



This is a repository copy of *Consumer anxieties about food grain safety in China*.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/106486/>

Version: Accepted Version

Article:

Zhu, H., Jackson, P.A. orcid.org/0000-0002-3654-1891 and Wang, W. (2017) Consumer anxieties about food grain safety in China. *Food Control*, 73, Part B. pp. 1256-1264. ISSN 1873-7129

<https://doi.org/10.1016/j.foodcont.2016.10.045>

Article available under the terms of the CC-BY-NC-ND licence
(<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Reuse

This article is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) licence. This licence only allows you to download this work and share it with others as long as you credit the authors, but you can't change the article in any way or use it commercially. More information and the full terms of the licence here: <https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>

Consumer anxieties about food grain safety in China

Accepted for publication in *Food Control*, 22 October 2016

<http://dx.doi.org/10.1016/j.foodcontrol.2016.10.045>

Huying Zhu^{1,2}, Peter Jackson³, Wentao Wang²

1. Business School, Xiangtan University, Hunan Xiangtan, 411105, China

2. School of Economics and Management, Hunan University of Science and Technology, Hunan Xiangtan, 411201, China

3. Department of Geography, University of Sheffield, Sheffield S10 2TN, UK

Abstract: China has a long history of eating staple plant foods which are mainly derived from food grains, especially rice and wheat. Food grain safety has been a worrying challenge on health and nutrition grounds in China, although evidence clearly suggests that expanding agricultural production is linked to reducing undernourishment. The focus of this study is to investigate consumers' anxieties about food grain safety in China. The nature and extent of consumer anxieties about grain safety, the cause of these anxieties, and possible ways to relieve anxiety are empirically analyzed. Data were collected using semi-structured interviews with 142 grain consumers in 29 provinces of China, in both rural and urban areas, during 2016. The results show that consumers are worried about the production and processing safety of food grains and genetically modified cereals and that the causes of anxiety are varied. Anxiety is amplified by social media reports of food scandals, polluted ecological environments, the high incidence of food-related chronic diseases and cancer, concerns about food system governance and lack of knowledge and ability to identify grain quality. Consumers seek to relieve their anxiety by identifying grain quality themselves, choosing foreign grains and paying close attention to reports about unsafe food. These findings have important implications for future programs aimed at improving consumer confidence about grain safety.

Keywords: Food grain; Food safety; Consumer anxiety; Semi-structured interviews; China

1. Introduction

Food grains are a staple plant food used for human consumption. Since ancient times, Chinese people have eaten food grains as an inexpensive and readily available food that supplies one or more of the three organic macronutrients needed for survival and health: carbohydrates, proteins, and fats. Humans get almost half of their food energy from grain. Food grain is defined by the Food and Agriculture Organization (FAO) as cereals including wheat, beans, rice and coarse grains, and other grains. In China, grain is called *liáng shi*, mainly including edible rice and wheat, beans and potatoes and other raw grain and grain products. Rice and wheat have long been a main staple food for Chinese

people (Li et al., 2012), like potatoes and bread for British and American consumers. China is one of the earliest rice cultivation countries in the world. According to archaeological evidence from ruins in Hemudu, around 5000 BC, rice was already being cultivated in the Yangtze River Basin. Wheat cultivation has a history of 7,000 years, which is confirmed by archaeological discoveries in several provinces in China.

Food grain is of great significance in China where its consumption accounts for 30 percent of total grain consumption (Xiong Zhiqiang, 2012). China's population is anticipated to peak at 1.4 billion in 2025 and the Chinese government has been making a variety of policies to meet the demand for food grain. For more than three decades, China has dramatically increased grain production and achieved the first Millennium Development Goal, mainly through adopting the rural household contract responsibility system and the Green Revolution. For most Chinese people, grains are no longer thought of simply as food for solving hunger, but for meeting healthy food preferences. However, more and more safety issues are being found in the production of grain. In addition to this, the fast transformation of China's grain processing industry may increase the possibility for opportunistic behaviour in grain practices, resulting in the emergence of grain adulteration in China. For example, two growing issues are illegal additives and contamination of the food grain supply by toxic industrial waste (Lam et al., 2013).

