydrolyse proteins are recommended, using soda with oxidative agents such as the intensifiers, peroxide or chlorine (Table 1).

Special procedures for sanitary processing and methods for maintaining cleanliness of hospitality equipment and inventory must be specified within the program, e.g. removing product residues when work stops (Popov-Raljic and Blesic, 2012; 2016).

Hospitality facilities must have formal protocols for cleaning and sanitary processing for all rooms (places for preparation, processing and storing foodstuffs), which specify which rooms, appliances or inventory need to be cleaned and how often, in order to reduce the risk of cross-contamination with allergens. Cleaning and sanitation methods vary depending on whether cleaning of equipment and its parts is done in a specified location off the production line (Cleaning-Off-Place — COP), or cleaning takes place immediately and on the production line, with or without disassembling the parts (Cleaning-In-Place — CIP).

The key factors in any effective cleaning regime are chemicals (water hardness, detergent type), contact time, temperature during cleaning and mechanical force used in the process. These key factors are usually shown in the ‘sinner’s circle’ (Figure 1). The sinner’s circle shows the actions of one or more individual key factors which can affect each other and balance each other to a certain extent (e.g. less time requires higher temperature and greater concentration of chemicals) (Basso et al., 2017).

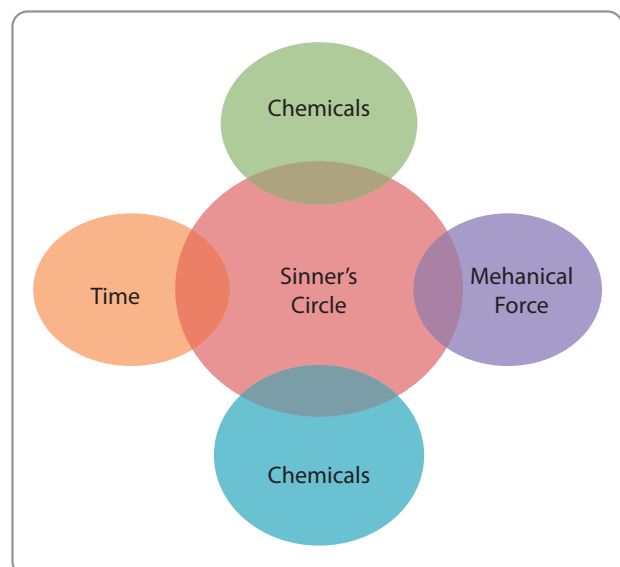


Figure 1. The sinner’s circle

According to the EU Commission (*Commission Directive*, 2007), materials which come into contact with food must be compatible with foodstuffs and cleaning protocols and must be made of materials that will not corrode after contact with foodstuffs or cleaning agents. The materials must not be toxic or contaminated with microorganisms and they must also be nonabsorbent, wear-resistant, and resistant to breakage, scratching and flaking, which is why work surfaces should not be made of wood or materials such as copper, antimony and other toxic or easily absorbing materials.

During transport of food that can become contaminated from other sources, all cross-carriers must be avoided. If there are not physically separated rooms and transport vehicles for transporting allergen-free foodstuffs and products, as an alternative, they can be transported in closed containers or capped containers.

Cleaning protocols for food allergens must enable the complete removal of allergenic foodstuff residues, e.g. remains of proteins, sulphates and lactose from equipment and inventory in rooms in the hospitality facility where foods are stored, prepared and served (*Flanagan*, 2015).

With the aim of consumer protection as well as defining a protocol for hygienic design, the study was designed to analyse the following: 1) check the labelling of a specified group of products for the presence of chosen allergens, and; 2) establish the allergen status of the work environment after preparation of the meal.

Materials and Methods

Allergen screening

The Ridascreen, R Biopharm ELISA kit was used to analyse four foods for the presence of egg proteins, β -lactoglobulin, soy and gluten/gliadin. Labels from the four foods (savoury cornbread, pizza pastry, sweet muffin and pork neck) were read to determine whether the foods contained the following declared allergens: egg proteins, milk proteins, gluten or soy.

Allergen status of the hospitality kitchen environment

In order to determine the presence of allergens in a hospitality kitchen, analytical validation was conducted using FLASH® Allergen-Indicator Protein Test swabs (Millipore) on the worktops, knives,

meat slicers, convection ovens, worker aprons and worker hands. The hospitality kitchen conducted its everyday business operations and its allergen status was determined after the specified cleaning plan was conducted (including after the validation of correct cleaning had been conducted by employees).

