

# Analysis of the original notifications in the Tuscany region “Rapid Alert System for Food and Feed” in the seven-year period 2015-2021

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## Abstract

The original notifications (n=1355) managed by the Rapid Alert System for Food and Feed of the Tuscany region in the seven-year period 2015-2021 were analyzed. 68.9% of them were classified as alert notifications, and they mostly originated (56.3%) from official controls on the market, followed by the company’s own checks (29.1%). Italy was the most represented notifying

country (73.3%) and the most represented country of origin of the notified products (64.5%). Out of the 28 considered food categories, “fish and products thereof” (F), “cereals and bakery products” (C), “bivalve mollusks and products thereof” (B), and “meat and meat products (other than poultry)” (M) were the most notified. F were especially notified for the presence of heavy metals (45.7%), C for undeclared allergens (32.1%), B for microbial contaminants (*Escherichia coli*, 49.6%), and M for pathogenic microorganisms (55.9%), mostly *Salmonella* spp. and *Listeria monocytogenes*. This study provides an updated framework for the main food safety issues at the regional level. The Rapid Alert System for Food and Feed should be periodically analyzed to evaluate historical trends and emerging or poorly known hazards. This is especially important for the planning of official control activities and the prevention of risks through the food supply chain.

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## Introduction

The European Union (EU) has one of the highest food safety standards in the world, largely thanks to the solid set of EU legislation in place (European Commission, 2024). Regulation 178/2002, also known as the General Food Law Regulation, establishes that only safe food and feed can be placed on the EU market or fed to food-producing animals (European Parliament and Council of the European Union, 2002). While food and feed business operators (FBOs) shall ensure that foods, feeds, or food contact materials satisfy the requirements of food law, compliance with those requirements is also subject to verification during official controls performed by competent authorities (CAs). The legal basis for these official controls is represented by Regulation 2017/625 (European Parliament and Council of the European Union, 2017) and subsequent delegated Regulations and implementing Regulations. As part of the food safety tools, the Rapid Alert System for Food and Feed (RASFF) was established to ensure rapid communication and cooperation between CAs of the member states and also to promote CA coordination in response to food and feed safety risks.

Created in 1979 through a proposal for a council decision (Commission of European Communities, 1979), RASFF has its legal basis in Article 50 of Regulation 178/2002, and it involves the member states, the Commission (responsible for managing the network), and the Authority, each designating a contact point that shall be a member of the network. With internet-based tools taking hold solidly in current times, data exchange on food and feed safety within the EU has sped up, making the RASFF more efficient and effective (Guardone *et al.*, 2022).

In this respect, iRASFF is the interactive RASFF web platform, which also includes the Administrative Assistance and

Cooperation network and the Agrifood Fraud network. Regulation 2017/625 required the Commission, in collaboration with member states, to set up and manage a computerized information management system for official controls (IMSOC) to manage, handle, and automatically exchange data, information, and documents concerning official controls. The IMSOC integrates the existing information systems managed by the Commission, namely i) the RASFF for notifying direct or indirect risks to human health deriving from food, food contact material or feed; ii) the system for notifying and reporting information on animal diseases; iii) the system for notifying and reporting the presence of pests in plants and plant products; iv) the technical tools for administrative assistance and cooperation; v) the TRACES system. To this purpose, the Commission Implementing Regulation 2019/1715 (the so-called IMSOC Regulation) was issued to lay down rules for the functioning of the IMSOC (European Commission, 2019a). This regulation also categorized the types of RASFF notifications. To date, several studies analyzing RASFF data are available (Guardone *et al.*, 2022). Moreover, the Commission publishes annual reports summarizing the main issues resulting from the RASFF notifications.

At the Italian level, guidelines for the operational management of the alert system for food, feed, and food contact materials were approved by the Permanent Conference for Relations between the State, Regions, and Autonomous Provinces with the agreement of May 5, 2021 (CSR, 2021). The RASFF contact points are represented by the Ministry of Health through the team called, in Italian, *DAV Allerta* (Veterinary Alert Department of Office VII of the Ministry of Health), which is the unique interface between the Commission and the regional contact points: the regions, autonomous provinces, and Local Health Authorities (LHAs).