In recent years, more and more scandals concerning food grains have been revealed by the media in China. These scandals, including adulteration, microbial contamination, excessive pesticide residues and additives, have raised consumers' anxieties about food grain safety. For example, the Cadmium rice event in 2013, uncovered by the Guangzhou Food and Drug Administration, induced extreme panic among southern residents (Zong He, 2013). Similarly, the rice adulteration event in Wuchang city of Heilongjiang province in 2015 undermined consumer confidence in the northeast rice brand *daohuaxiang*, and caused 200 rice plants to go out of business (Cui Xiaolin, 2010). Analyzing, discussing and managing grain consumption safety risks have therefore become important tasks for food regulators and researchers in the interests of consumer protection and food safety. The media (e.g. Xinhua News Agency) investigated the causes, influences and results of these scandals in 2013. Moreover, some scholars in China have investigated the cadmium contamination of rice and assessed its potential health risks (Ke et al. 2015), tried to analyze governmental responsibility for the scandals (Li, 2013), and proposed some measures to improve the expected control systems of grain safety (Mao XueFei et al. 2013). Certainly, these studies have advanced our understanding of grain consumption safety. However, only a limited number of cases were actually reported. For example, grain-based food items involved in fraud and adulteration account for less than 23percent of 1553 food cases (Zhang & Xue, 2016). But a lack of reports does not mean that few events happen. In fact, it could be said that underreporting of unsafe grain consumption incidents is common, especially when the adverse health effects of eating unsafe grains are chronic or with minor symptoms. So, further research is needed to better understand food grain safety from a consumer perspective in countries around the world.

Consumer anxiety has been understood in various ways in the literature. In contemporary English usage, anxiety is a physically embodied state involving mental and emotional distress, combined with a more diffuse sense of uneasiness about a coming event (Jackson, 2015). But some researchers such as Hunt (1999) and Jackson & Everts (2010) argue that anxiety has social as well as personal significance insofar as it is a shared experience that results in some discernible action by significant numbers of people, and anxiety may affect social entities such as organisations and governments whether or not particular individuals are psychologically troubled. Following their views, we argue

that anxiety is not restricted to personal psychology, but should also be understood as a social phenomenon. Previous studies of consumer anxiety about food have focused mainly on specific events such as the contamination of infant formula in China (Gong & Jackson, 2012). Less attention has been paid to food grains. In addition, some research about grain consumption preference and demand attributes has been conducted (Unnevehr, 1986), and attention to grain safety has been rising. For example, urban consumers in West Africa who regarded domestic rice to be of poor quality, have developed a marked preference for imported rice and associated purchasing and eating habits (Rutsaert et al., 2013; Naseem et al., 2013). Although several studies have analysed Chinese consumers' anxiety about specific foods, a detailed analysis of anxiety about grain safety has been limited to a few notable incidents by the media and scholars (e.g. Qiao et al. 2010; Zhong & Yi, 2010). There has been little or no specialized research on consumer anxiety about grain safety. Therefore, the purpose of this study is to provide a holistic analysis of consumer anxieties about food grain safety in China. Based on in-depth interviews with 142 consumers from 29 provinces on the Chinese mainland (all except Tibet and Qinghai Provinces), a survey was conducted with open- and closed- questions. The results are reported in statistical form (in Tables and diagrams) and via qualitative analysis (interview extracts). A copy of the interview schedule is available on request from the authors.

2. Methodology

2.1. Participants

Participants were recruited from the interviewers' hometown or neighbourhood. **Thirty-two interviewers** were drawn from universities in China from 29 provinces. Before interview, they had two weeks training on the design and administration of the interview questions. The participants are consumers of different socio-economic background including urban and rural residents of different ages and educational backgrounds. They were chosen because of their responsibility for 'managing' family grains. Participants were recruited during family reunions, at friends' parties, at residents' homes and in neighbourhood parks.

2.2. Interviews

Interviews were conducted between January and March 2016. Each interview lasted between thirty and eighty minutes, with two to six interviewees from each province. Rather than focusing exclusively on grain consumption, we asked open-ended questions about our respondents' staple food consumption experiences, their decision to buy domestic or foreign grain, and their practices and perceptions of food grain safety now and in the past. Our research examines consumer anxieties towards grain consumption, exploring the social and cultural underpinnings of their grain safety concerns, wider economic and political issues, cultural norms, regional differences and social support.

The project received ethical approval from the University of Sheffield in January 2016. Travel reimbursements were made at the end of each session with the help of a (locally-recruited, female, Mandarin-speaking) research assistant. Groups were audio and video taped, transcribed in full, translated from Chinese to English and coded using N.Vivo8 (a qualitative analysis software package). We acknowledge that our research is qualitative in nature, focusing on grain consumption safety issues from the perspective of a relatively small number of consumers from all over China. This research is exploratory in nature, given the relatively small sample size. Further research is needed to establish broader consumer trends and to explore the perspectives of those involved in food production, marketing and regulation.

