Food Safety Notification on Indonesian Food Export

Nugroho Indrotristanto[1,2] and Nuri Andarwulan[1,3]
[1]*Directorate of Food Processed Standardization, National Agency for Drug and Food Control, Jalan Percetakan Negara No 23, Jakarta, Indonesia*
[2]*Department of Food Science and Technology, IPB University, Gedung Fateta, Kampus IPB University, Dramaga, Bogor, West Java, Indonesia*
[3]*Southeast Asian Food and Agricultural Science and Technology Centre, IPB University, LPPM-IPB University, Jalan Ulin No 1, Kampus IPB University, Dramaga, Bogor, West Java, Indonesia*

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Abstract: Notifications due to food safety by importing countries may pose a significant economic burden for exporting countries, including Indonesia. This review was conducted systematically to list and to identify Indonesian food commodities notifications, as discussed by published literatures. The study was conducted using a systematic approach, as recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Eight of 7,210 research papers were selected due to information on Indonesian exported food notifications. However, only four papers were included in analysis, due to the availability of quantitative data on the notifications. There were 17 reports from these institutions included in the analysis. Fishery based fresh food seems to be the major sources of notification, followed by plant or animal based fresh food, processed food and minimally processed fresh food. This study result indicates that comprehensive risk profiles may be developed for foods from fishery and plant or animal based fresh food products. The profiles may aid to discuss about risk factors contributing food notifications as well as identifying gaps for necessary scientific researches and/or risk assessments.

1 INTRODUCTION

Food export is an important source of revenue for a country. However, importing countries may issue notification to exporting countries if the traded foods do not meet food safety requirement in importing countries. The notification may differ in location where food safety authorities found exported food which does not meet food safety standards or high-risk food. The European Union Rapid Alert System for Food and Feed (EU-RASFF) classified notifications into several categories. Border rejection is activated when food safety officials determine high-risk food in point of entry (EURASFF, 2018). While, Alert and Information are issued when food safety officials found the high-risk food in the market (EURASFF, 2018). News is considered when there is information on the availability of high-risk food however it does not fall under Border rejection, Alert and Information status (EURASFF, 2018).

The United States government has a different type of notifications. The United Stated Food and Drug Administration (US-FDA) has authorities to check food of their concern, not only for food safety requirements but also indication of food fraud (Bovay, 2016). Import alert status is given to food shipments which violate US food safety standards therefore food authorities may carry out Detention without Physical Examination for the shipment (Bovay, 2016; USFDA, 2019a, 2019b). US-FDA commonly follow up import alert status with rejection of imported foods eventhough rejection can be performed without having the status (Bovay, 2016). The detention is then recorded in a database called Operational and Administrative System for Import System or OASIS (Bovay, 2016). Exporting countries may look for their food refusals from this database, since US government make it available on-line. Therefore, stakeholders in exporting countries may take necessary follow-up actions.

Food safety notifications likely affect international food trade for both importing countries and exporting countries. Both producers and government bear the burden due to notification of their exported food commodities. Notification, such

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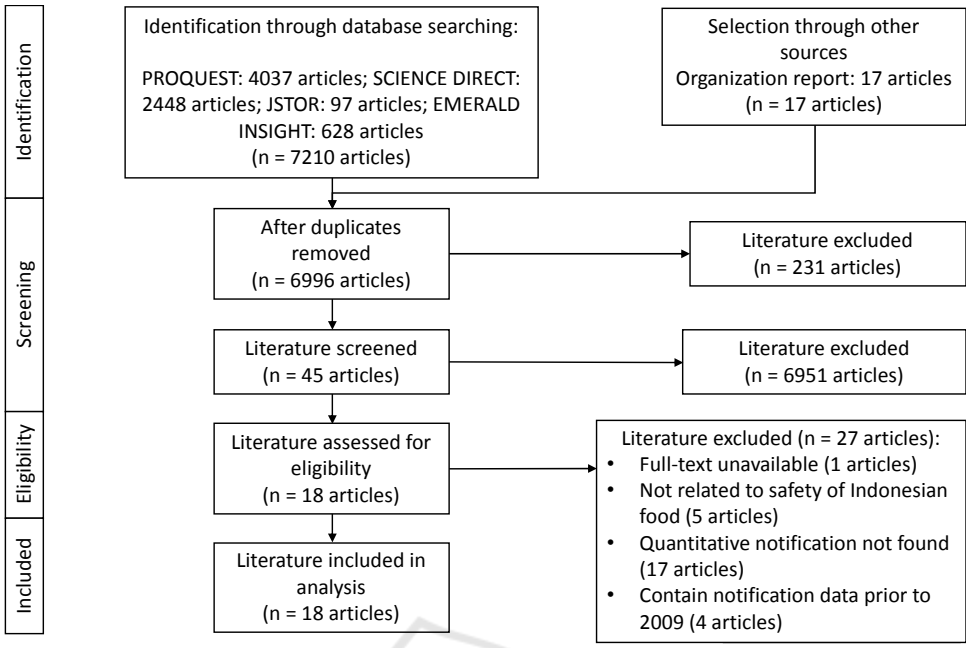


Figure 1: Summary of Literature Selection Processes.

as rejection, would likely have an enormous impact for the export value which is supposed to be earned by exported countries. These burdens may arise due several factors, such as export value loss, handling cost, liability risk and brand equity losses (GMA, 2011). Jongwanich (2009) studied food detention cases by US-FDA on 2002, 2003, and 2004 for determining export value losses divided by detention numbers. Value exports per detention cases of Asia countries varied between 0.25 Million (Pakistan) until 6.94 Million (Thailand) USD per year. While, the burden bear by Indonesia due to detention of food product was reported over 2 Million USD per case per year for export value losses only (Jongwanich, 2009). Therefore, strategic steps should be taken to minimize the loss due to food notification by importing countries.

Food safety policy development requires risk profiling. This profile provides information on combination of food and its associated hazards (Cressey, 2014). Risk profiling is one of steps in food safety risk management. Codex Alimentarius Comission (CAC) recommends risk management in establishing food safety policies, which consists of a preliminary risk management activities, the evaluation of options for risk management, decision implementations, and monitoring for the impacts of the implemented policies (FAO/WHO, 2007). The development a risk profile is one of several activities in preliminary risk management activities. By providing relevant information regarding food and its associated hazards, a risk profil may assisst policy makers to formulate such efficient and effective food safety policies (Cressey, 2014). Risk profiling may also provide information on immediate actions as well as gaps for necessary research and risk assessments (Cressey, 2014).