The Tuscany Region transposed this agreement into the Decision of the Regional Council No. 593 of May 31, 2021. Since January 2015, in the context of the regional Health Information System for Collective Prevention (with the Italian acronym SISPC), the regional RASFF (having the Italian acronym SARAM) has been active in the operational management of notifications involving the territory of the Tuscany Region.

In this study, the original notifications managed by the SARAM of the Tuscany region in the seven-year period 2015-2021 were analyzed to highlight the most relevant food-related issues and investigate the possible relationships between the variables characterizing the notified products. This study can provide a valuable source of data for directing official control activities toward major foods and hazards and for supporting FBOs in managing the food safety of their products.

## Materials and Methods

### Data collection and analysis

Original notifications managed by the SARAM of the Tuscany region in the seven-year period from January 1, 2015, to December 31, 2021, were analyzed. The following information was considered: i) type of notification; ii) contact point; iii) type of control; iv) notifying country and country of origin; v) product matrix and category; vi) hazard. Each information was analyzed as detailed in the following sub-sections.

### Type of notification

The notification was categorized as “alert notification”, “information notification for attention”, “information notification for

follow-up”, and “border rejection notification” as defined by IMSOC Regulation (European Commission, 2019a - Regulation 2019/1715).

### Contact point

The contact point was categorized according to the contact points designed for the Tuscany region, namely the three macro-areas of the Tuscany LHA-AUSL Toscana Nord-Ovest (AUSL-NO), AUSL Toscana Sud-Est (AUSL-SE), AUSL Toscana Centro (AUSL-C), and the “sector of Hygiene, Public Health, and Veterinary of the Health, Welfare, and Social Cohesion Directorate” of the Tuscany Region (with the Italian acronym ISPV).

### Type of control

The notifications were categorized according to the types of control reported by the RASFF Annual Report 2020 (European Commission, 2020), namely “official control on the market” (products placed on the market in one of the member countries, including the countries of the European Economic Area, namely Norway, Liechtenstein, and Iceland), “official control in non-member country”, “company’s own check”, “food poisoning”, “consumer complaint”, and “border control”.

### Notifying country and country of origin

The notifying country was intended as the country that inserted the notification. The country of origin was intended as the country from which the notified product originates.

### Product matrix and category

The notified product was categorized in “food”, “food contact material”, and “feed” matrices (European Commission, 2019a - Regulation 2019/1715) and then in one of the 35 categories reported in the RASFF Annual Report 2020 (European Commission, 2020).

### Hazard

The hazard related to the notified product was categorized in “chemical” physical” and “biological” according to its nature, and attributed to one out of the types reported in the RASFF Annual Report 2020 (European Commission, 2020).

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## Results and Discussion

### Data analysis

#### Overall number and type of notification

Overall, 1355 original notifications were collected. Of them, 934 (68.9%) were classified as “alert notification”, 264 (19.5%) as “information notification for attention”, 156 (11.5%) as “information notification for follow-up” and only one (0.1%) as “border rejection notification”. On the one hand, the number of notifications could be overestimated if the same product, distributed in more member states, is notified by more than one network member. Considering that information about the name of the producer, the importer, or the lot is not available in SARAM, it is impossible to detect notifications associated with the same product. On the other hand, underestimation could occur, whereas incidents associated with the products were not notified (D’Amico *et al.*, 2018). The 1355 original notifications were distributed over the years, as reported in Figure 1, with the highest number (n=245; 18.1%) in 2021 (182 alert notifications). This can be linked to the emergency

due to ethylene oxide contamination in sesame seeds from India (see section “Notifying country and country of origin”). After the first case was inserted in the RASFF portal from Belgium in September 2020, the number of notifications related to this issue highly increased, up to 32% of monthly notifications in 2021 (Dudkiewicz *et al.*, 2022).

### Contact point

Most of the original notifications (n=1168; 86.2%) were inserted by the ISPV, while the other 187 were similarly distributed among the three macro-areas of the Tuscany LHA, with 87 (6.4%) inserted by AUSL-NO, 68 (5.0%) by AUSL-C, and 32 (2.4%) by AUSL-SE. This can be explained by the fact that the ISPV inserts in SARAM the notifications from the other regional contact points as well as the national contact point (the Ministry of Health). In contrast, the LHAs exclusively insert notifications originating in and involving the territory they cover.

