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Food integrity in China: Insights from the national food spot check data in 2016

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ABSTRACT

Food integrity is a major global public issue. China's food industry has demonstrated a sustained growth trend since the 1980s; however, the years between 1980 and 2012 witnessed a worrisome food integrity situation. Thankfully, in recent years, the situation is improving after the Chinese government's implementation of food safety regulations. In order to understand the current status of food integrity in China, this study analyzes the national food spot check data in 2016. The data covers almost all kinds of food in the market, and it reveals that overuse of food additives, microbial contamination and subpar food quality indicators are the top three factors limiting food integrity. Additionally, the paper discusses other challenges that affect food integrity in China, and we make suggestions for improving food integrity.

1. Introduction

The rapid growth of China's economy enhances the demands of many consumers, and ensuring that food is safe, of high quality and genuine is particularly important for every society. Incorporating the implications of food safety, food quality and food authenticity, the concept, food integrity, has been suggested (Aung & Chang, 2014; Hoorfar, Prugger, Butler, & Jordan, 2011). Food integrity is defined as ensuring that food which is offered for sale or sold is not only safe and of the nature and quality expected by the purchaser but also captures other aspects of food production, such as the way it has been sourced, procured and distributed and being honest about those elements to consumers (HM Government, 2014). But our present understanding of food integrity is mainly based on microbial and chemical food safety, authenticity of origin, fraud and quality (Hoorfar et al., 2011). So far, the term “food integrity” is not widely used, and it is also not a legal or formal Chinese government term.

Food integrity is a global public issue, and countries with highly concentrated population, such as China, have attracted continuous attention. However, the frequent outbreaks of food related scandals before 2012, such as the melamine milk scandal in 2008 (Pei et al., 2011), the ditch oil crime in 2011 (Song, Li, & Zhang, 2014) and the ractopamine incidents in 2011 (Zhang et al., 2012), made the weak food integrity situation in China evident.

In the last several years, the Chinese government has implemented a series of action plans aimed at ensuring food integrity, such as the promulgation, implementation and revision of the Food Safety Law, as well as the establishment of the State Council Food Safety Committee, the National Food Safety Risk Assessment Center and the China Food and Drug Administration (CFDA). However, the current food integrity status has not been well studied.

Some recent studies have tried to explore China's food safety problem through the analysis of incidents of acute foodborne illness (Xue & Zhang, 2013), soil heavy metal pollution (Zhang, Zhong, Liu, & Ouyang, 2015) or soil and water pollution (Lu et al., 2015). To the best of our knowledge, no report has tried to understand food integrity through spot check data from the CFDA, and these aggregated data should be helpful for food integrity status analysis and policy making. This current study presents a brief profile of food integrity in China through the analysis of national spot check data. Factors linked to food integrity are discussed. Afterward, the implications of this study and our suggestions are provided.

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2. Data source and methods

In this study, national spot check data in 2016 was collected from the national food spot check announcement in CFDA website (http://www.sfda.gov.cn/WS01/CL1698/) to present a profile of food integrity in China. The data source in each season gathered by CFDA was freely accessible as a file, covering the category of food, number of inspected samples, number of unqualified products, and reasons for identifying the products as unqualified ones. Some provincial spot check data were also accessible from the same CFDA website, but the data were not presented since information about unqualified products in most of provinces were missing or not sufficient. The present analysis focuses on the rate of failure of each kind of food in each season and the factors that affect food safety. Statistical analyses were performed with SPSS Statistics V20.0.

3. Results

3.1. National spot check

The general national spot check data in 2016 was categorized into four seasons (Table 1). As can be seen, a total of 1,499,903 samples were inspected and the up-to-standard percentage of food products was between 97.3% and 97.8%, varying slightly in different seasons ($P > 0.05$). The spot check data covered almost all kinds of food in the market, and the rates of failure for each kind of food in the four seasons were listed in Table 2. As can be seen, the average rate of failure for starch and starch products was the highest, followed by catering food, pastries, alcohol, and processed vegetable products. It is worth mentioning that the average rate of failure for processed dairy products was the lowest, which may have benefited from strict management after the melamine milk scandal. Additionally, the average rate of failure for infant formula was also very low. One of the reasons for this might lie in the low number of inspected samples. However, undoubtedly, infant formula has always been under strict supervision, especially after the Fuyang city, Anhui province substandard infant milk powder incident in 2003 (Chan & Lai, 2009).