The objective of this review is to list and to identify Indonesian food commodities notifications. Futhermore, the associated hazards, which cause food notification are also identified. This study uses a systematic review approach, which includes determining, selecting, and analyzing data of related literature (Moher *et al.*, 2009). The identified food and its associated hazards may be a valuable source of information in selecting food commodities for risk profiling.

2 MATERIALS AND METHODS

2.1 Search Strategies

Literature searching was conducted systematically using an approach recommended by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher *et al.*, 2009). The searching was conducted in ScienceDirect, Proquest, Emerald Insight dan JSTOR. Keywords used in the searching were (food OR agricultur* OR fish*) AND (import OR export) AND (reject* OR refus* OR

notif*) AND Indonesia for Proquest, Emerald Insight and JSTOR whereas (food OR agriculture OR fisheries) AND (export OR import) AND (reject OR refusal OR notification) AND Indonesia were keywords for ScienceDirect.

The literature selection processes included duplication checking, screening for abstract and titles, as well as assessing for eligibility of full-text (Figure 1). Several criteria were applied in the searching. Inclusion criteria for selection in screening process included peer-reviewed articles, titles and abstracts related to food exportation and food safety issue, articles are in English or Bahasa Indonesia. While, inclusion criteria for assessing eligibility of a study included the availability of full-text, the availability of quantitative data on food notification, and the data were issued during 2009 – 2019. Besides scientific literature, searching was carried out for reports related to food safety notifications in Search Engine. The criteria for reports were related to food exportation and food safety issue, articles are in English or Bahasa Indonesia, the availability of quantitative data on food notification, and the data were issued during 2009 – 2019

2.2 Data Extraction and Grouping

Number of notifications were identified from selected literature. The notifications were grouped under several classifications, based on food and hazard associated with the notification. Food was grouped into four major categories, including fishery based fresh food, plant or animal based fresh food, minimally processed foods and processed foods. Each major group was divided into several sub-groups, which is called commodities (Table 1). While, hazards associated with notification were also divided into several major groups. These major groups were chemical hazards, microbiological hazards, and non-chemical and microbiological hazards (Table 2).

2.3 Information Presentation

Notification data were presented in a form of bar charts. The charts consist of notification numbers and references (expressed as first author and year of publication). Notification type was divided into two categories, which was due to refusals and due to other reasons. Refusals were mostly reported as the cause of notification whereas alert, information, and news were less reported by references. There were two types of bar charts presented in each major food group. First chart reported notification number based on commodities and related references. While another chart presented the number of notifications based on hazard types and related references.

Table 1: The classification of notified foods.

Group	Commodities	Examples as Reported in References
Fishery Based Fresh Food	Fish	Fish, frozen catfish, red tail gobi, todak, tuna, frozen tuna steak, trout
	Crustacea	Crab, Shrimp
	Chephalophod	Frozen squid, frozen octopus, chepalophod
Plant or Animal Based Fresh Food	Stimulants	Coffee
	Herbs and Spices	Cooked spices, nutmegs, cinnamon
	Frog legs	Frozen frog legs
	Rice	Rice
Minimally Processed Foods	Dessicated coconut	Dessicated coconut
Processed Foods	Instant noodle	Instant noodle
	Canned Food	Canned Food
	Sauces	Chilli sauce
	Chips and Snacks	Chips, *ceriping pedas*, potato chips, cassava chips, shrimp chips, fruit chips
	Processed peanut	*Medan* peanut
	Biscuit/Wafer	Biscuit, chocolate wafer
	Chocholate product	Chocolate, chocolate bar
	Beverages	Ginger beverages
Food contact materials	Gloves	Gloves

3 RESULTS

3.1 Literature Included in Systematic Review

3.1.1 Research Papers

The search strategy resulted in as many as 7,210 articles from scientific databases (Proquest, ScienceDirect, JSTOR dan Emerald Science) (Figure 1). As many as 231 articles were exluded due to duplication. Selection process reduced the number of articles, from 6,951 into 28 articlesOne article was not available for full-text (Moazami and Jinap, 2009). Publications from Kok and Radzi (2017), FitzSimons

Table 2: The classification of hazard causing notification.

Hazard group	Hazard types	Examples as Reported in References
Chemical	Allergen	Allergen
	Hazardous Substances	Leucocrystal violet, Leucomalachite green, Unsafe add
	Food Additives	Cyclamate, sulphite, azorubine
	Heavy metals	Cadmium, mercury, heavy metals
	Total migration	Packaging material total migration
	Mycotoxin	Aflatoxin, ochratoxin
	Processing contaminants	Benzopyrene, PAH
	Pesticide residues	Carbaryl
	Histamine	Histamine
	Chloramphenicol and Veterinary Drug Residues	Chloramphenicol, nitrofurans, veterinary drugs
Microbio-logical	Pathogenic Bacteria	Bacillus, Salmonella, Streptococcus faecali, Vibrio
	Fungi/Yeast	Fungi
	Bugs infestation	Bugs
Non-chemical and microbio-logical	Filth	Filth
	Improper process	Lacks Firm, Inappropriate temperature control, Unregistered Low Acid Canned Food Company
	Improper labelling	Undeclared coloring and sulphite and GMO
	Improper Certification	Improper Health Certificate, No Health Certificate
	Poisonous	Poisonous

(2010), Wan Norhana *et al.* (2010), Majumder and Banik (2019), and Quested *et al.* (2010) were focusing on aspects which are irrelevant to the safety of Indonesian food products. As many as 14 references have already mentioned the safety of Indonesian food products, however no information about the quantity of notification were found (Anggrahini *et al.*, 2015; Bachev and Ito, 2013; Bhat and Reddy, 2017; Hassan *et al.*, 2018; Imperato *et al.*, 2011; Kleter *et al.*, 2009; Manning, 2016; Marroquín-Cardona *et al.,* 2014; McLauchlin *et al.*, 2019; Paterson *et al.*, 2014; Reiter *et al.*, 2010; Robertson *et al.*, 2014; Skretteberg *et al.*, 2015; Wang *et al.*, 2013). While, four scientific publications have reported notification number on Indonesian exported food products, however the notification were received before 2009 (Banach *et al.*, 2016; Bouzembrak *et al*., 2018; Jongwanich, 2009; Kuchler *et al.*, 2010). Therefore, the assessment of eligibility resulted in four articles for further analysis (Table 3).