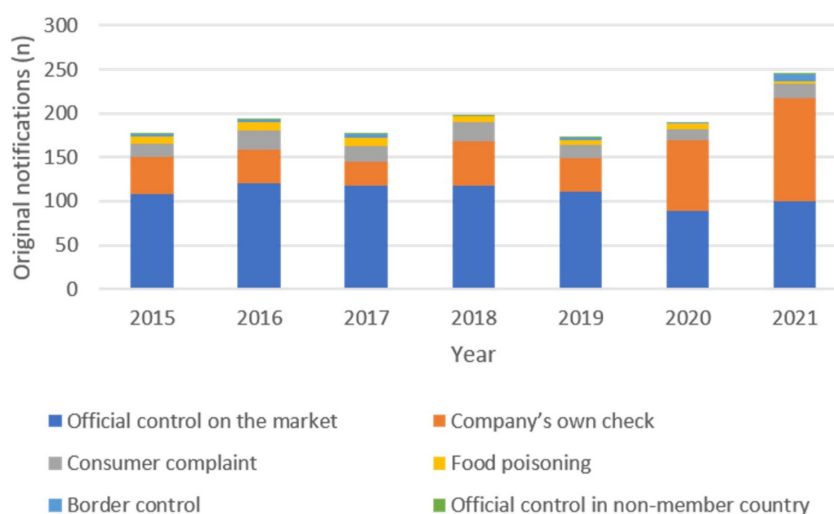
### Type of control

56.3% of the original notifications (n=763) originated from “official control on the market”, followed by “company’s own check” (n=394; 29.1%), “consumer complaint” (n=121; 8.9%), “food poisoning” (n=48; 3.5%), “border control” (n=22; 1.6%) and “official control in non-member country” (n=7; 0.5%). Results confirmed the “official control on the market” and the “company’s own check” as the first and second notification origins, respectively. To note, however, that in 2020 the number of notifications originating from “official control on the market” and “company’s own check” were likely equivalent (n=89 and n=81, respectively), and that in 2021 this trend has been inverted, with 117 notifications from “company’s own check” versus 101 from “official control on the market” (Figure 1). The substantial increase in “company’s own check” notifications can be linked to the reduction of official control activity during the SARS-CoV-2 pandemic, as highlighted by the RASFF Annual Report 2020 (European Commission, 2020). The overall number of RASFF notifications decreased by over 25% between 2019 and 2020 (Marti *et al.*, 2021). This reduction especially involved the controls on products with the highest

import volumes, namely bivalve mollusks and agricultural products, which in the first 5 months of 2020 suffered an international trade reduction. In 2020, the notification originating from Northern member countries increased respect to those from Southern member countries, likely due to the not-consistent pandemic trend, which required particularly aggressive self-isolation measures in Spain and Italy (Marti *et al.*, 2021).

### Notifying country and country of origin

Among the EU member countries, Italy was the most represented notifying country, inserting 73.3% of the notifications. Other notifying countries that inserted more than 10 notifications in the investigated period were Germany (6.3% of the notifications), France (4.0%), the Netherlands (3.4%), Spain (3.1%), Belgium (2.0%), Slovenia (2.0%), Austria (1.3%) and Sweden (0.8%). According to the literature, Italy, France, and Germany are the main notifying countries in the RASFF (D’Amico *et al.*, 2018). Indeed, the member countries inserting the higher notification number are usually those mostly involved in community trade and extra-EU imports (D’Amico *et al.*, 2018). In this case, Italy is most widely represented with respect to the other countries since it is required that notifications of interest limited to the territory of the Tuscany region be inserted together with notifications of national and international interest in SARAM. UK and Finland were instead the most represented notifying extra-EU countries, contributing together to 1.4% of the notifications. Italy was also the most represented member country of origin, with 64.5% (n=687) of the notifications, followed by Spain (n=118; 11.1%), France (n=74; 6.9%), Germany (n=34; 3.2%), and the Netherlands (n=26; 2.4%). China, with 28.4% of the notifications, was instead the main third country of origin, followed by India (20.1%), Turkey (6.6%), the UK (5.2%), and Vietnam (4.2%). China was the main country of origin of notifications for “food contact material”, which represented 45% of the notifications from this country. Indeed, a study evaluating serious alert and border rejection notifications on food contact materials retrieved from the RASFF database in the period 2012–2019 showed that China was the main transgressor country for both types of notifications



