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Survey on the occurrence of allergens on food-contact surfaces from school canteen kitchens

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ABSTRACT

According to Regulation (EU) 1169/2011, restaurants and catering services have to manage the risk of food allergens in the products they offer. One of the sources of hidden allergens in food could come from the cross-contact with surfaces or utensils. In order to gain knowledge about the current situation in such kind of establishments, the occurrence of 3 main allergen residues (milk, egg and gluten) has been evaluated in food-contact surfaces from 50 school canteens during a period of two academic years (2014–2016). The study included not only food-contact surfaces of general use but also surfaces for exclusive use in meals free of specific allergens. These food-contact surfaces were selected and analyzed *in situ* by using a rapid LFIA test during the visits to kitchens. Leftover sample was sent to a laboratory where an ELISA test was performed to confirm results. Out of 621 analyzed surfaces (213 samples for milk and egg and 195 samples for gluten) none of them were found to content milk with the rapid tests. However, the presence of egg and gluten was detected in 15 and 45% of the food-contact surfaces, respectively. The results obtained with ELISA showed also a low occurrence for milk (6%) but higher for egg (24%) and gluten (57%). It has to be highlighted that for some specific food-contact surfaces the occurrence reached up to 40%. These results indicate that the current cleaning procedures as well as the subsequent manipulation of surfaces are not enough suitable for the control of allergen residues in canteens. Besides, the presence of allergens in food-contact surfaces of exclusive-use to prepare allergen-free meals implies that cross-contaminations might happen, thus increasing the risk of hidden allergens in the final product.

1. Introduction

Food allergy prevalence has increased over the last decades in both industrialized and developing countries. Around 1% of adult population suffers from food allergy and more remarkable is the prevalence in children (5–8%) (EFSA Panel on Dietetic Products, Nutrition and Allergies, 2014; Pawankar, Canonica, Holgate, Lockey, & Blaiss, 2013). Symptoms can vary from mild to severe. They can even cause death due to an abnormal or hyperactive immune response to the allergenic compounds in food. Despite tolerance therapies are becoming very promising, up to date, the most effective protection for allergenic people is to avoid exposure to the allergens (EFSA Panel on Dietetic Products, Nutrition and Allergies, 2014).

An accurate information about the content of allergens in food is crucial for a suitable protection of the allergenic people (Muraro et al., 2014). With this purpose, in many countries laws oblige to declare the presence of the major allergens through food labeling (Gendel, 2012). As an example, in Europe 14 allergenic ingredients are required to be indicated on the food label (Regulation (EU) 1169/2011). In order to assure the information in the label as accurate as possible, operators in food industry need to control not only the allergenic ingredients, but also the risk of unintended allergen presence (Crevel et al., 2014; FoodDrinkEurope, 2013). Hidden allergens in food or meals can mainly come from cross-contact, which occurs when an allergen is inadvertently transferred from a food containing an allergen to a food that does not contain it (FoodDrinkEurope, 2013). Utensils and working surfaces are also a source for cross-contact.

Regulation (EU) 1169/2011 that came into force in December

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2014 applies to food business operators at all stages of the food chain. Thus, all stakeholders in food industry chain have to include allergens in their HACCP systems to reduce the risk of unexpected allergens in the food offered to consumers (Muraro et al., 2014). Concern to avoid unexpected allergens affects not only the food industry but also other operators, such as restaurants, catering companies and canteens, thus, all of them have to comply with current legislation. On the other hand, since food allergy has become an increasing social concern, some restaurants could offer allergen-free menus as a competitive advantage. In general terms, allergic population becomes very loyal as a customer once they have confidence with an establishment. Moreover, hospital or school canteens need to offer allergen-free meals (Sergeant et al., 2003).

Therefore, either to meet current legislation or to obtain a competitive advantage, restaurants and catering services need to implement specific plans for controlling allergens (USFDA, 2006). In the last years, HACCP systems have become mandatory for food industry and now food operators are familiar with allergen control plans. In a similar way, the catering sector has begun to implement allergen control plans (Dzwolak, 2017; Medeiros, Cavalli, Salay, & Proença, 2011; Petruzzelli et al., 2014). However, the available information about the main sources of contamination in this sector is still scarce. Therefore, establishing effective and objective measures to control allergens is very difficult. Traditionally, control of allergens in food industry or restoration has been focused on the ingredients used to prepare meals, but little or no attention has been paid to the cross-contact through working surfaces and utensils (Dzwolak, 2017).