Four articles analyzed information from refusal database published by institutions who have authorities to notify high-risk imported foods. Wahidin and Purnhagen (2018) as well as D.'Amico *et al.* (2018) studied the information from the database published in EU-RASFF website. Dataset of food refusal by US-FDA was used as materials for analysis by Fahmi *et al.* (2015). While, Nugroho (2014) studied imported food rejection by Japanese food authority.

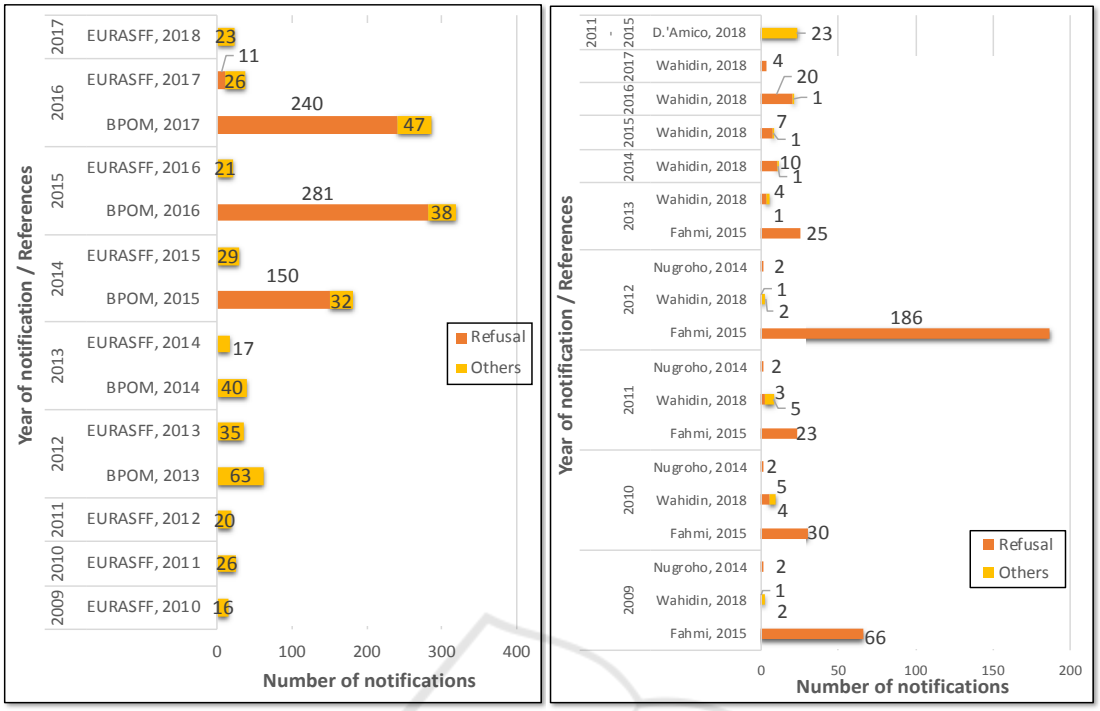
3.1.2 Other Sources

There were 17 articles obtained in search by search engine in internet. Sixteen of these sources were annual reports from EU-RASFF and The National Agency of Drug and Food Control, The Republic of Indonesia (NADFC). EU-RASFF is an institution who has the authority of notifying imported food which do not meet the food safety requirements in Europe, according to EC Regulation No 178/2002 related to General Principle of Food Law (EURASFF, 2018). The foundation of EU-RASFF is stated in the article number 50 of The Law. The purpose of the founding is to build information sharing system among EU member countries to take actions accordingly wherever imported high-risk imported food are found (EURASFF, 2018).

EU-RASFF publishes annual report which contain information on the number of notifications from EU-member countries. The structures of annual reports begin with the organization legal aspects and then notification types. Then, there are parts which discuss the most often hazards causing the notifications (EURASFF, 2018, 2017, 2016, 2015, 2014, 2013, 2012, 2011, 2010). One of the important parts of the report is the data on the number notification, which is presented based on notifying countries as well as country of origin for the imported food. There are nine EU-RASFF annual reports as the source of information in this study.

Table 3: Main characteristics of selected scientific literature.

References	Nugroho (2015)	Fahmi *et al.* (2018)	D.'Amico *et al.* (2018)	Wahidin and Purnhagen (2018)
Title	The Impact of Food Safety Standard on Indonesia's Coffee Exports	USFDA Import Refusal and Export Competitiveness of Indonesian Crab in US Market	Seafood products notifications in the EU Rapid Alert System for Food and Feed (RASFF) database: Data analysis during the period 2011–2015	Improving the level of food safety and market access in developing countries
Objectives	Presenting how a regulation may affect the global trade of coffee from Indonesia. Analysis was performed using Gravity Model	Analyze impor refusal by US-FDA on Indonesia crab competitiveness in The US market	To determine the profile of notification for seafood product carried out by EU-RASFF in 2011 – 2015	To investigate the risk management of two case studies: shrimp and nutmeg, to formulate policies to comply with EU regulation as well as to make Indonesian food commodity competitive
Source of notification data	Secondary	Secondary	Secondary	Secondary
Notifying Country or Institutions	Japan	US-FDA	EU-RASFF	EU-RASFF
Notification time	2008-2012 (notification data are available per year)	2002-2013 (notification data are available per year)	2011-2015 (accumulative)	2000-2017 (notification data are available per year)
Food type	Coffee	Crab	Seafood	Shrimp and Nutmeg
Hazard Type	Several hazards, as case studies	All related hazards	All related hazards	Several hazards, as case studies
Conclusions	Regulation on ochratoxin affect Indonesian coffee commodities compared to specific country regulation, for example carbaryl. Furthermore, bilateral negotiation may settle issues related to specific country regulation.	Indonesia experienced numbers of crab refusal in 2002 – 2013, with 381 cases. Chloramphenicol was the most reason for refusals, with 171 cases. The highly competitive commodities were unfrozen and processed crab whereas frozen crabs were considered fairly competitive.	RASFF database provides useful information to know the recent food safety issues. Analyisis results indicates that attention should be paid not only to imported product but also produced in EU Furthermore, the information is useful for hazard identification	FSO/ALOP analysis showed that "top-down" approach is more suitable to settle chloramphenicol in shrimp issue. Whereas "bottom-up" approach is necessary to overcome the issue of aflatoxin in nutmeg