**Figure 1.** Distribution of the original notifications over the years. The type of control is also detailed.

(Papapanagiotou, 2021). The notification number is strongly affected by the frequency of the control activities, which is higher for products imported from third countries. Indeed, according to Regulation 625/17, increased controls on entry into the EU are performed on certain other goods where emerging or known risks are present. According to Article 65 of this Regulation, when the CAs have reasons to suspect fraudulent practices or the official controls give grounds to believe that the rules have been infringed, they intensify official controls on consignments with the same origin or use. In Annex 1 of the Commission Implementing Regulation 2019/1793 of October 22, 2019 (European Commission, 2019b), food and feed of non-animal origin from certain third countries subject to a temporary increase of official controls at border control posts and control points are reported. Following the consolidation of this Regulation, India has been subjected to a higher frequency of control (one in every two imported consignments) in the case of sesame seeds, following the numerous cases of non-compliance detected relating to the presence of high levels of ethylene oxide. In fact, the previous version of the Regulation only provided information for microbiological control (*Salmonella* spp., one in every five consignments subjected to physical and identity checks).

### Product matrix and category

“Food” was the most notified matrix, with 1251 original notifications out of a total of 1355 (92.3%). “Food contact material” and “feed” matrices only covered 4.6% (n=63) and 3.0% (n=41) of the total original notifications, respectively. The growth trend of notifications related to “food contact material” since 2015 declined by 25% in 2020 with respect to 2019, as also reported in the RASFF Annual Report 2020 (European Commission, 2020). The original notifications were distributed in 32 out of the 35 product categories reported in the RASFF Annual Report 2020 (European Commission, 2020), being notifications linked to “animal by-products”, “gastropods”, and “water for human consumption (other)” not involved. Figure 2 illustrates the overall distribution. “Fish and products thereof” was the first notified category (n=188; 13.9%), followed by “cereals and bakery products” (n=140; 10.3%), “bivalve molluscs and products thereof” (n=129; 9.5%), and “meat and meat products (other than poultry)” (n=127; 9.4%). The other 28 product categories obtained one to 87 original notifications (Figure 2). Similar findings were reported by a study analyzing the notifications in RASFF in the previous five-year period (2011-2015), where “fish and fish products” was the product category with the highest number of notifications, followed by “bivalve mollusks” (D’Amico *et al.*, 2018). Indeed, these two product cate-



**Figure 2.** Distribution of the original notifications according to the product category. Product categories listed by the Rapid Alert System for Food and Feed Annual Report (2020) were used.

gories are the most traded within the EU (D'Amico *et al.*, 2018). Contrariwise, the RASFF Annual Report 2020 reported “fruits and vegetables” as the most notified category (European Commission, 2020). Indeed, in that year, it was observed that there were increased notifications from Bulgaria on pesticide non-compliances, mainly in produce from Turkey (European Commission, 2020). In this study, only hazards related to the product categories having more than 100 original notifications and thus corresponding to the four above-mentioned categories are discussed (see the following sections).

### **Hazard related to fish and products thereof**

This product category was especially notified for chemical hazards associated with the presence of heavy metals ( $n=86$ ; 45.7% of the original notifications related to this product category), namely mercury, cadmium, or both. With respect to the origin, the products mostly came from Spain ( $n=44$ ; 51.2%), Italy ( $n=15$ ; 17.4%), Portugal ( $n=12$ ; 14.0%), while Vietnam was the only third country notified ( $n=2$ ; 2.3%). Accordingly, heavy metals (and particularly mercury and cadmium) notifications were found as mostly related to “fish and fish products” also in the study by Pięłowski (2020), in which notifications reported in the RASFF system in nearly forty years (1979–2017) were analyzed. Additionally, a survey of the Italian veterinary office for compliance with EU requirements in Tuscany highlighted that 38.5% of the total non-compliant consignments of fish involved the presence of mercury (Giusti *et al.*, 2019).