3. Results and Discussion

3.1. Participant profiles

Demographic information about the participants is listed in Table 1. Half of the participants lived in cities, the other half in the countryside. This ratio is different from data from the National Bureau of Statistics of the People's Republic of China, which showed that 56% of the population lived in urban areas and 42% in rural areas in 2015 (National Bureau of Statistics of the People's Republic of China, 2016). This is the main difference between government data and our survey, where some of the 'rural' participants had been born in the countryside but worked or studied in cities. As is common in China, the main division of labour sees decision-making beyond the household as men's responsibility, while women generally have responsibility for managing family food consumption including grains. This model is gradually changing, but is still the mainstream model of Chinese family life. This is reflected in our interviews where 23% of participants are men and 77% are woman. Table 1 demonstrates the age range of participants (from 22 to 84-years-old) who manage the household consumption of grains. Participants were divided into low (30%), middle (47%) and high (23%) levels of education according to years of schooling. Most households had 3-4 members, because China is now implementing a two-child policy, replacing the one-child policy in the past. In addition, to a large extent, household size is decided by whether elderly relatives lived with their children. When older people live alone, the household is smaller with 1-2 members. Other households are larger with 5-8 members. Most survey respondents did not plant grains - only 44 consumers from rural areas reported that they grew their own.

Table 1: Profile of the participants.

Region	Gender (female=F, male=M)	Age range(in years)	Education level level=L(Low) level=M(Middle) level=H(High)	Household size	Residents R=Rural U=Urban	Main consumed grains	Whether plant grains Y=yes, N=no
Xinjiang	F=2&M=1	36-71	L=1&M=2	2-5	R=1&U=2	Wheat & rice	N=3
Ningxia	F=3	42-60	M=3	4	R=3	Wheat	Y=3
Inner Mongolia	F=3&M=3	26-69	L=2 M=3 H=1	4-8	R=2&U=4	Wheat & rice	Y=1&N=5
Gansu	F=6	23-73	L=3 H=3	1-5	R=3&U=3	Wheat& Buckwheat& rice	Y=1&N=5
Shaanxi	F=1&M=2	28-62	L=1 M=1 H=1	3-4	R=2&U=1	Wheat&corn&rice	Y=2&N=1
Heilongjiang	F=5	29-77	L=1 M=3 H=1	1-5	R=2&U=3	Rice & wheat	Y=1&N=4
Jilin	F=6	40-76	L=3 M=3	4-6	R=3&U=3	Wheat&rice&corn	Y=3&N=3
Liaoning	F=4&M=1	42-70	L=2 M=1 H=2	2-6	R=3&U=2	Rice & wheat	Y=2&N=3
Hebei	F=6	22-71	L=3 M=2 H=1	3-6	R=3&U=3	Wheat & rice	Y=2&N=4
Tianjin	F=3	39-61	M=3	3-6	R=3	Wheat & rice	Y=2&N=1
Beijing	F=1&M=1	31-46	M=1&H=1	2-4	R=1&U=1	Wheat & rice	N=2
Shanxi	F=2&M=1	40-72	L=2&M=1	2-4	R=3	Wheat & corn	Y=3
Shandong	F=6	29-61	L=1 M=3 H=2	2-4	R=3&U=3	Wheat & corn	Y=2&N=4
Henan	F=2&M=4	22-68	M=4 H=2	2-6	R=3&U=3	Wheat & rice	Y=3&N=3
Anhui	F=4&M=2	29-78	L=3 M=2 H=1	2-4	R=3&U=3	Rice & wheat	Y=2&N=4
Hubei	F=5&M=2	22-77	L=1 M=3 H=3	3-5	R=3&U=3	Rice	N=7
Hunan	F=3&M=3	26-84	L=2 M=2 H=2	3-5	R=2&U=4	Rice	Y=2&N=4
Jiangxi	F=3&M=2	29-67	L=3 M=2	2-3	R=2&U=3	Rice	Y=2&N=3
Zhejiang	F=3	27-73	L=1 M=1 H=1	2-3	U=3	Rice	N=3
Shanghai	M=2	49-75	L=1 M=1	2-3	U=2	Rice	N=2
Jiangsu	F=3&M=2	28-74	L=1 M=2 H=2	3-5	R=2&U=3	Rice	Y=1&N=4
Fujian	F=4&M=1	40-60	L=3 M=2	2-7	R=3&U=3	Rice	Y=2&N=3
Guangdong	F=5	34-66	L=1 M=2 H=2	4-7	R=4&U=1	Rice	Y=1&N=4
Guangxi	F=6&M=1	30-70	L=1 M=5 H=1	2-7	R=3&U=4	Rice	Y=3&N=4
Chongqing	F=4&M=1	22-72	L=1 M=2 H=2	2-4	R=3&U=2	Rice	N=5

Guizhou	F=6	30-72	L=1 M=4 H=1	3-7	R=3&U=3	Rice	Y=1&N=5
Sichuan	F=4&M=2	23-77	L=3 M=3	2-4	R=3&U=3	Rice	Y=3&N=3
Yunnan	F=6	21-70	L=1 M=3 H=2	2-5	R=3&U=3	Rice	Y=1&N=5
Hainan	F=3&M=2	26-66	L=1 M=3 H=1	3-6	R=2&U=3	Rice	Y=1&N=4

Source: author's calculation.