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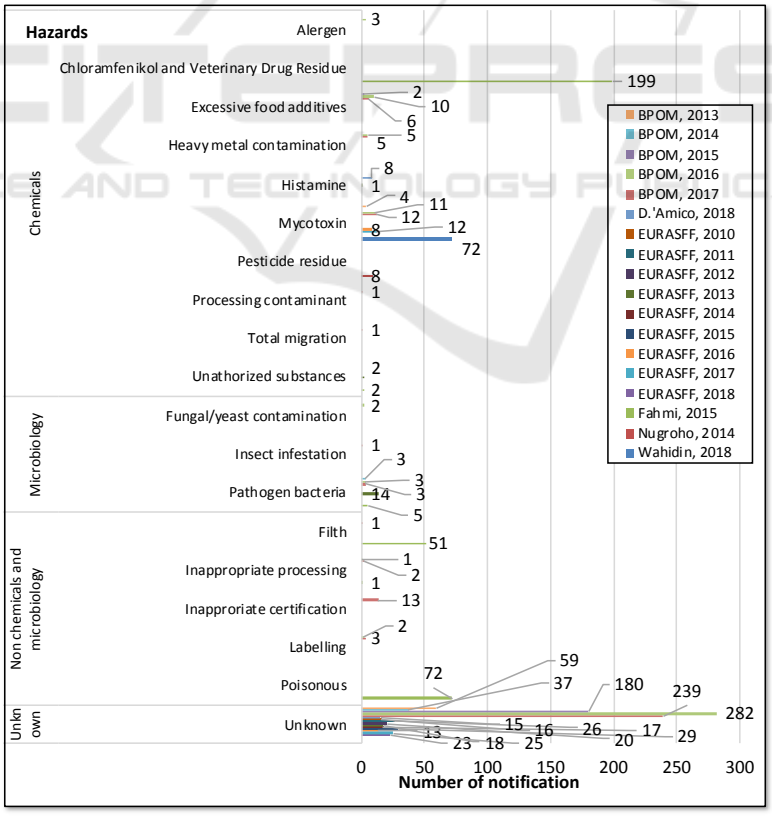


(c)

Figure 2: Notifications of exported food from Indonesia 2009 – 2019 as reported in annual reports (a) and scientific literature (b) as well as their hazards of concern (c).

NADFC is a government agency which serves as the secretarat of *Indonesia Rapid Alert System for Food and Feed* (INRASFF). INRASFF has a function more or less the same as EU-RASFF, which facilitate information exchange between contact points of Indonesian ministries and agencies related to following up notified exported food or high-risk imported foods (BPOM, 2018). The numbers of Indonesian exported food notification are mostly found in NADFC annual reports (BPOM, 2017, 2016, 2015, 2014, 2013). However, two annual reports do not provide the number of notifications of Indonesian exported food (BPOM, 2018, 2012). Nevertheless, five annual reports provide valuable information for analysis in this study, despite of the variability of notification presented.

An analysis report on refusal by The US government also became the result of literature searching process in web search engine. Unlike EU-RASFF and NADFC, US-FDA does not provide the number of refusals in their annual reports. However, a study conducted by Bovay (2016) aimed at showing trends of refusal of imported food by The US. Bovay (2016) analyzed the data from OASIS and stated that Indonesian seafood were among the most refused food commodities by The US government. Unfortunately, the number of refusals of these commodities are not available in the report, as well as the information of hazards causing the notifications. Therefore, this report was excluded for analysis in this study

3.2 Notified Foods During 2009 – 2019

The number of notifications and refusals reported in NADFC annual reports is more than that of EU-RASFF (Figure 2a). The number of notifications for Indonesian exported food was around 16 – 27 in 2009 – 2019 as reported in EU-RASFF annual reports (EURASFF, 2018, 2017, 2016, 2015, 2014, 2013, 2012, 2011, 2010). Only one annual report published the number of border rejections, as many as 11 rejections in 2016. NADFC collected Indonesian exported food notifications from many sources, including EU-RASFF, The US, Malaysia, and South Korea (BPOM, 2017, 2016). Besides that, NADFC also shows the refusals as reported in OASIS. The number of notifications for Indonesian exported food was around 63 and 40 in 2012 – 2013, respectively (BPOM, 2014, 2013). Then, the number rose in the range of 182 – 319 during 2014 – 2016 (BPOM, 2017, 2016, 2015). Starting 2014, NADFC included refusal data from OASIS, which made the number of notifications more than that as reported by EU-RASFF.

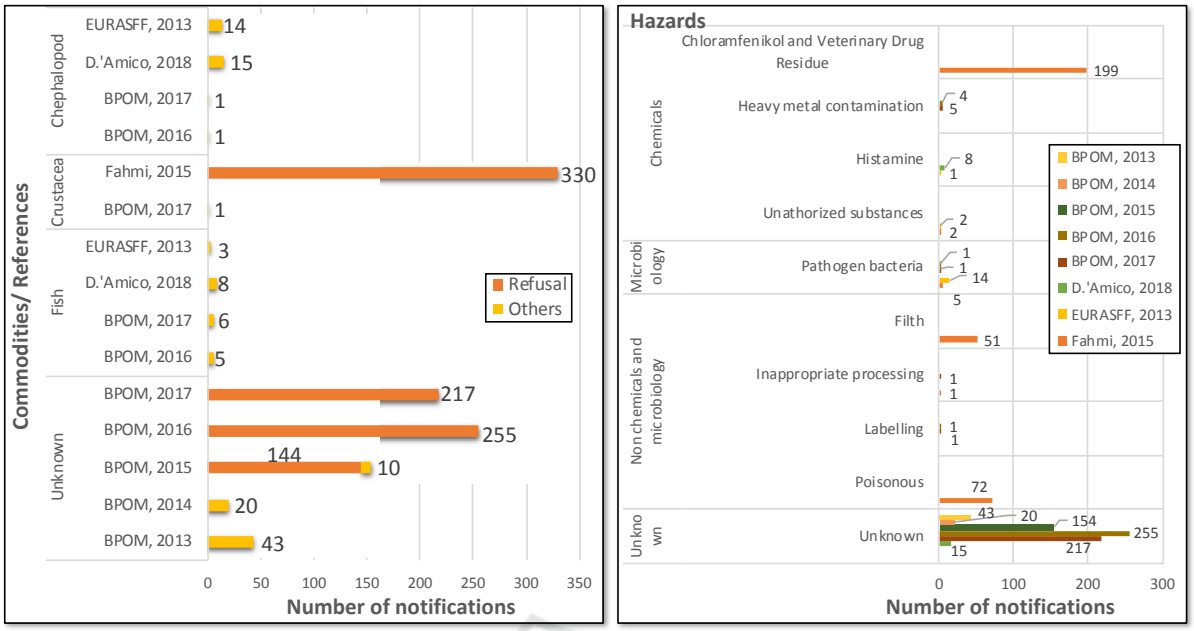
Research papers commonly discuss the refusals of specific food commodities. Therefore, the reported numbers of notifications from scientific papers are less than that from organization annual reports (Figure 2b). The highest number of notified foods are reported by Fahmi *et al.* (2015). Fahmi *et al.* (2015) used crab refusal data from OASIS for analysis.