Indeed, heavy metals are the most marked forms of pollution in aquatic environments, discharged through agriculture, combustion, mining, and urban and industrial discharge (Milenkovic *et al.*, 2019). In the aquatic environment (waters and sediments), mercury is methylated by microbial and abiotic processes. Fish and other seafood provide the major source of dietary exposure to methylmercury for consumers. The contribution of methylmercury to total mercury is typically 80–100% in fish and 50–80% in seafood other than fish (European Food Safety Authority, 2012). The second hazard for which this product category was notified was pathogenic microorganisms ( $n=27$ ; 14.4%). In most cases ( $n=21$ ; 77.8%), the products were contaminated by *Listeria monocytogenes*, and they all originated from EU member countries, especially Italy ( $n=10$ ; 37.0% of the products notified for *L. monocytogenes*). This is probably due to the fact that “fish and products thereof” are usually marketed in fresh or chilled form ( $+2^{\circ}\text{C}$  to  $+4^{\circ}\text{C}$ ) in the internal (national or community) market, a condition that allows the growth of this psychrophilic pathogen (European Food Safety Authority, 2018). Contrariwise, products imported from third countries, which are usually frozen, do not offer such favorable conditions. Other original notifications related to pathogenic microorganisms involved *Salmonella* spp. ( $n=4$ ; 14.8%), and *Clostridium botulinum* ( $n=1$ ; 3.7%).

Among biological hazards, 27 products (14.4%) were notified as having a histamine level exceeding the legal limits established by Commission Regulation (EC) No 2073/2005 (European Commission, 2005). The products were especially represented by tunas ( $n=18$ ; 66.7%), anchovies ( $n=6$ ; 22.2%), sardines ( $n=2$ ; 7.4%), and mackerels ( $n=1$ ; 3.7%), and they mostly originated from Spain ( $n=11$ ; 44.4%) and Italy ( $n=8$ ; 29.6%). More than half of these notifications were inserted in SARAM following “food poisoning”. Indeed, histamine poisoning is monitored through the mandatory notification of foodborne illness outbreaks. From 2011 to 2015, RASFF counted 190 notifications (10.2% of the fish and fish products notifications) due to histamine, mainly involving

these same fish species (D'Amico *et al.*, 2018). A recent eight-year survey of follow-up and official control activities on histamine in fish products in the Abruzzo region (Central Italy) found that 5.9% of the examined batches resulted in non-compliant, with tunas, anchovies, sardines, and mackerels as involved species (Annunziata *et al.*, 2022). Several notifications ( $n=11$ ; 5.9%) in this product category were also related to parasitic infections, especially *Anisakis* spp. The products were represented by anchovies ( $n=4$ ), anglerfish ( $n=3$ ), cod ( $n=1$ ), gurnard ( $n=1$ ), and weever ( $n=1$ ). The actual issue related to parasitic infections could be underestimated (in the SARAM as well as in the RASFF system) since notification to public health authorities is not mandatory. Consequently, official reports do not reflect the true prevalence or incidence of these diseases (Guardone *et al.*, 2018). In this respect, a study evaluating the notification of *Anisakis* spp. recorded through the RASFF portal from the beginning of 1979 until 2019 found that only 0.95% of them were related to this parasitic infection, with the first notification occurring in 2001 and with significant annual variability in the subsequent period (Caldeira *et al.*, 2021).

