

OVERVIEW OF MILK AND DAIRY PRODUCTS FOOD FRAUD ON EUROPEAN UNION MARKET

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Abstract

European Union is the world's leading cheese exporter and one of the world's top three suppliers for dairy exports (cheese, skimmed milk powder and packed milk). In milk and milk products industries, the adulteration has been reported almost all the time as a result of various risks associated with food safety hazards. Because of this, vulnerability reduction of dairy foods to adulteration is a high priority to everyone, from processors to consumers. In this context, our study analysed notifications made in E.U. dairy market through the Rapid Alert System for Food and Feed for the past two decades (between January 2000 and September 2019) in order to identify patterns and correlations between types of dairy products and the incidence of various hazards by dairy product category, notification type, origin of dairy products, action taken and distribution status. For the period taken into study, we identified 979 notifications, representing 1.77% from the total E.U. food notifications. The highest number of notifications was registered in 2018 (n=76, representing 2.10%) and the lowest in 2001 (n=15, representing 2.13 %). The findings of this study can be used to prioritize and target the research areas for identification of adulterants and food fraud practices in dairy products, to boost the awareness of the final customer and to promote and enhance the legislation on food safety, with emphasis on the European dairy sector.

Key words: RASFF, E.U., food fraud, dairy products

INTRODUCTION

Food fraud and adulteration in milk and dairy industry is a topic that has escalated to research and legislative involvement due to some tragic incidents in the last years [1, 2]. In this industry, the adulteration has been reported almost all the time as a result of various risks associated with food safety hazards [3]. Today, due to the growing and more complexity of modern food supply systems, this has increased the risk of food fraud to the entire global population, usually this subject being linked to high-quality or limited produced quantities of dairy products, this being a real concern to all the parties involved (regulators, food producers, retailers and consumers) [4, 5, 6, 7, 8, 9, 10]. For proper control, in E.U. member states it was

implemented the Rapid Alert System for Food and Feed, created since in 1979, with the scope of sharing information between parties in cases where dangerous food or feed is detected on the market or at the borders [11].

In a context where E.U.28 is the world's leading cheese exporter and one of the world's top three suppliers for dairy exports (cheese, skimmed milk powder and packed milk), the objective of this present paper is based on the continuous need of being up to date in order to prioritize and target the research milk and dairy products (MDP) area for adulterants identification and food fraud practices in dairy products, to boost the awareness of consumer and to promote and enhance the legislation on food safety, with emphasis on the European dairy sector [12, 13, 14].

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MATERIAL AND METHOD

Data were retrieved from the RASFF portal [15, 16]. Search criteria for the original *RASFF notifications* with E.U. involvement were considered for *date* [time period: notified between 01/01/2000 – 01/09/2019], *product* [category: milk and dairy products – *MDP*] and *hazard* [category], the remaining criteria being no filtered [*all*] [*query from 20/09/2019, Version 1.9*]. Both two data sets were transferred to Microsoft Excel 2010 (Microsoft Corp., Redmond, USA) to create descriptive statistics, including frequency distributions (Pivot tables, with filtering). The principal filter classes for further data interpretation were: *date* (by year), *product type* (food, feed), *notification type*, *notification basis*, *country's role* (notification, origin, distribution), *action taken* and *risk decision*. All 979 notifications were included in creating the database cases (n=1010) by *hazard category*, some involved notifications containing more than one item, hazard or origin country. The code to generate the chord diagram (Fig. 1E) was performed using the Microsoft Power Platform. Articles in specialized journals found on the Web of Science Group, Scopus, Google Scholar and official EU databases have been used as references.

RESULTS AND DISCUSSIONS

In milk and milk products industries, the adulteration has been reported almost all the time as a result of various risks associated with food safety hazards. Because of this, vulnerability reduction of dairy foods to adulteration is a high priority to everyone, from processors to consumers. Recent studies regarding food fraud statistics patterns highlighted that dairy products, like milk, cream or different types of cheese and dairy ingredients are the items that are most at risk of food fraud. These trends are not largely changed, since the statistics from 2016 placed milk on the second most common adulterated ingredient, with 14% of global 1980 to 2010 records [17, 18].