Notifications without knowing the hazards were commonly found in selected references (Figure 2c). Chemicals were the known hazards causing most notification as reported in 11 references. The number of notification due to this type of hazard were between two and 200 notifications (BPOM, 2017, 2016, 2015, 2013; D.'Amico *et al.*, 2018; EURASFF, 2017, 2016, 2013; Fahmi *et al.*, 2015; Nugroho, 2014; Wahidin and Purnhagen, 2018). Microbiological hazards as the causes of notifications were reported by five references. The numbers of notification ranged between three until 14 notifications (BPOM, 2017, 2016, 2014; EURASFF, 2013; Fahmi *et al.*, 2015). In non-chemical and microbiological hazards category, only three references reported the notification, ranging from three until 125 notifications.

3.3 Fishery based Fresh Foods Notification during 2009 – 2019

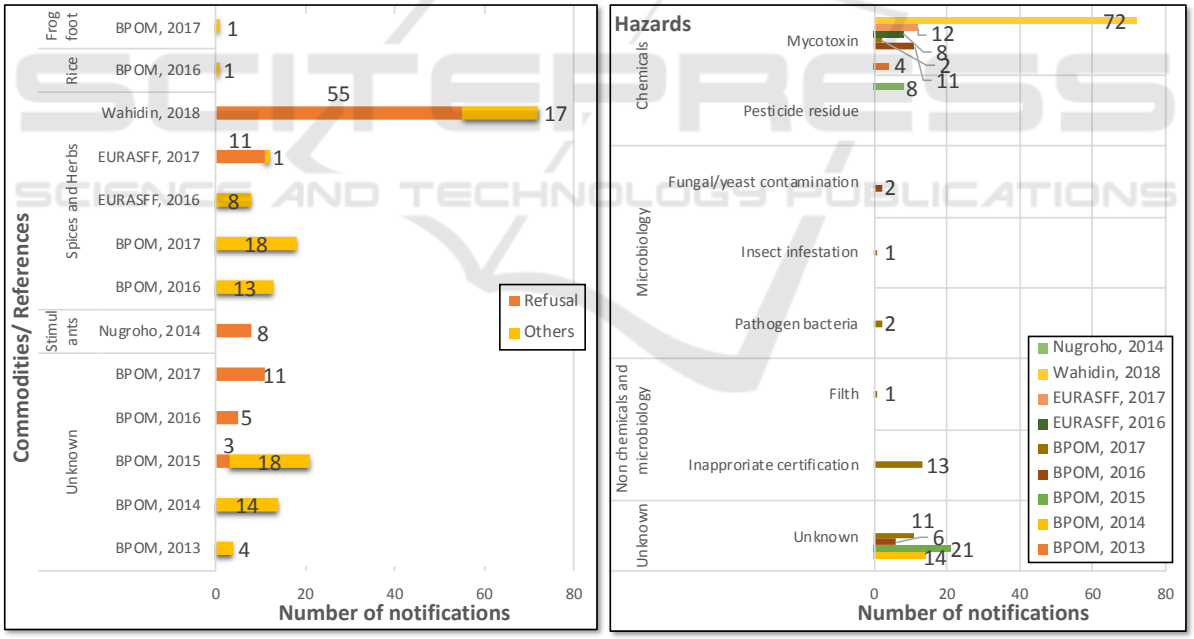
Food from fishery products received most notification compare to other major food groups (Figure 3a). Crustacea was the most notified food, reaching 330 notifications during 2009 – 2019 as reported by one reference (Fahmi *et al*., 2015). However, there were two foods included in crustacea group, where crabs were the most notified while shrimp only received one notification (BPOM, 2017; Fahmi *et al*., 2015). Unlike crustacea group, chepalopod and fish commodities received less than 20 and 10 notifications, respectively, as reported by four references (BPOM, 2017, 2016; D.'Amico *et al.*, 2018; EURASFF, 2013). However, there are more notifications for sub groups which is unknown for the details of commodities, ranging from 40 until 255 notifications (BPOM, 2017, 2016, 2015, 2014, 2013). This sub group was reported by most references in this major groups, with five articles mentioned about it (BPOM, 2017, 2016, 2015, 2014, 2013).

Hazards causing notification in this major food group mostly were chloramphenicol and veterinary drug residue, poisonous, and filth eventhough each of the hazard mentioned by one article (Figure 3b) (Fahmi *et al.*, 2015). However, pathogenic bacteria



(a) (b)

Figure 3: Notifications of exported fishery-based fresh foods 2009 – 2019 (a) and their hazards of concern (b).



(a) (b)

Figure 4: Notifications of exported plant and animal-based fresh foods 2009 – 2019 (a) and their hazards of concern (b).

were reported by more references, despite having less notification with one until 14 notifications reported (BPOM, 2017, 2016; EURASFF, 2013; Fahmi *et al.*, 2015). Other hazards, such as heavy metals, histamine, unauthorized substances, inappropriate processing, and labelling, reported by two references each, with less than 10 notifications received (BPOM, 2017, 2016; D.'Amico *et al.*, 2018; EURASFF, 2013; Fahmi *et al.*, 2015). The notifications without knowing detail hazards were the most reported by

most references in this major food group, ranging from 15 to 255 notifications (BPOM, 2017, 2016, 2015, 2014, 2014; D.'Amico *et al.*, 2018).

3.4 Plant or Animal based Fresh Food Notification During 2009 – 2019

The number of notifications in this major food group was not as high as that of food from fishery (Figure 4a). Herbs and spices dominated the number of notified foods as reported in most references. These commodities received 8 – 72 notifications during 2009 – 2019 as discussed in five references (BPOM, 2017, 2016; EURASFF, 2017, 2016; Wahidin and Purnhagen, 2018). While other commodities, such as frog legs, rice, and stimulants only discussed in one reference each, with less than 10 notifications (BPOM, 2017, 2016; Nugroho, 2014). The numbers of notification without the detail of foods were also reported in five references, ranging from four to 18 notifications (BPOM, 2017, 2016, 2015, 2014, 2013).