### **Hazard related to cereals and bakery products**

32.1% of original notifications related to this category ( $n=45$ ) were linked to the presence of undeclared allergens. This is in line with the literature, which reported this product category as mostly notified in RASFF for this same hazard (Pádua *et al.*, 2019). According to Regulation 1169/2011 on the provision of food information to consumers (European Parliament and Council of the European Union, 2011), any ingredient or processing aid listed in Annex II (or derived from a substance or product listed in Annex II) causing allergies or intolerances used in the manufacture or preparation of food and still present in the finished product, even if in an altered form, must be declared on the food label. Indeed, it was observed that there was a correlation between the notifications related to food allergens in RASFF and the entry into force of Regulation 1169/2011 (Pádua *et al.*, 2019). Among the ingredients listed in Annex II, we especially observed the presence of undeclared soybeans and products thereof ( $n=14$ ), milk and products thereof ( $n=7$ ), cereals containing gluten ( $n=5$ ), mustard and products thereof ( $n=5$ ), and others in lower numbers. Food recalls associated with undeclared allergens were identified as the most common cause of recalls and withdrawals globally (Soon and Wahab, 2021). The second hazard in terms of the number of original notifications ( $n=44$ ; 31.4%) was related to the presence beyond the legal limits of pesticide residues, especially ethylene oxide ( $n=39$ ; 95.1% of original notifications related to this hazard in this product category). Ethylene oxide is a pesticide listed in Regulation 396/2005 on maximum residue levels (MRLs) (European Parliament and Council of the European Union, 2005). In the EU, it has been prohibited since 1991 to use or place on the market all plant protection products containing ethylene oxide as an active ingredient, as they are classified as hazard category 1B for carcinogens, germ cells, mutagens, and reproductive toxicants (Intergovernmental Negotiating Committee, 2001). As anticipated in the section “Overall number and type of notification”, since the notified cases of contamination exceeded the EU MRLs in sesame seeds from India, the number of cases in the RASFF system has increased considerably. One reason for this increase was the issuing of the Commission Implementing Regulation 2019/1793 on the temporary increase of official controls and emergency measures governing the entry into the EU of certain goods from certain third countries, where the number of controls for pesticide residues was

enforced on every second shipment of sesame seeds from India (Dudkiewicz *et al.*, 2022). India is the largest producer and exporter of sesame worldwide, contributing to more than 50% of the volume of sesame imported to the EU (Dudkiewicz *et al.*, 2022). Since October 2019, each consignment of sesame seeds from India shall be accompanied by an official certificate following the model set out in Annex IV (European Commission, 2019b - Regulation 2019/1793). The third hazard was of a physical nature, related to the presence of foreign bodies (n=25; 17.8%), and especially pests (n=11) associated with unsuitable storage conditions of the products. Eleven (7.9%) original notifications related to mycotoxins were found, represented by Aflatoxin (n=4), Ocratoxin (n=2), Fumonisin (n=2), and others. Indeed, cereals are widely reported to be a significant source of risk for both humans and animals due to the presence of mycotoxins. Aflatoxins, produced primarily by toxigenic strains of the fungi *Aspergillus* spp., is a potent natural mycotoxin (Mousavi Khaneghah *et al.*, 2018). Aflatoxin-producing fungi are found in areas with a hot, humid climate, and climate change is anticipated to impact the presence of aflatoxins in food in Europe (European Food Safety Authority, 2020). Therefore, there is a need to continue to monitor aflatoxin occurrence in food (European Food Safety Authority, 2020).

#### **Hazard related to bivalve mollusks and products thereof**

The hazards that were most notified in this product category were represented by microbial contaminants: *Escherichia coli* (n=64; 49.6%), pathogenic micro-organisms (n=38; 29.5%), and natural toxins (n=17; 13.2%). *Norovirus* (NoV) was detected in 50% (n=19) of the products notified for pathogenic micro-organisms. The other original notifications for pathogenic microorganisms, when they were identified, were related to *Salmonella* spp. (n=11; 28.9%), *Hepatitis virus* spp. (n=3; 7.9%), *Vibrio parahaemolyticus* (n=3; 7.9%). Products notified for pathogenic microorganisms mostly originated from Italy (n=17; 44.7%), France (n=13; 34.2%), and Spain (n=5; 13.2%). In France, an increasing trend in the number of intoxication outbreaks by calicivirus (including NoV) was observed, which may probably arise from the circulation of both new and/or re-emergent strains of NoV in the country (D'Amico *et al.*, 2018).

