



Economically motivated food fraud and adulteration in China: An analysis based on 1553 media reports



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ABSTRACT

Based on 1553 media reports on food safety scandals and concerns, we conducted an aggregated analysis on economically motivated food frauds and adulterations in China. A systematic approach is used to analyze the country's food safety concern in terms of fraud type, implicated foods, adulterants, contaminants and abnormal conditions, and concerned food sources. This study indicates that economically motivated food fraud and adulteration was an emerging and serious food safety problem in China. The results of the study can be used not only to analyze food safety risks but also to prioritize target areas for food policy-making and enforcement of food safety regulation.

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1. Introduction

With human unawareness and negligence, microbiological, chemical and physical hazards can accidentally enter our foods, causing foodborne illnesses and deaths. While accidental food contamination of these hazards has always been an issue of food safety, a growing concern is in the introduction of hazards by deliberate human actions known as food fraud or economically motivated adulteration (FF/EMA) (Everstine, Spink, & Kennedy, 2013; Moore, Spink, & Lipp, 2012; Tähtkääpää, Majjala, Korkeala, & Nevas, 2015). Recent notorious examples of FF/EMA that have drawn great attentions around the world include the 2008 incident of intentional tampering of infant milk formula with melamine in China (Guan et al., 2009; Qiao, Guo, & Klein, 2012; Xiu & Klein, 2010) and the 2013 horsemeat substitution scandal in Europe (Bouzembrak & Marvin, 2016; Tähtkääpää et al., 2015). Therefore, analyzing, communicating and managing risks from FF/EMA have become important tasks for food regulators and researchers in the interests of consumer protection and food safety. In order to better understand FF/EMA, several databases such as the EMA food fraud database, the United States Pharmacopeial Convention (USP) food fraud database, and the Rapid Alert System for Food and Feed (RASFF) have been created to document FF/EMA incidents

(Bouzembrak & Marvin, 2016; Everstine et al., 2013; Moore et al., 2012). Based on these databases, some scholars have tried to analyze the characteristics of FF/EMA and predict the expected food fraud type with notifications available (e.g., Everstine et al., 2013). Certainly, these studies have advanced our understanding of FF/EMA. However, only a limited number of cases were actually notified and documented in these databases (Bouzembrak & Marvin, 2016), suggesting further research is needed to better understand the extent of FF/EMA in countries around the world.

Though FF/EMA has long existed in human society (Spink & Moyer, 2011), today the increasingly prolonged and intricate food supply chain, often with mixed ingredients in processed foods, may create an environment in which fraudulent activities are easier to hide but difficult to detect (Everstine et al., 2013; Moore et al., 2012), resulting in new emergence of FF/EMA. This is especially true in China. For more than three decades, China has been experiencing rapid industrialization and urbanization, causing tremendous changes to its food supply chain. In 1978, the beginning of China's economic reform, more than 82% of the country's population lived in rural areas (Chinese Statistical Yearbook, 2015), and thus, China was largely an agricultural society. People consumed mostly raw, homemade, and less processed foods. Nevertheless, for the last three decades, as industrialization and urbanization accelerates, the proportion of the rural population has reduced to 45.23% (Chinese Statistical Yearbook, 2015). Modernization of China's food industry has resulted in increasing animal food production and growing capacity of food processing. People

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now consume much more processed and packaged foods, and often away from home (Liu, Wahl, Seale, & Bai, 2015; Waldron, Brown, & Longworth, 2010; Zhai et al., 2014; Zhang, Wu, Yao, Bai, & Xiong, 2014; Zhou, Zhang, & Xu, 2012). The fast transformation of China's food industry with massive food processing may increase the possibility for opportunistic behavior in food practices, resulting in emergence of FF/EMA in the country. In fact, the world's attention that has been given to FF/EMA is largely due to the uncovering of several high profile cases occurred inside China, for example, the 2008 *melamine*-contamination of baby milk powder causing six deaths and tenth of thousands of illnesses, the 2005 illegal use of carcinogenic red dye *Sudan Red 1* in chicken products, and the 2009 illegal use of *clenbuterol hydrochloride* in animal feed also causing many foodborne illnesses (Everstine et al., 2013; Jia & Jukes, 2013). To our knowledge, fraudulent activities in food practice in the country were found in many circumstances. Nevertheless, detailed analysis of FF/EMA in China has limited to a few high profile cases. Given the sheer size and ever changing food supply chain of the country, an aggregated analysis of FF/EMA in China can be important not only for Chinese consumers' food safety and protection, but also for consumers in the rest of the world. Therefore, the objective of this study is to provide a comprehensive analysis on FF/EMA in China. Based on 1,553 media reports, we have attempted to characterize the fraud type, implicated foods and locations, as well as the adulterants, contaminants and abnormal conditions identified in these reported incidents as described below.