Mycotoxin was the most reported hazards of causing the notifications (Figure 4b). There were six references discussed and quantified this hazard, ranging from four to 72 notifications (BPOM, 2017, 2016, 2013; EURASFF, 2017, 2016; Wahidin and Purnhagen, 2018). Other hazards, such as pesticide residue, fungi/yeast contamination, insect infestation, pathogenic bacteria, filth and inappropriate certification, were reported by one reference each, with less than 13 notifications (BPOM, 2017, 2016; Nugroho, 2014). Notifications with no mentioned hazards were reported in four references, ranging from six to 21 notifications (BPOM, 2017, 2016, 2015, 2014).

3.5 Minimalized Processed Food Notification During 2009 – 2019

Notifications received by this major food group were the least reported notification compare to other major food groups (Figure 5a). The only commodity reported in this major food group was dessicated coconut. There were two references reported this commodity, receiving one notification each (BPOM, 2017, 2016). Hazards reported in this major food group were pathogenic bacteria and excessive food additive (Figure 5b). Pathogenic bacteria were reported in one notification as reported by BPOM (2016) and three notifications as reported by BPOM (2014). While, excessive food additives were reported as the cause of one notification by BPOM (2017).

3.6 Processed Food and Food Contact Material Notification During 2009 – 2019

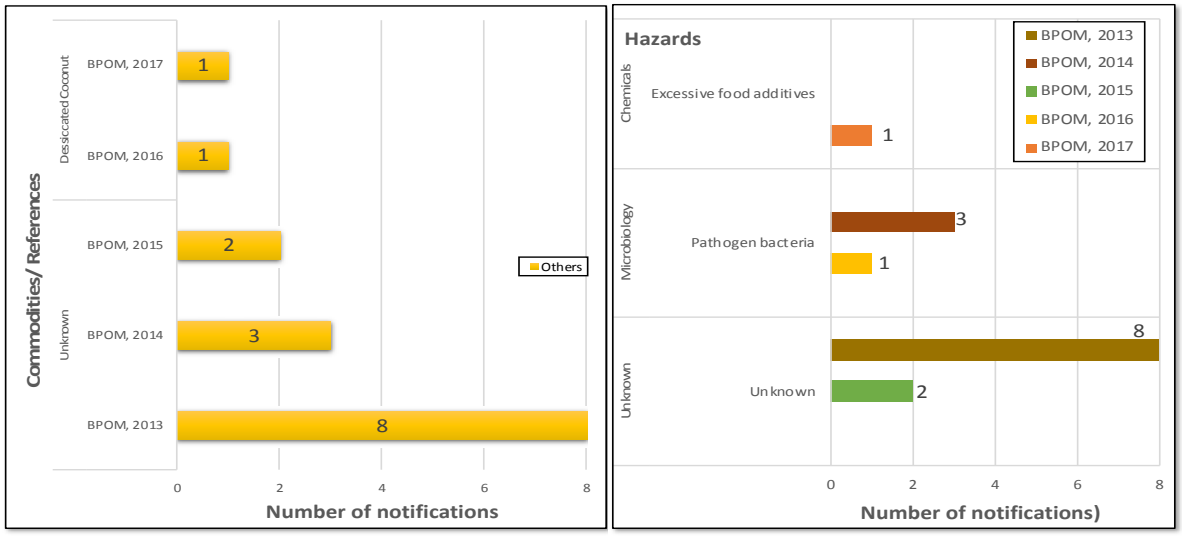
This major food group was also included as less notified food, both by refusal other other reasons (Figure 6a). Chips and snacks were the only food commodity receiving more notifications compare to other commodities in this food group. The notifications reported in BPOM (2016) and BPOM (2017), with 13 and 3 notifications, respectively. Other commodities, such as beverages, biscuit/wafers, canned foods, chocolates, instant noodles were reported having one notification, with less than three notifications, and as reported by one reference for each commodity (BPOM, 2017, 2016). Beside food, food contact material also had one notification as reported by one reference (BPOM, 2017).

There were more hazard types reported in chemicals group compared to other hazard group in this major food category (Figure 6b). Excessive food additives was the most cause of notification, with three references reported 2 – 10 notifications (BPOM, 2017, 2016, 2015). Other hazards, such as allergen, heavy metal, processing contaminant, total migration were reported causing one notification each except for allergen with three notifications (BPOM, 2017, 2016). Inappropriate processing and labelling were reported by two references each, for causing mostly one notification (BPOM, 2017, 2016). While, pathogenic bacteria were reported causing one notification by one reference (BPOM, 2016). However, there were many unidentified food commodities receiving notification as well as unidentified causing hazards, ranging from 3 – 21 notifications (BPOM, 2017, 2016, 2015, 2014, 2013).

4 DISCUSSION

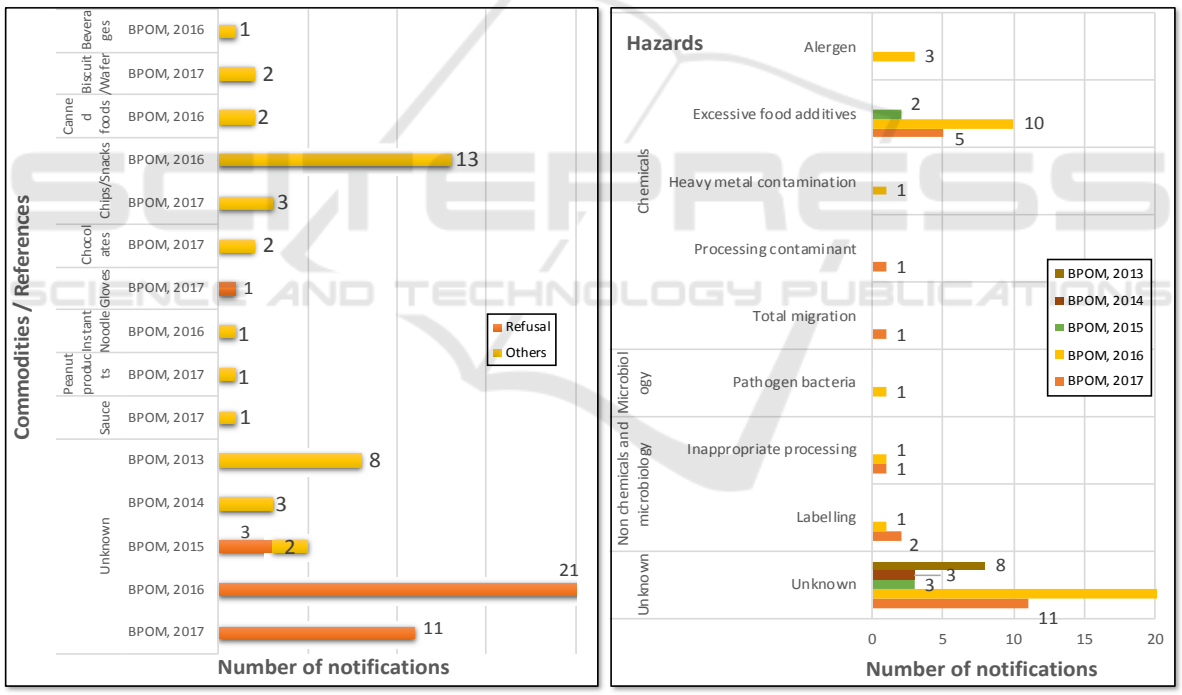
4.1 The Notification of Indonesian Exported Food During 2009 – 2019