3.2. Consumption of grains

3.2.1. Which grains do they buy?

Rice and wheat are the main staple foods in China. Southern consumers have a habit of eating rice, while northern consumers prefer foods made of wheat. This characteristic is well reflected in our interviews, as indicated in Table 1. Except for three provinces in the northeast of China, northern consumers' staple food is wheat. Corn and rice are also alternative foods for northern residents. For southerners, since ancient times, rice is their first choice of staple food, even though they sometimes eat some food made of meat and corn.

3.2.2. Where do they buy and why?

Convenience, choice and low price are the main factors influencing consumer decisions about where they bought grains. In our interviews, about 51% of consumers bought grains from supermarkets or general stores because of low price and more choice. According to Ms. Yang (48 years old, city resident) from Zunyi City of Guizhou province:

The quality of grains in supermarkets can be guaranteed, so I didn't worry about grain safety problems such as adulteration. Sometimes I can get a lower price because supermarkets often have discounts. In addition, there were more varieties of grains in some big supermarkets and I can have more choice of what to buy.

Some consumers (16%) choose grain stores because they are perceived to have better service and more variety of grains than supermarkets and general stores. As Ms. Song (36 years old, city resident) from Huhhot City of Inner Mongolia province explained:

The grain store was located in my neighbourhood and had more kinds of grains in it than in general stores; it was very convenient and had more choice for me. At the same time, I could get the same price as in the supermarket and an extra home delivery service, yet supermarkets didn't usually provide home delivery service. Home delivery service was very important for me because a bag of rice was too heavy to carry home by myself.

In addition, a few people get grains from their friends and relatives in rural areas. They think the grains by this approach are healthier and safer because they trust their friends and relatives and believe the grains are grown in a non-polluted or less polluted environment. According to Miss. Han (26 years old, rural resident) from Hainan province:

I bought rice from my relatives in rural areas, because my relatives always left the best rice for me, their rice was low price and of better quality, I had no worry about rice safety. Sometimes, the message about where rice of high quality was available from my friends in rural areas had an important impact on my decision about buying rice.

3.2.3. Consumer preferences

Our findings indicate that most respondents have multiple preferences. Around 44% (63/142) of respondents say they have a preference for a particular quality of grain which they appraise by production date, origin, brand, price and mouthfeel. Up to 66% of respondents report that they consider price when buying grains, but less than 15 % (21/142) have a price preference due to limited income or experience of poverty in the past. More than 34% of respondents (48/142) claim to focus on other factors besides price, such as grain mouthfeel, appearance, origin and variety. As Ms. Guo (46 years old, rural resident) in Changping District of Beijing City explained:

I am concerned about the brand of grain, not the price. I was picky about rice quality and chose Thailand rice, which has satisfactory appearance, no bacteria and mildew, and good rice flavour [judged by smell].

3.3. Consumer anxieties about food grain safety

3.3.1. Anxieties about grain production

Consumer anxieties about grain production are reflected in their perception of changing grain quality in recent decades. Several decades ago, the Chinese aggressively embraced a Green Revolution (Briggs, 2009) approach for increasing grain production and experienced a dramatic change of grain planting methods. Simultaneously, they suffered a deterioration of the planting environment and a decline in food quality as a result of the proliferation of pesticides and fertilizers. Official data listed in Figure 1 reveal that the use of pesticides and fertilizers has increased by more than 60% in the last two decades (Chinese Statistical Yearbook, 2014). In the context of the Green Revolution, our respondents, especially grain growers, feel that there are excessive pesticide residues in grains in China, due to more and more usage of pesticides. Our findings in Figure 2 show that 42% (60/142) of respondents underline how excessive pesticide residues lead to a decrease in grain safety and how the use of fertilizers reduces grain flavour. As a result, grain quality is perceived to have become worse over recent decades. But 33% (46/142) of respondents said there were more varieties to buy at higher quality because of advances in technology, while 11% (16/142) have a neutral attitude. The remainder have a very weak perception about changes in grain production and feel that there is no change of grain quality although more scandals about grain quality are reported currently than in the past. In addition to the proliferation of pesticides and fertilizers, respondents also think that the problem of heavy metals in grains is more serious than in the past. As Mr. He (29 years old, city resident) from Fuzhou City of Jiangxi province said:

I asked my relatives who planted grains whether more pesticides were used in this year. They answered yes, and mentioned another problem that their local government had introduced a number of factories, which produced a lot of emissions; they were worried that local water and land had been polluted, and heavy metals in grains had exceeded the standard there. After listening to this, I felt there was no safety about grains; the only things I could do were to build a stronger body to resist these dangers or to buy safer imported food.