The allergen status of the food preparation environment was determined using FLASH® swabs in work areas after work had finished and after five different wet cleaning protocols:

- Protocol A — a sanitation procedure cold water / warm water / the same wiping cloth after cold and warm water (microfiber) (Table 3);
- Protocol B — a sanitation procedure warm water / warm water with detergent / the same wiping cloth after warm/warm water (microfiber) (Table 4);
- Protocol C — a sanitation procedure warm water / warm water with detergent / changing the cloth after warm water (microfiber) (Table 5);
- Protocol D — a sanitation procedure warm water / warm water with detergent / changing the cloth after warm water (microfiber) / changing the work uniform after food preparation (Table 6);
- Protocol E — a sanitation procedure warm water / warm water with detergent / changing the cloth (microfiber) / changing the work uniform after food preparation / washing hands after food preparation (Table 7).

Results and Discussion

The presence of allergens in the four food products is shown in Table 2.

In the four examined foods, the detected allergens were declared on the label as required by law. Based on the test results, and similarly to reports by *Jankovic et al.* (2016; 2019), there were no deviations from the declared allergens for this group of products, which is subject to risk because of manipulation of raw materials in the food preparation process and possible cross-contamination and contact.

Used as a part of the HACCP allergen control program, FLASH supports process verification requirements that ensure cleaning methods, which are validated to effectively remove allergens, are consistently applied.

Table 2. Presence of declared allergens in examined food products

TYPE	GLUTEN	SOY	MILK PROTEINS	EGG PROTEINS
Savoury cornbread	+	–	–	–
Pizza pastry	+	–	–	–
Sweet muffin	+	–	–	–
Pork neck	–	+	–	–

The results obtained for allergen detection in the hospitality kitchen after normal daily work and according to the five different cleaning protocols are shown in Tables 3–7.

The results show the best allergen-removal protocols were D and E. After the implementation of protocol D, possible allergen contamination was detected on an employee’s apron, which did not occur with protocol E because the employee’s uniform was changed. Protocol E, which includes appropriate sanitation procedures, a change of uniform and washing hands after food preparation, could be an excellent allergen mitigation choice, because no food allergens were detected on any of the surfaces examined.

The reduction of the risks presented by food allergens, which everybody in food businesses and consumers face, can be achieved by timely identification

of food products which contain materials causing allergic reactions and adequate control in food production and storage process (GMP, HACCP). A hospitality kitchen is a complex and busy system of functionally deployed work areas that undergo wet cleaning, disinfection and sterilization according to protocols. Wet cleaning protocols require high standards of hygienic design for the hospitality equipment, and well-trained staff, which contribute to the removal of allergens and enable safe food production.

In order for the food business to declare that their product does not contain allergens, there must be adequate routine control of the presence of allergens. Such allergen control provides reliable and confirmed information about each specific allergen, and could indicate any possible cross-contamination of the input raw materials (*Grujic, 2015; Jankovic, 2019*).

Table 3. Allergen detection after cleaning protocol A

	SANITATION PROCEDURE COLD WATER / CLOTH (MICROFIBER)	SANITATION PROCEDURE WARM WATER / CLOTH (MICROFIBER)
Worktop	+++	++++
Knives	+++	+++
Meat slicer	+++	+++
Convection ovens	++++	+++
Employee apron	++++	++++
Employee hands	+++	++++

Legend: –, not determined; ++, possible contamination; +++, determined level 1 contamination; +++++, determined level 2 contamination.

Table 4. Allergen detection after cleaning protocol B

	SANITATION PROCEDURE WARM WATER / CLOTH (MICROFIBER)	SANITATION PROCEDURE WARM WATER WITH DETERGENT / CLOTH (MICROFIBER)
Worktop	++	++
Knives	++	++
Meat slicer	+++	+++
Convection ovens	+++	++
Employee apron	+++	+++
Employee hands	++	+++

Legend: –, not determined; ++, possible contamination; +++, determined level 1 contamination; +++++, determined level 2 contamination.