Food can serve as a vehicle for foodborne illnesses. In different seasons, the rate of failure of certain foods varied. As can be seen in Table 2, in Seasons 3 and 4, the rate of failure of processed vegetable products, processed fruit products, processed bean products, and chilling drinks increased greatly ($P < 0.05$). The highest rate of failure for potatoes/puffed food and processed bee products occurred in Season 3, while the lowest rate of failure for catering food was detected in Season 1. It was remarkable that the numbers of inspected samples in Seasons 3 and 4 were far greater than those in Seasons 1 and 2, especially in Season 4, but the reason remained unknown.

3.2. Factors that affect food integrity

The factors causing unqualified products and the percentages of all the factors were listed in Table 3. As can be seen, seven factors, including microorganisms, chemical contamination and illegal food additives, were the key factors affecting food integrity, which was in line with the conclusion of Lam (Lam, Remais, Fung, Xu, & Sun, 2013).

In Season 1, the overuse of food additives accounted for 33.8% of the total factors of failure, and there were not significant differences in the four seasons ($P < 0.05$). It was notable that the overuse of food additives was the primary factor behind failures. The main reasons were violations of the provisions of the use of preservatives in order to extend the shelf life of the product; illegal use of sweeteners to improve the taste of products; illegal use of colorants to modify product appearance, illegal use of sulfite bleaching treatment in the production process; illegal use of stabilizers in order to prevent or delay normal food fading, oxidation, rancidity, turbidity and flavor changes; and misunderstanding of food safety standards or poor technology levels.

Microbial contamination ranked as second in the factors causing unqualified products. In Season 3, microbial contamination caused 30.1% of the total failures, which was the highest among the four seasons, followed by Seasons 4, 2 and 1, in agreement with the variation in temperature, which has a great effect on the propagation of microorganisms. The main reasons for microbial contamination were poor management of sanitary conditions during production, storage, and transportation of raw materials; not strictly following the requirements of production, poor processing environments, unclean production tools, unsatisfactory disinfection equipment and poor personal health management; poor packaging sealing; and substandard storage conditions during production, circulation and sale.

Problems of poor food quality indicators ranked as the third leading cause of failures. In Season 1, it accounted for 21.1% of the total factors of failure, and such problems were found in 29 provinces. The main reason was poor management during the production, storage and transportation process of raw materials. For example, the temperature and time were not well managed during production, storage or transportation of meat products, leading to high acid values.

Problematic pesticide residues were higher in Seasons 2 and 4 and were the fourth-leading cause of failures. The main reasons were: the misuse of pesticides during the cultivation and breeding process; not strictly abiding by the provisions of the withdrawal period; and long-term non-standard use, leading to environmental pollution and accumulation that thus led to pesticides in the product.

Contamination by metal elements, detection of non-food substances and mycotoxins contamination were also key cause of failures. The main reasons for metal elements contamination were that the water and soil of some areas had heavy metal pollution, which entered the food chain through planting and breeding; poor management of raw materials; and migration of equipment metal elements to food during the production process. For non-food substances, the main reasons were the producers' plans to change the appearance, taste, efficacy and other specific effects of the product; and migration of non-food substances into food during production, processing, transportation and storage. The main reasons for mycotoxins contamination were: fungal contamination during cultivation, harvesting, transportation and storage process of food raw materials; and improper control of the production

Table 1
General national food spot check data in 2016.

Season	Number of inspected samples	Number of unqualified samples	Up-to-standard rate (%)
1	198961	5344	97.3
2	191672	4690	97.6
3	370298	9593	97.4
4	738972	16489	97.8