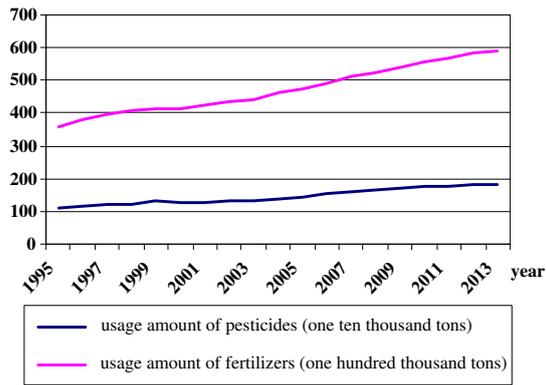


Fig.1 Usage of pesticides and fertilizers in China

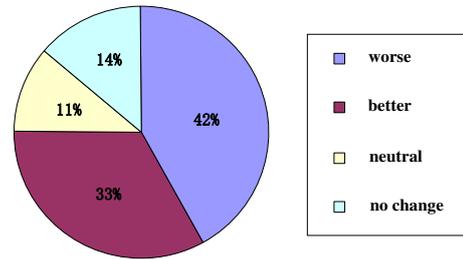


Fig.2 Consumer perception of change in grain quality

3.3.2. Anxieties about grain processing

Our interviews reveal consumers' anxiety about grain processing. In order to pursue increased sales and profits, grain processing enterprises in China use hidden or ulterior methods to cater to consumer demand for low price and high quality in the absence of effective regulation (Wei Pansheng, 2012). In our interviews, respondents use the words *dān xīn* (担心) or *hài pà* (害怕) instead of anxiety. Our findings in Figure 3 show that more than half of the participants are very anxious about nutritional decline as a result of using excessive additives for better appearance and more pleasing taste, adulteration and adding toxic substances for protecting against insect damage and mildew in grain processing. But most of them are unsure how to protect themselves from unsettling trends in grain processing (Roberts, 2013). As Mr. Li (66 years old, city resident) from Nanning city of Guangxi Province said,

When I was young, grain was more nutritious because rough processing methods were used in grain processing. But now it is common that further processing grain is applied. Further processing of grain met the demand for mouthfeel and improved gastrointestinal absorption of grain, but decreased nutrition of grains and may be harmful to health. As I couldn't process grain by myself and had no knowledge to distinguish the safety of processing, I could do nothing about it.

Mrs. Hou (49 years old, rural resident) from Jiamusi City of Heilongjiang province also *claimed that:*

Many processing plants used a Coating method¹ to get fortified rice, which rice was different from traditional processed rice. I was not sure whether it was safe, because the plants add other additives (such as brightener) to improve the appearance of rice, and these additives may be harmful to my health. I thought it was possible in the absence of government regulation.

In contrast, 49 participants thought that worries about grain processing safety were unnecessary. There are two reasons for this view. One reason is that some people from rural areas plant and process grains themselves and think grain processing is safe. Others claim they only accept current processing

¹ Coating takes clean rice (free rice washing) as a raw material and coats it with a variety of nutrient solutions so that the solution covers the surface of the rice. This process involves several coatings and different nutrient solutions are used in different coatings.

methods as a result of getting no information about grain processing. As Mr. Li (40 years old, rural resident) from Xinxiang City of Henan Province said,

My diet was wheat. Most of the wheat I ate was planted by me; I could take wheat to flour mills for directly converting wheat into flour. It was more convenient and safer for me than getting flour from the market. So I didn't worry about grain processing. If I didn't plant and process grain by myself, I also wasn't worried about it because I didn't know how to solve it.

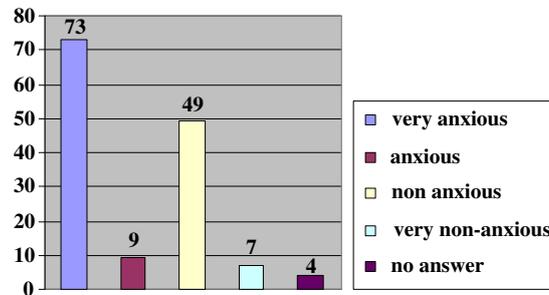


Fig.3 Anxiety about grain processing

3.3.3. Concerns about Genetically Modified (GM) food

Studies have shown that consumers' willingness to buy GM food is at a low level in China (Feng Liangxuan et al. 2012). Moreover, Fu Lili's (2016) report of a survey about public attitudes to GM technology by Science and Technology Daily and the Chinese Academy of Science and Technology for Development showed that China's public acceptance of GM in recent years has continued to decline rapidly. Over 70% of respondents (72.8) do not accept GM foods now compared to 65% ten years ago. This survey also showed that only 25.7% of respondents expressed clear support for the country to promote the cultivation of genetically modified rice, while 65.2% clearly expressed their opposition. He Guangxi, who led the survey, said:

There were two reasons that caused a reversal of public attitudes towards GM food. The first was that the public didn't understand GM food or misunderstood it [listened to rumours]; the second reason was that the public generally distrusted the information from government and the scientific community.