In 2019, NoV was associated with 457 outbreaks and, in 22.5% of total cases, with related illnesses in the EU, with an increase of 13.1% with respect to 2018 (Savini *et al.*, 2021). NoV was actually identified as the second most frequently reported causative agent in food-borne outbreaks in Europe after *Salmonella* spp. (Savini *et al.*, 2021). In a previous study analyzing data from the sanitary survey carried out on the bivalve mollusks' production areas of the Gulf of La Spezia (Liguria, Italy), we observed a very high prevalence of NoV (93.7%) (Giusti *et al.*, 2020). Despite this, the EU legislation only recognizes *E. coli* and *Salmonella* spp. as microbiological criteria for bivalve mollusks. In 2015, the Center for Environment, Fisheries and Aquaculture Science published a discussion paper to identify options for improving controls for NoV and hepatitis A virus contamination of bivalve mollusks in the EU food legislation (Giusti *et al.*, 2020). It was especially recommended that quantitative and qualitative standards be introduced.

However, in March 2020, the Directorate-General for Health and Food Safety published the working document No. 10432/2020 (DG SANTE, 2020) that lays the foundation for a review of Regulation 853/2004 (European Parliament and Council of the European Union, 2004), especially concerning i) the inclusion of NoV detection in the control plan of FBOs operating in dispatch and purification centers; ii) the analysis of 10% of batches of live

bivalve mollusks intended to be consumed raw (if marketed in the period from November to April) for the detection of enteric viruses before they leave the dispatch centers; iii) the limit of 500 genome copies per gram, measured on the total pulp of live bivalve mollusks.

Currently, this draft delegated act is under review by the Advisory Council for Aquaculture. Concerning natural toxins beyond the legislative limits, those responsible for diarrhetic shellfish poisoning, namely okadaic acid and dinophytoxins, were mostly notified (n=11; 64.7% of original notifications related to this hazard in this product category). Yessitoxins (n=2; 11.7%) and Saxitoxins responsible for paralytic shellfish poisoning (n=1; 5.9%) were also notified. Also in this case, the products mostly originated from Italy (n=11; 64.7%) and France (n=6; 35.3%). In marine waters, saxitoxins are produced by dinoflagellates, and they share a high structural affinity with tetrodotoxin and a similar mechanism of action (Malloggi *et al.*, 2023). A high concentration of both tetrodotoxins and saxitoxins was recently detected in mussels from Sicily, and this observation was correlated with algal bloom phenomena on the Ionian coasts of Sicily (Dell'Aversano *et al.*, 2019). The spread of these toxins and organisms potentially accumulating in the Mediterranean waters is mainly due to global warming, and it represents an emerging risk for EU citizens (Malloggi *et al.*, 2023).

#### **Hazard related to meat and meat products (other than poultry)**

This product category was especially notified for pathogenic microorganisms (n=71; 55.9%), of which the most represented were *Salmonella* spp. (n=34; 47.9%) and *L. monocytogenes* (n=25; 35.2%). This high representativeness was expected, as both were included in the microbiological criteria for meat products in Regulation 073/2005. Salmonellosis is the second-most frequent foodborne illness in the EU. Between 2018 and 2019, the reported cases of salmonellosis in the EU were interpreted as 20 recorded cases for every 100,000 people (European Food Safety Authority, 2022). Pork meat and its products are one of the four most commonly reported foods in cases of salmonellosis (European Food Safety Authority, 2022). With respect to *L. monocytogenes*, different types of meat have been implicated in major human listeriosis outbreaks worldwide (Matle *et al.*, 2020). In the EU, ready-to-eat meat (RTE) and meat products are typically associated with human listeriosis, and they are considered to be of significance from a food safety perspective (European Food Safety Authority, 2018). Between 2008 and 2015, the reported annual non-compliance of *L. monocytogenes* in RTE foods at processing sites was the highest at 1-7% in RTE products of meat origin other than fermented sausage (European Food Safety Authority, 2018).

## **Conclusions**

To the best of our knowledge, this is the first study investigating a regional food notification system. The outcomes of this study provide a deeper update on the framework of the main food safety issues at the regional level. As a matter of fact, the SARAM system can be used as a precious source of data to analyze historical trends, evaluate emerging and/or poorly known hazards, and prevent future risks through the food supply chain. Furthermore, the CAs can benefit from SARAM analysis for the planning of the official controls, thanks to the possibility of prioritizing the activities and setting their frequency based on the risk assessment.

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