There seems a wide opportunity to explore the notification of Indonesian exported food and publish it in international scientific literature. Of 7,210 articles found, only eight papers contain information on the quantity of Indonesian exported food notification (Banach *et al*., 2016; Bouzembrak *et al*., 2018; D.'Amico *et al*., 2018; Fahmi *et al*., 2015; Jongwanich, 2009; Kuchler *et al*., 2010; Nugroho, 2014; Wahidin and Purnhagen, 2018). However, only



(a) (b)

Figure 5: Notifications of exported minimally processed foods 2009 – 2019 (a) and their hazards of concern (b).



(a) (b)

Figure 6: Notifications of exported processed foods 2009 – 2019 (a) and their hazards of concern (b).

four articles published the notification on 2009 – 2019, which can be included for analysis in this study (D.'Amico *et al*., 2018; Fahmi *et al*., 2015; Nugroho, 2014; Wahidin and Purnhagen, 2018). Those four articles analyzed refusal data from published dataset by the authorities. The refusal data may be used for several purposes, such as studying food refusal trends, emerging hazards early detection, as well as prevention of future risks (D.'Amico *et al*., 2018). D.'Amico *et al*. (2018) studied refusal data from EU-RASFF to determine the trend of refusal for imported seafood to EU as well as to characterize hazards most contributing to the refusals. D.'Amico *et al*. (2018) also concluded that the refusals may be a valuable

information for hazard identification in food safety risk assessment step.

Another example of a study using EU-RASFF database was a study conducted by Banach *et al.* (2016). The purpose of the study was to determine the trend of food safety hazards in herbs and spices commodities during 2004 -2014. Banach *et al.* (2016) combined EU-RASFF database with other literatures, such as annual report of European Food Safety Authority, World Health Organization Global Environmental Monitoring System (GEMS)/Food database, and The Netherland Food and Consumer Product Safety Authority database. Banach *et al.* (2016) showed that several herbs and spices, such as blackpepper and dried herbs, were dominated by pathogenic bacteria, such as *Salmonella* spp. and *E. coli* whereas *Bacillus* spp. was also found in chillies and curries. Mycotoxin contamination was a major cause of notification for herbs and spices as shown in EU-RASFF database, GEMS/Food database and The Netherland Food and Consumer Product Safety Authority database. The mycotoxin contamination caused more than 500 notifications as recorded in EU-RASFF database and The Netherland Database, even reaching 30,000 notifications as recorded in GEMS/Food database (Banach *et al*., 2016). Banach *et al.* (2016) concluded that the most concerned microbiological hazards for herbs and spices were *Salmonella* spp and *Bacillus* spp whereas most concerned chemical hazards were aflatoxin B1 and ochratoxin A. Moreover, Banach *et al.* (2016) also recommended the use of notification data collected in authorized institutions database for hazard identification as also suggested by D.'Amico *et al.* (2018).

Fishery based fresh food is one of the important export commodities for Indonesia. Besides for exporting, the high number of fish resources, which is estimated reaching 12.5 tonnes in 2016, makes this commodity reliable for domestic consumption as well (KKP, 2018). However, this food is the most receiving notification compared to other major food groups (Figure 3a). Rosabel (2018) conducted a study related to the refusal of Indonesian exported food by the US in 2010 – 2017 by using OASIS database. The average of refusals of Indonesian product was 282 cases per year in 2010 – 2017, dominated by fishery products with the average of 126 refusal cases per year (Rosabel, 2018). The refusal number is almost the same as the difference between notification of Indonesian food as reported by EU-RASFF and NADFC (Figure 2a). It suggests that refusal by The US government dominated the number of notifications of Indonesian exported foods. Rosabel (2018) study was in line with study conducted by Bovay (2016). Indonesia, together with Thailand, was the most countries receiving notification from US-FDA for fishery products (Bovay, 2016).

Further exploration is needed for determining the most commodity receiving notification in food from fishery group. In this study, the most notified food from fishery was crabs as reported by Fahmi *et al* (2015) (Figure 3a). However, there were numbers of notifications, which were unable to determine the details of the commodities as well as the causing hazards, ranging from 40 until 255 notifications (BPOM, 2017, 2016, 2015, 2014, 2013). Therefore, it is likely that there were other commodities which received notifications at the same amount or even more than crab commodities. Rosabel (2018) found that tuna dominated in the number of refusals by US-FDA, receiving more than 1,000 out of 2,019 notifications of seafood products. The number of notifications of snapper, shrimp and crab were almost the same, which were 245, 242 and 232 notifications, respectively (Rosabel, 2018). On the other hand, Irawati *et al.* (2019) reported that tuna was the most notified food from The European Union on 2011 – 2017, with 27 notifications. Whereas in this study, fish commodity was reported receiving only 3 – 8 notifications (BPOM, 2017, 2016; D.'Amico *et al.*, 2018; EURASFF, 2013). Further analysis of notification using published database by authorized institutions may be carried out to get better profile of the notified fishery-based foods.