Our study reveals similar results. In our findings, most consumers in China, especially rural residents, have too little knowledge about GM food to appraise it. Most respondents have heard about GM soybeans and corn, but except for a few highly educated respondents, they have no knowledge about processes of food production by GM technology. Some respondents express confusion about GM food when controversial comments from government and media are broadcast. Table 2 shows how a lack of knowledge and a strong sense that GM grain and fruits and vegetables may be harmful to health (such as reducing fertility or being carcinogenic) prevents 51% of respondents from accepting GM food. As Mr. Liu (33 years old, city resident) from Xiangtan City of Hunan Province said:

I was doubtful about GM food. GM food generally shouldn't be recommended for human consumption in the absence of reliable tests. I knew most soybean oils were made of GM soybeans in China, and I had heard that pigs in my birthplace [a village] couldn't give birth after eating

genetically modified corn. Though I didn't confirm whether this was true, I was worried about the safety of GM food. After all, GM food was not natural, and it was reported that labelling of GM foods was required in some foreign countries.

Mr. Guo (68 years old, city resident) from Anyang City of Henan province disagreed about buying GM food. He said:

I personally could not distinguish whether GM food is good or bad, because I lacked the knowledge of GM food. I knew that some social media disputed the safety of GM food. To be on the safe side, I do not buy GM food.

In contrast, 6% of respondents supported the development of GM food in China. Mr. Yang (47 years old, City resident) from Huaibei City of Anhui Province said:

I supported GM food and thought it was the future direction of development in China. Because GM food used new technology and had more advantages than other food, the yield of GM food was higher and its inputs (such as pesticides) were less. Moreover, the Chinese government encouraged and tried to popularize GM technology by CCTV news. Currently, there was no evidence that GM food was unsafe. However, I lacked the knowledge of GM grain.

Since GM food technology is not well established, 13% of respondents hold neutral attitudes. As Ms. Zhang from Ji County of Tianjin City said:

I didn't know much about GM food. I thought GM food should not have much impact on health. After all, GM food was not yet common in China. The technology of GM food was still in the exploratory and development stage, it was not yet conclusive whether GM food had a bad impact on health. So it was not easy for me to eat GM food, but I didn't oppose it.

Table 2

Attitudes to GM food.

Attitudes	Respondent numbers	Reasons
Opposed	51%(73/142)	<ul style="list-style-type: none"> • Fear is generated by a lack of relevant knowledge about GM food; • GM food is considered to be harmful by media or friends; • GM food is not natural food; • Labelling of GM foods is required in some foreign countries; • Currently rising incidence of cancer and infertility is considered to relate to GM food.
Neutral	13%(18/142)	<ul style="list-style-type: none"> • Little knowledge about GM food; • Everything has its good and bad sides; • It is not yet conclusive whether GM food is bad for health.
Supported	6%(8/142)	<ul style="list-style-type: none"> • Advocated by government; • Encouraging technological innovation; • Thinking that GM food is safe.
Not evaluated	30%(43/142)	<ul style="list-style-type: none"> • No knowledge or interest in GM food.

Source: author's calculation.

3.4. The causes of consumer anxiety about food grain safety

3.4.1. Lack of knowledge

In our interviews, some respondents admitted that a lack of knowledge caused confusion about grain safety. They have a different understanding about grain nutrition, GM food, and grain safety from experts, because they lacked knowledge of grain nutrition. According to the survey from Martine De Bore (2005), most experts have little confidence in the public's understanding of food risk issues, their assessment of food risks, their ability to deal with scientific information and their food safety practices. Our survey (Table 2) also shows that about 79% of respondents express a lack of knowledge about GM food, and 48% of young respondents between 21-30 years old admitted they lacked knowledge and experience about grain safety.