Currently, *RASFF notifications* are studied from a statistical point of view and results are provided by *RASFF* through an

annual report. Although the information is almost up to date, there is a deficiency of data in the studied time frame for 4 years (2000 – 2001 & 2015 – 2016), even if some statistics are available from 1999 to 2014 in relation to the total number of original notifications (n=698).

MDP RASFF notifications

In nearly 20 years' time, a total of 979 original *MDP notifications* were transmitted via *RASFF*, of which 59% were classified as alert (n=578), 21.14% (n=207) as information, 10.21% (n=100) as information for follow-up, 7.46% (n=73) as information for attention and 2.15% (n=21) as border rejection. Overall, in the last decade, *MDP notifications* have increased with 21.14% (60.57%, n=593) compared to the period 2000 – 2009 (39.43%, n=386), more than half of them being classified as serious (32.2%, n=315) from risk decision responsibility point of view. Between 2000 – 2009, all *MDP notifications* were categorized as undecided, with data improved over the last decade (2000 – 2019), these notifications declining dramatically (46.37%, n=207), while those considered not serious (7.3%, n=71), as a final answer to the decision risk category, increased.

The largest category of *MDP notifications* concerned official controls on the internal market (35.3%, n=346), usually carried out at business operators (manufacturer, wholesaler, storage, retailer), which involved an inspection and possibly also a sample taking for the purpose of analysis. Typically, three special types of *MDP notifications* were identified: company's own checks (34.8%, n=341), consumer complaints (10.8%, n=106) or food poisoning (3.8%, n=37). In this time frame, only 5.52% (n=54) of *MDP notifications* concerned checks at the outer European Economic Area (EEA) borders at points of entry or border posts. When the consignment was not accepted for import, a border rejection notification was issued, in some cases being taken samples for analysis for final decision (detained or released). From all border controls, statistics indicates more detained dairy products (4.39%, n=43) than released (1.12%, n=11). Only a small number

of *MDP notifications* were triggered by the official controls in a non-member country (0.72%, n=7) or through *RASFF* network (0.1%, n=1).

MDP RASFF notifications: origin, products affected and hazards 99% of all original *RASFF MDP notifications* studied referred to a *MDP* food type, with an output of 1009 cases, while the single case was referring to an antibiotic presence (chloramphenicol) in processed milk, being a residue of veterinary medicinal products used at animals. France and Italy were notifying countries in almost half of these notifications (France 32.77%, n=331; Italy 14.06%,

n=142), followed by Germany (9.60%, n=97), all three countries accounted for 56.44% of all cases. Belgium, Netherlands, Spain, United Kingdom, Lithuania, Austria and Poland have, as a group, a share quota of 20% (with less than 5% each) of all *MDP* cases, as country of origin, while the remaining 238 cases (23.47%) came from 63 countries worldwide, each with less than 2% share quota.

Table 1 below shows the number of *MDP* cases per product type (roughly similar to what is reported in *RASFF*) between 2000 and 09.2019, while hazards were borrowed from *RASFF*.

Table 1 *MDP* product category cases by identified hazards between 2000 – 09.2019

MDP types	Hazard types																	Sum					
	Adulteration - fraud	Allergens	Biological contamination	Composition	Env. pollutants	Food additives and flavorings	Foreign bodies	Industrial contaminants	Labeling absent/incomplete/incorrect	Metals	Microbial contaminants (other)	Mycotoxins	Natural toxins (other)	Not determined / other	Organoleptic aspects	Packaging defective / incorrect	Pathogenic micro-organisms		Pesticides residues	Poor or insufficient controls	Residues of veterinary medicinal products		
Butters	4						1	1		12					1	1					1	1	24
Cheeses	3	3	2	1	2	8	36	4	4	436	3	2	4	22	7	62	3	7	3				608
Creams	2	1						1	1	2						4							11
Dried milks (powders and concentrate)	4	2	1				2			1					1	6					4	17	38
Milk & dairy products from other mammals than cattle	1	1							2	1	68		1		1	16	4	2	1				98
Other milk & dairy products	14	4				1	12	5	1	11	3			3	5	10					3	14	86
Processed liquid milk	2				1		4	2		18	1				18	2	5				2	6	61
Raw milk	1									13	8	1					3				1	4	31
Yoghurts	3	4				2	22	1	2	13				3	1	1						1	53
Sum	34	15	2	2	5	11	78	9	10	1	574	15	3	5	47	17	108	7	20	47			1010