Table 5. Allergen detection after cleaning protocol C

	SANITATION PROCEDURE WARM WATER / CLOTH (MICROFIBER)	SANITATION PROCEDURE WARM WATER WITH DETERGENT / CHANGING THE CLOTH (MICROFIBER)
Worktop	++	–
Knives	++	++
Meat slicer	+++	++
Convection ovens	+++	++
Employee apron	+++	+++
Employee hands	++	++

Legend: –, not determined; ++, possible contamination; +++, determined level 1 contamination; +++++, determined level 2 contamination.

Table 6. Allergen detection after cleaning protocol D

	SANITATION PROCEDURE WARM WATER / CLOTH (MICROFIBER)	SANITATION PROCEDURE WARM WATER WITH DETERGENT / CHANGING THE CLOTH (MICROFIBER) / CHANGING THE UNIFORM
Worktop	++	–
Knives	++	–
Meat slicer	+++	–
Convection ovens	+++	–
Employee apron	+++	++
Employee hands	++	–

Legend: –, not determined; ++, possible contamination; +++, determined level 1 contamination; +++++, determined level 2 contamination.

Table 7. Allergen detection after cleaning protocol E

	SANITATION PROCEDURE WARM WATER/ CLOTH (MICROFIBER)	SANITATION PROCEDURE WARM WATER WITH DETERGENT/ CHANGING THE CLOTH (MICROFIBER) / CHANGING THE UNIFORM
Worktop	++	–
Knives	++	–
Meat slicer	+++	–
Convection ovens	+++	–
Employee apron	+++	–
Employee hands	++	–

Legend: –, not determined; ++, possible contamination; +++, determined level 1 contamination; +++++, determined level 2 contamination.

Conclusion

A food allergen risk reduction strategy, which all food businesses and many consumers require, can be achieved by timely identification of food products and raw materials that contain food allergens and adequate control in food production, storage and distribution processes (HACCP). The results of this research show verification of cleaning

protocols is required in order to confirm a procedure is efficient. In situations when visual inspections are not practical or sufficient, staff must regularly monitor critical control points. Within the management of food allergens, it is of crucial importance to ascertain the effectiveness of cleaning hospitality equipment, worktops, staff and inventory from food allergens. In order to confirm that an implemented cleaning protocol completely eliminates the allergen

risk and the danger of cross-contamination with food allergens, a complete validation study must be conducted. A documented validation method should be contained in the HACCP plan and be periodically renewed within it in accordance with the dynamics of changes that arise from operations in a hospitality kitchen or from larger changes in business operations (e.g. use of new equipment).

Recommendations for hospitality businesses to protect consumers from allergens are to:

- i) develop, improve, implement, maintain and regularly review allergen protocols;
- ii) educate employees regarding precisely defined and consistent protocols so they manage allergens properly and produce safe food.

Kontrola prisustva nutritivnih alergena u ugostiteljstvu

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A p s t r a k t: Pružanje usluga u oblast ugostiteljstva je složen postupak sa aspekta sigurnosti zaposlenih i potrošača, zbog čega je sistematski pristup neophodan za uvođenje sistema bezbednosti hrane kroz definisanje kritičnih kontrolnih tačaka (HACCP). Da bi se dobio siguran gastronomski proizvod u pogledu prehrambenih alergena, pored analize sastojaka i / ili gotovog proizvoda, potrebni su validirani protokoli čišćenja u kuhinjama ugostiteljskih objekata kao preduslov uspešne analize rizika i opasnosti. Primena principa redovne kontrole alergena omogućava subjektima u poslovanju hranom da primenjuju odgovarajuće protokole za čišćenje i sanitaciju kako bi umanjili rizik od unakrsne kontaminacije alergenima.

Cilj ovog rada je da ukaže na značaj primene potvrđenih režima čišćenja i kontrole sirovina / gotovih proizvoda, kako bi se definisao sistem kontrole na prisustvo nutritivnih alergena, a sve u cilju definisanja dobre higijenske prakse (GHP) i dobre proizvodne prakse (GMP) u ugostiteljskim objektima.

Ključne reči: nutritivni alergeni, protokoli čišćenja, kontrola alergena, ugostiteljstvo

Disclosure statement: No potential conflict of interest was reported by the authors.

Acknowledgment: This paper was supported by the Innovation Fund of the Republic of Serbia, through the funding of the Project: Allergens as potential contaminants in the food safety system in the hospitality industry, project number 252.

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Paper received: February 13nd2020.

Paper corrected: March 13nd 2020.

Paper accepted: March 9th 2020.