In addition, we surveyed consumer perceptions of grain nutrition through the question 'do you know which grains are more nutritious?' The result is very different from expert opinion. In the past years, several epidemiological studies showed that coarse cereals were helpful in reducing several kinds of chronic diseases like cancers, cardiovascular diseases, type II diabetes and various gastrointestinal disorders (Kaur et al. 2014). But Figure 4 reveals that only 25% (35/142) of respondents think coarse grains are more nutritious, compared to wheat and rice because of its more simple processing. They miss the dietary habits of the past (Zhu, 2005) and have a consensus that contemporary low-coarse grain diets are likely to cause chronic diseases such as diabetes and heart disease. Twenty percent (29/142) of respondents who report a lack of nutritional knowledge about single grains, consider different grains have different nutritional value, and nutritional balance from different grains is more important than assessing the nutrition of single grains. But 46% respondents, mostly from rural areas, claim their favourite staple grains are more nutritious, while 9% (13/142) of respondents evaluate healthy grains (involving pollution-free, low-processed, low-chemical fertilizers and pesticides, non-genetically modified grains) as nutritious grains. The serious consequences of the Green Revolution, through the creation of abundance by breaking out of nature's limits and variabilities, aroused suspicion of grain quality and nutrition as explored in Vandana Shiva's (2016) book on the violence of the green revolution for third world agriculture and ecology.

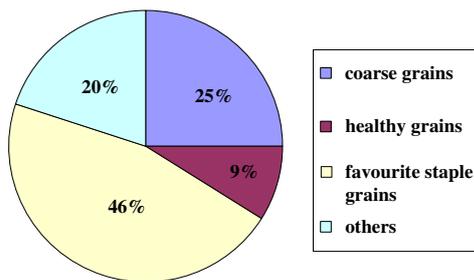


Fig.4 Opinion about which grains are most nutritious

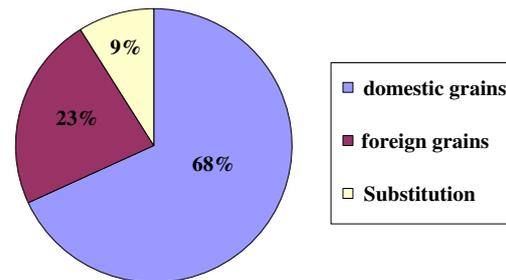


Fig.5 Choice of grain origins

3.4.2. Environmental deterioration

The deterioration of the growing fields is a very important reason affecting respondents' attitudes towards grain safety. From surveys about perceptions of changes to the planting environment, some respondents, especially rural residents, consider that the ecological environment has become worse over the last decade, and that there is a higher incidence of food-related chronic disease and cancer. The perception has been confirmed by other researchers. According to Lu et al. (2015), in some Chinese regions the long-term use of waste-water irrigation has caused serious agricultural land and

grain pollution, especially for heavy metals. Pesticide over-application and heavy metal pollution are potentially contributing to ‘cancer villages’ which appear to correlate strongly with the main grain producing areas. As Ms. Lian (47 years old, rural resident) from Qingyang City of Gansu Province said:

Over-application of pesticides and chemical fertilizers polluted the farmland and had increasingly negative effects on planting grain. When I was very young, grain was healthier and safer although there were fewer species of grain because farmers used manure to increase soil fertility instead of chemical fertilizers. Now, I have found the incidence of cancer was higher than in the past, this situation may be correlated with unsafe food, planted in polluted farmland. I watched some reports on TV about heavy metal contamination from middle and southern areas of China, and felt what we ate was more unsafe and the probability of getting cancer was higher.

3.4.3. Concerns about food system governance

Concerns about food system governance aggravate consumer anxieties about grains safety. Consumer confidence is undermined by the frequent disclosure of food scandals. Literature suggests that many food safety concerns and scandals in China were initially uncovered by the media rather than by official surveillance (Peng et al., 2015), with the result that consumers have a greater distrust of the government. We find that about 57% of respondents express their disappointment about food system governance in China. Disappointment focuses on the poor effectiveness of governance, less strict law enforcement and lack of prior monitoring and detection about unsafe grains. For most rural residents, it is difficult to understand the role of government in food system governance with many feeling that it is ignored in rural areas. Mrs. Wu (34 years old, rural resident) from Heyuan City of Guangdong Province told us:

I didn't know what government have done except giving me some subsidies to encourage planting; they never investigated what I had planted or cared whether my grains were safe.

Mrs. Li (67 years old, rural resident) from Fuzhou City of Jiangxi Province had similar views. She said:

I did not quite know what the government did in food system governance. Nobody regulated this matter even if I sold bad grains containing too much pesticide. The government should increase the intensity of supervision of unsafe grains and avoid these grains getting into markets.

City residents complained that food system governance is not so effective that food insecurity events are frequently disclosed. They feel personally powerless in preventing unsafe food because of a lack of relevant knowledge and they hope the government will ensure food safety by borrowing foreign experience in food system governance. As Mr. Hou (57 years old, city resident) from Fuzhou City of Fujian Province said:

Most of the time, there was a lack of supervision in advance in China. Our government did less until the events of food safety happened. Inefficient food system governance caused more and more scandals to be found. Sometimes, our suggestion for government was useless because of lack of effective communication mechanism.