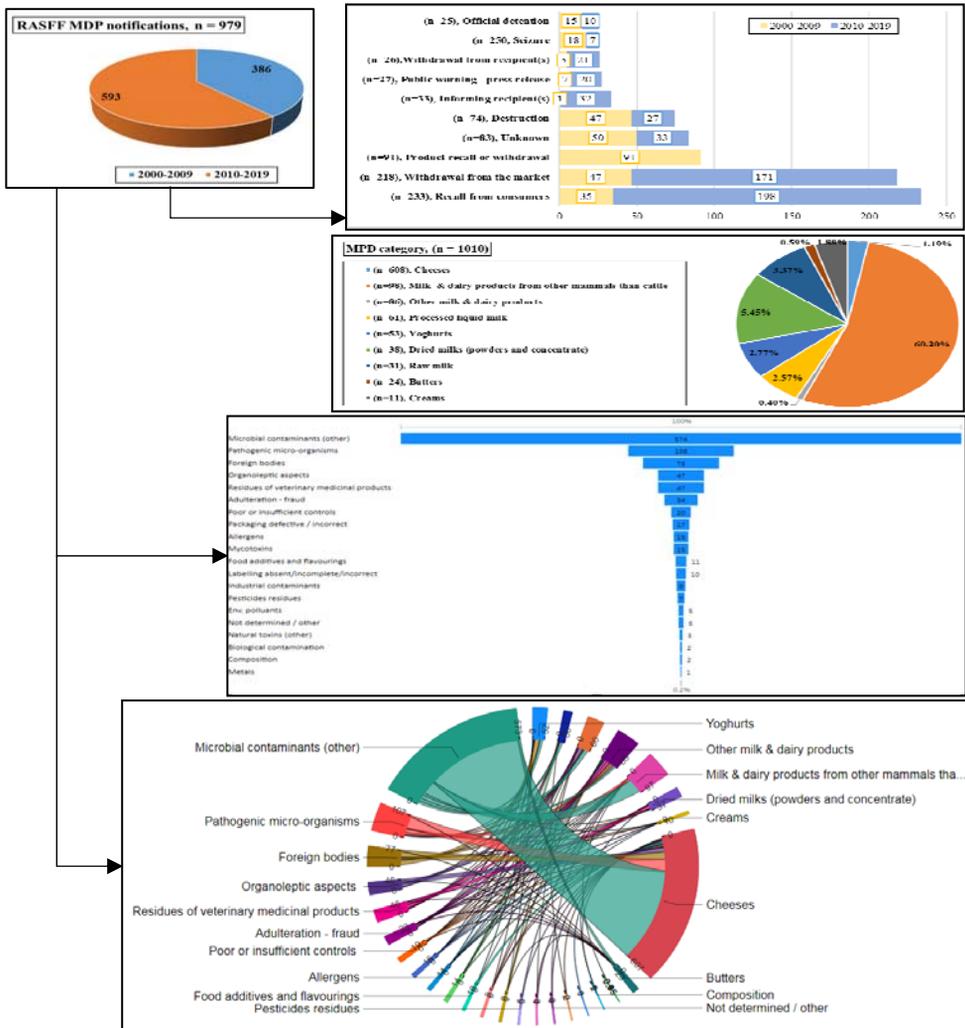
Most of *DMP notifications*, 2000 to 09.2019, concerned various types of cheese (60.20%, n=608), particularly soft chesse, followed by milk & dairy products from other mammals than cattle (9.70%), other milk & dairy products (8.51%), processed liquid milk (6.04%), yoghurts (5.25%), dried milks (3.76%), raw milk (3.07%), butters (2.38%) and creams (1.09%). Within the cheese category, the majority of cases were related to microbiological contamination, Fig. 1 presenting the overall image of studied cases. In the studied time frame, except cheese category, the proportion of *MDP* food categories complained every year varied, shifting the main focus between other milk and dairy products from other mammals than cattle, other milk and dairy, processed liquid

milk or yoghurts (Fig. 2). Overall, more than half of products (59.60%, n=602) remained undecided regarding final risk decision, this contributing active to the increased number of follow ups, from the last decade, to improve the situation.