To offer allergen-free meals, restaurants have to take some measures such as preparing meals in separate lines, elaborating allergen-free meals before the conventional menus or outsourcing them. Nevertheless, the assessment of the cross-contaminations from some working surfaces or utensils remains essential. One part of such control should be performed through an effective cleaning plan for allergens after preparing or serving meals (Jackson et al., 2008). Cleaning processes should be validated previously and a regular monitoring should be also implemented. Verification of the cleaning processes implies not only a visual inspection about the correct performance but also an analytical testing that confirms the allergens were completely removed (Jackson et al., 2008). Two kinds of analytical tools are available for this purpose, qualitative lateral flow tests (LFIA) for on-site rapid verification and quantitative ELISA tests for validation of the cleaning process (Galan-Malo et al., 2017). However, most of food companies do not verify their cleaning procedures with allergen-specific verification tools (Taylor et al., 2006).

On the other hand, to design a cleaning control plan, operators could take advantage from either internal or external studies as a starting point. However, so far any information has not been reported about the occurrence of allergens or the efficacy of cleaning procedures in collective canteens.

In this work we present the results of a survey on the occurrence of three main food allergens on food-contact surfaces from 50 school canteen kitchens. Our objective was to obtain an overview of the current situation in school kitchens that will help operators to establish objective measures in their allergen control plans. This study could also help inspectors and auditors to select the more critical points to be surveyed during their audits to restaurants or canteens. The study includes food-contact surfaces not only for general use but also for exclusive use to prepare meals free of specific allergens. In our knowledge, this is the first report on the occurrence of food allergens on food-contact surfaces from collective canteens.

2. Material and methods

2.1. Sampling

Fifty school canteen kitchens were selected in Hortaleza District of Madrid, Spain. In each of them, at least two clean food-contact surfaces were randomly selected for the analysis of egg, milk or gluten. Food-contact surfaces were selected among kitchen containers (glasses, pots, pans, plates, trays and food boxes) and utensils (blenders, knifes, ladles, slotted spoons, spatulas, spoons, strainers, tongs, forks, pastry brushes, scissors and spaghetti spoons). Most of the kitchens used automatic washer systems for small tools and containers of general use. Some kitchens washed by hand the biggest food-contact surfaces of general use and the tools and containers of exclusive use to prepare allergen-free menus. In all cases, cleaning was performed with conventional detergents and disinfectants to control microbial contaminations. Each item was analyzed for only one allergen residue. Swabs provided with the kits were dipped into the analysis buffer and then the correspondent surfaces were swabbed. Although allergen risk management guidelines usually recommends to swab at least a working surface of 100 cm^2, by practical reasons, in this study the whole food contact surface of each tool or container was swabbed (for only one residue). Performance of the swabbing procedure on surfaces was previously validated (Galan-Malo et al., 2017).

2.2. Rapid LFIA test

Analyses were performed *in situ* by using specific rapid LFIA tests for milk (beta-lactoglobulin), egg (ovalbumin) and gluten (Proteon Express, ZEULAB, Spain). The assays were performed following the manufacturer instructions. Once the samples were collected, the swabs were placed in the tube that contained the analysis buffer for 30 min at room temperature. Finally, the swab was removed and a rapid strip was introduced in the buffer tube. After 10 min the result of the test was read. A unique blue line indicated a negative result. Positive results were indicated when both blue and red lines were displayed. The leftover of sample extract was sent to the laboratory for confirmation by ELISA. According to previous results the methods are able to detect 0.07 μg of egg protein, 0.6 μg of milk protein (Galan-Malo et al., 2017) and 0.2 μg of gluten (data not published) on food-contact surfaces.

2.3. ELISA test

The leftover of samples extract was kept frozen at −20 °C for no more than 4 weeks until the analysis by ELISA was performed. Sandwich ELISA specific for milk (beta-lactoglobulin), egg (ovalbumin) and gluten were used (Proteon Milk and Egg, ZEULAB, Spain and GlutenTox ELISA, Biomedal, Spain). The assays were performed following the manufacturer instructions. According to previous results the methods are able to detect 0.04 μg of egg protein, 0.2 μg of milk protein (Galan-Malo et al., 2017) and 0.1 μg of gluten (data not published) on food-contact surfaces.

3. Results

3.1. Occurrence of allergen residues on food-contact surfaces from school canteens

The occurrence of three allergens (milk, egg and gluten proteins) was evaluated in cleaned food-contact surfaces from 50 school canteen kitchens during a period of two academic years (2014–2015 and 2015–2016). In each of them, at least two different surfaces were randomly chosen for egg, milk and gluten analysis