2. Materials and methods

2.1. The source of data

Learning about food safety problems is a perplexing task because of the intricate nature of food safety incidents, in which, many food items, contaminants, sources, and environments are concerned. Generally, people pay more attention to food incidents involved with acute foodborne illnesses to which immediate medical attention is usually required. In China, mandatory reporting on severe cases by medical staff or further professional investigation by Chinese Center for Disease Control and Prevention can be filed to the government or published in academic journals (Xue & Zhang, 2013). However, underreporting of foodborne illnesses is common, especially when the adverse health effects are chronic or with minor symptoms (Soon, Singn, & Baines, 2011). This is particularly true in the case of food fraud or adulteration in which deliberate acts are designed to evade detection (Everstine et al., 2013). Consequentially, professional or academic reports may not include most incidents of food fraud and adulteration. Literature suggests that many food safety concerns and scandals in China were initially uncovered by the media reports rather than official surveillance (Peng, Li, Xia, Qi, & Li, 2015). Therefore, for FF/EMA, we consider Chinese media coverage as our data source. Our analysis is based on media reports of food scandals that occurred in Chinese mainland and Hong Kong (a special district nearby Shenzhen, Guangdong province) for the period of 2004–2014. A total of 2,534 reports on food safety related problems were manually scanned. After excluding those repetitive or cross-published coverage and reports on incidents caused by human negligence, a total of 1553 reports on intentional food fraud and adulteration are used for our analysis. Detailed information about the source of our data is outlined in Table 1.

2.2. Method and the classification of FF/EMA

Based on these reported incidents or scandals, we conducted a

systematic review. Our interest primarily lies in the following categories of information: regional distribution of recorded cases, food fraud type, food items involved, adulterants, contaminants or abnormal conditions involved, and implicated food source or locations. Since information on most of the categories is straightforward, we simply extract it for our analysis. For identifying food fraud type, to our best knowledge, there are several classifications available, including the USP food fraud database (Moore et al., 2012; USP, 2014), the EMA food fraud database (EMA, 2014), and the RASFF database (Bouzembrak & Marvin, 2016). The USP food fraud database has named 3 types of food fraud: *replacement, addition, and removal*; the RASFF database has listed 6 types of food fraud: *HC* (Improper, fraudulent, missing or absent health certificate), *illegal importation, tampering, CED* (Improper, expired, fraudulent or missing common entry document), *Expiration date, and Mislabeling*; and the EMA has classified 8 types of FF/EMA: *Intentional distribution of contaminated products, artificial enhancement, counterfeit, substitution, mislabeling, dilution, transshipment/origin masking, and theft and resale*. So far, there is no clear classification of FF/EMA by any Chinese source yet. Since the EMA database has defined the most types of FF/EMA and is inclusive of other classifications, this study uses it to categorize food fraud types for the reported cases in China. The description of food fraud type in the EMA database is listed in Table 2.

3. Results and discussion

3.1. Regional distribution of reported FF/EMA

Our result shows that a total of 1553 media reports of food scandals or incidents were actually all about economically motivated food fraud or adulteration. They occurred in 32 provinces or special districts in Mainland China and Hong Kong. The regional distribution of these cases is illustrated in Fig. 1, from which, one can see great regional variations for the reported cases. Regions like Guangdong, Beijing, Shandong, Zhejiang, Jiangsu had the highest numbers respectively, but places like Xinjiang, Qinghai, Ningxia, Inner Mongolia, and Yunnan had the lowest numbers correspondingly. It indicates a trend: regions with higher level of industrialization and urbanization had much higher number of cases, but less developed areas had the least number of cases in food fraud and adulteration.

3.2. Number of reported cases per type of FF/EMA

As mentioned in Section 2.2, we characterize food fraud types according to the EMA food fraud database. For those eight food fraud types described by the database (see Table 2), we have identified seven of them from the reported cases in our dataset and the number of cases for each type of food fraud or adulteration was accounted and listed in Table 3. While “artificial enhancement,” “counterfeit,” “substitution” and “dilution” mostly occurred in the procedure of food processing, “intentional distribution of contaminated products” and “mislabeling” was often involved in illegal food businesses. This can be further confirmed by the information in Table 5 (adulterants, contaminants or abnormal conditions) in Section 3.4 and Table 6 (implicated food source or location) in Section 3.5.

3.3. Foods involved in FF/EMA

In addition to identifying food fraud types, learning about the types of foods involved can be helpful to understanding the nature of fraudulent activities. Food items involved in fraud and adulteration are outlined in Table 4. Because some of these 1553 cases have

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