It is clear from the point of view of the hazard type that microbiological contamination is the main reason, being responsible for 67.52% of all cases (10.69% due pathogenic micro-organisms & 56.83% due to other microbial contaminants). The most common food borne outbreak were cause by *spp.* as follow: *Salmonella*, *Bacillus cereus*, *Campylobacter*, *Clostridium* or *Escherichia coli*. Foreign bodies, such as plastic parts, glass fragments or metal wires were usually identified in the 7.72% affected

MDP cases. Residues of veterinary medicinal products (4.65%), organoleptic aspects (4.65%) and adulteration - fraud (3.37%) complete top 5 of 20 identified hazards. In case of adulteration – fraud, the most

frequent subjects were: illegal imports, absence, improper of fraudulent documents related with MDP food safety (health certificates), fraud of shelf life dates or tampering with needles.



From left to right and up to down: **Subfig. A** – Total number of original RASFF milk and dairy products (MDP) notifications in the period 2000 – 2009 vs. 2010 – 2019; **Subfig. B** – Top 10 action taken measures for original MDP RASFF notifications in the period 2000 – 2009 vs. 2010 – 2019; **Subfig. C** – Distribution of MDP in relation with category of product (2000 – 2019); **Subfig. D** – Distribution of MDP in relation with the involved type of hazard (2000 – 2019); **Subfig. E**: MDP RASFF cases of notifications, by the most frequent hazard types, 2000 – 2019. Arc lengths on the inner circle are proportional to the number of cases of a product or of a hazard type.

Fig. 1 Overview of RASFF MDP notifications in nearly last 20 years

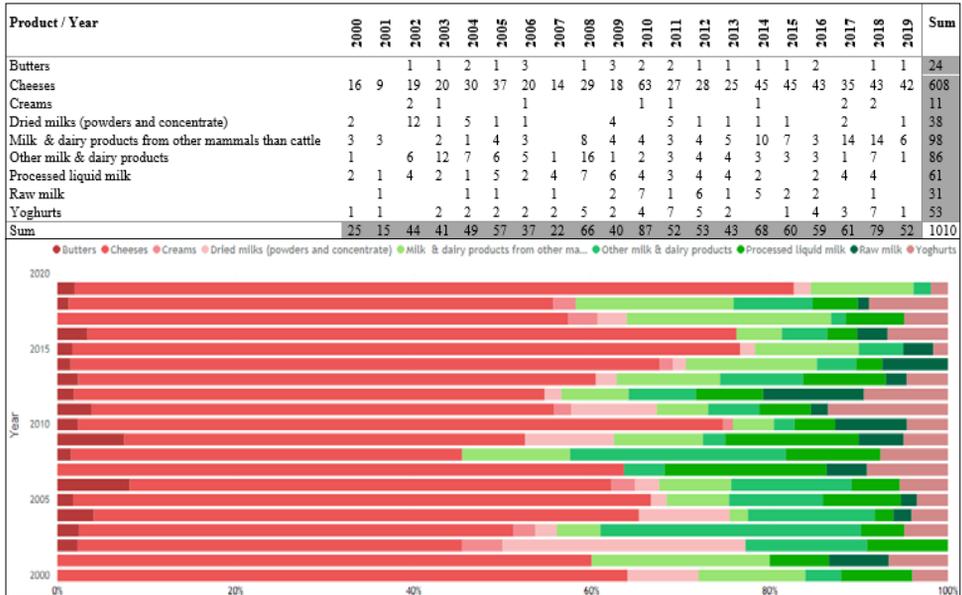


Fig. 2 Percentages of MDP cases for product category, 2000 – 09.2019, per year

REMARKS

Independent of the country affected, five countries in the EU28 area were the main players in releasing *MDP notifications*: France, Italy and Germany, followed by Netherlands and United Kingdom, first three having the highest gross domestic products at market prices. The connections between trade relations and nation particular differences in awareness and efficiency of own food surveillance system could be the major factors for their top ranking.

Milk and dairy products cases of notifications have been increasing in the last decade.

Listeria spp. caused the most notifications.

Cheese was the product type most notified.

The main issues regarding *MDP* food fraud adulterations are presence of different illegal chemical substances (as pesticides, residues veterinary medicinal products or substances to enhance the quality); illegal imports; absence, improper of fraudulent documents related with *MDP* food safety (health certificates), fraud of shelf life dates or biosecurity (tampering with needles).

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