Chloramphenicol and veterinary drug residue, poisonous and filth, and pathogenic bacteria dominated as the cause of notification in fishery based fresh food. Chloramphenicol is prohibited to be added in animals as food ingredient in many countries, because of possibility causing cancer and aplastic anemia in humans (Berendsen *et al*., 2010). Veterinary drugs commonly used to treat and to prevent animal disease in aquaculture. However, imprudent used of these drugs may contribute to antimicrobial resistence of pathogenic microorganism (Economou and Gousia, 2015). Food authorities have urged prudent use of veterinary drugs as a prevention step from antimicrobial resistence. Food refusals due to chloramphenicols and veterinary drug residues are also reported in elsewhere. Rosabel (2018) reported that 202 refusal cases of crab producs was due to these chemicals during 2010 – 2017. Rahmawaty *et al*. (2014) also reported the number of seafood refusal due to chloramphenicol, as many as 29 cases in 2010 – 2012. Food is considered adulterated if there are poisonous ingredient, prohibited colorants and filth, according to The US

Food, Drug, and Cosmetic Act (Bovay, 2016). Filth is defined as common sense, any materials supposed not to be in the food, such as bugs, parasites, metal shards, and glass pieces (USFDA, 2013).

Pathogenic bacteria were another hazard not many reported as the cause of notifications. In this study, four references reported notifications due to these bacteria, ranging from only 1 – 14 notifications in 2009 – 2019 (BPOM, 2017, 2016; EURASFF, 2013; Fahmi *et al.*, 2015). On the other hands, several studies reported numbers of notification were caused by this hazard. Rosabel (2018) reported that the number of refusals for food from fishery product due pathogenic microorganisms may reach 706 cases in 2010 – 2017. Rahmawaty *et al.* (2014) also reported 534 refusal cases of foods from fishery-based food due to the same hazards in 2010 – 2012. Both of them mentioned that pathogenic microorganisms were included as major cause of notification for this fishery food. The different results may be from different methodology used in this study. However, this study also resulted in several notifications with unidentified food commodities and hazards. Further study may be needed to reveal those unidentified notifications.

Herbs and spices are the most notified commodities in plant or animal based fresh food, as reported in both annual reports and research papers (Figure 4a). Enhancing flavor and bioactive compounds are the purpose of addition of herbs and spices in food (Banach *et al.*, 2016). One of popular foods in this commodity is nutmeg. Nutmeg is commonly consumed as powder mixed in the food. This study showed that mycotoxin dominated as the cause of refusals. Several literature also report that this food is contaminated with pathogens and mycotoxins (Banach *et al*., 2016). Eventough nutmeg consumption level is low in Indonesia, the presence of mycotoxin makes this food included as high-risk food (Wahidin and Purnhagen, 2018).

Several attempts have been made by Indonesian authorities to minimize contamination of mycotoxin, starting from improving handling practices until providing education for exporters (Kemtan, 2018). Importing countries also implement policy to control incoming nutmegs, for example EU issued Commission Implementing Regulation (EU) 2016/24 of 8 January 2016 on imposing special conditions governing the import of groundnuts from Brazil, Capsicum annuum from India and nutmeg from Indonesia and amending Regulations (EC) No. 669/2009 and (EU) No 884/2014. This regulation requires health certificate on importing nutmegs from Indonesia and checking for 20% of every consignment as sample (EU, 2016). Implementation of good practices in exporting countries and continuous education for exporters are necessary to minimize the chance of being notified by importing countries.

Dessicated coconut is one of the examples of minimally processed foods with highly competitive value for global trade. This commodity is considered as high potency of export, beside other coconut product, such as nata de coco, brown sugar, and coconut shell (Probowati *et al.*, 2011). Dessicated coconut has not only high nutrition value but also many usages. Fat and oil, carbohydrate and protein content from this commodity around 60%, 20% and 7% of total weight, respectively (DebMandal and Mandal, 2011). Therefore, dessicated coconut can be suitable ingredients for biscuits (Manley, 2000). However, notifications are also received for this commodity eventhough the numbers is less (Figure 5a). *Salmonella* spp., *Streptococcus* spp., and *Bacillus* spp. caused four notifications in 2013 and 2015 (BPOM, 2016, 2014). Whereas, food additives cause one notification of this food in 2016 (BPOM, 2017). The presence of pathogenic bacteria may be from contaminated water used for cleaning coconut prior to drying process whereas shulphur dioxide may be from fuel impurities (Manley, 2000). National authorities should pay attention to this commodity since Indonesia is one of the world suppliers of this product, together with Sri Lanka and Philipine (Manley, 2000).

One of the most reasons for notified processed food is the use of food additives. Chips and snacks are the commodities mostly notified in 2015 and 2016, with 13 and 3 notifications, respectively (Figure 6a). However, the notifications due to difference in food safety regulation between Indonesia and importing countries. There are additives, for example cyclamate and sulphite, which are not permitted to be used in food in importing countries eventhough those food additives are permitted with maximum limits in Indonesia (BPOM, 2017, 2016). Continous education to food producers and exporters on food safety regulation in importing countries is required for reducing the numbers of notification.

4.2 Recommendation for Risk Profiling

Several major notifications in Indonesian food export may be used as a starting point for the development of risk profiles. In fishery based fresh food products, this study results suggest that risk profile may be developed for crab, because of the number of notifications. This commodity was reported to contain chloramphenicol, veterinary drug residues,

poisonous and filth. However, other hazards may be present in this food. There is also possibility that other fishery products needed to be further explored for risk profiling. Fish, together with cephalopod, are commodities discussed by more references. Several other studies also reported fish commodity mostly received notifications (Rahmawaty *et al*., 2014; Rosabel, 2018).

Herbs and spices, including nutmeg, is one of main topics of notification in plant or animal based fresh food. Several efforts have been made however there are re-occured notifications. Profiling of risk factors in producing chains may be necessary for mitigating strategies. Eventhough having less notifications, dessicated coconut may also be prioritized for profiling. It is due to Indonesia is major supply for this food for the world (Manley, 2000).

5 CONCLUSION

Fishery based fresh food was the most receiving food safety notification during 2009 – 2019. Crustacea, especially crab, was the most notified, whereas fish and cephalopod were discussed in more references. The type of hazards most discussed in this food group were chloramphenicol and veterinary drug residue, filth, poisonous and pathogenic bacteria. Herbs and spices dominated in terms of notification in plant or animal based fresh food, with mycotoxin were the most reported hazards of concern. The number of notifications of minimally processed and processed food were lower than that of fresh food. Comprehensive risk profiles may be developed for fishery and plant or animal-based food. The profile may identify risk factors contributing to food safety notification as well as gaps for research needed. The profile may also be developed for minimally processed and processed food due to their contribution to Indonesian revenue. This study is limited to the figures reported in published literatures from selected scientific database. Expanding the scope of database and analyzing data directly from the dataset published by notifying authorities may be useful for determining unidentified foods and hazards

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