3.4.4. False reports from social media

In China, consumers find it very difficult to confirm the truthfulness of news reports. Social media can fan the flames of food scandals or cause panic by manufacturing fake news in order to increase their web traffic. Zhang Zhi'an, dean of the College of Communication and Design in Zhongshan University, issued a "Research Report of Chinese Internet users' Cognition about Food Safety in 2015". The report estimated that between 2012 and 2014 over 15% of information about food safety incidents was false (Wang Lin, 2016). Xu Rujun, who is president of Economic Daily, declared at the media responsibility forum of the National Food Safety Awareness Week that the media have a great responsibility regarding the food safety field which is often the hardest hit by rumours (Li, 2016). The Annual Report on Development of New Media in China No.7 (2016), undertaken by the Institute of Journalism and disseminated by CASS and Social Science Academic Press, notes that over 60% of Internet users are suspicious about most of the rumours that appeared on wechat (a social media platform in China). The most common rumours focus on health, food and personal safety and up to 70% of Internet users are reported to believe it (Kan Feng, 2016). Some research shows that social media is often despised as a collective rumour mill during crises, which create distrust that may be difficult to counter among the public (Tanaka et al., 2013).

Our surveys also confirm this. As reported in section 3.3.3, the GM food report from social media had a great influence on Mr. Guo (68 years old, city resident) from Anyang City of Henan province, who suspected the report about GM food from social media, but preferred to believe it and chose not to buy GM food. In addition, most consumers in our interviews said that they choose to believe the negative reports about food safety, because they did not know how to identify the truth. As Mr. Li (33 years old, city resident) from Beijing City said:

Negative reports about food events were more than in the past. Many food scandals in China were initially uncovered by the media reports, some of which were rejected as rumours by government. Some media, driven by economic interests, made fake news or exaggerate events to cause the public panic. However, it was very difficult to identify the truth because the response from scientists or government was very slow and I didn't have experience and knowledge to assess it. Sometimes, I mistrusted the response from government because government didn't always represent the interests of the public. So I chose to believe the reports about food events in order to reduce the risks of unsafe food.

3.5. Reducing anxiety

3.5.1. Consumers' identification of grain quality

In our interviews, most experienced respondents used mixed approaches (observing, smelling and tasting) to judge grain quality. They observed physical attributes (impurities, breakage, colour, and grain shape), cooking attributes (ease of cooking, grain cohesion and swelling capacity) and the origin or brand of grains, smelt the aroma (before buying and after cooking), tasting boiled grains. Our results show that tasting grains was used by 64% of respondents, observing colour and shape was used by about 40% and observing the origin or brand was used by 31%. In addition, some respondents observed the change of water colour when they washed the grains.

As respondents (Mrs. Ding, 71 years old, city resident and Mr. Zhan, 45 years old, rural resident) from Tumxuk City of Xinjiang Province said:

[Mrs. Ding] I usually judged rice quality by observing color, the origin and tasting, a little musty, old rice looked a little black. Whiter rice tasted more delicious, but almost better nutritious rice had no pleasing colour, because it didn't damage the outer membrane.

[Mr. Zhan] I thought long grains from northeast areas had better quality in China. I checked the rate of impurities in rice and broken rice, and observed the production date of rice when I chose rice in the market, then judged the quality by tasting it after cooking.

We also found that young people had relatively less experience than middle-aged and older people in judging grain quality: 48% of young respondents between 21-30 years old reported that they lacked experience, and borrowed experiences from relatives and friends, or looked for information from the Internet or TV. As Mrs. Wu (27 years old, city resident) from Hangzhou City of Zhejiang Province said:

I didn't know how to judge the quality of food, and had no experience in it. My personal preference was Thai rice which 'tasted' more delicious. I learned some approaches from the television, for example I was told that adulterated rice (old rice re-processed or new rice added to old rice) had more broken rice, and the water may be oil slick if the rice was soaked in water.

3.5.2. Attitudes to domestic and foreign grains

Our findings show that education level has a great influence on consumer attitudes to grain origin. As illustrated in Figure 5, 68% of respondents, most from middle or low educated groups in rural areas, prefer to purchase domestic grains as staple food due to patriotism, or more confidence by more easily getting comprehensive information about domestic grains. They criticize the length of supply chains of foreign grains which bear a greater risk for purchase, such as non-fresh or GM grains that may be bought without prior knowledge. However, 23% of respondents, mostly from urban areas with higher education, felt that foreign grains are safer than domestic grains as a result of tighter regulation. As Mr. Huang from Shanghai City (49 years old, city resident) said, China has had a recent history of 'food scares', undermining consumer confidence and trust in food, and he preferred to purchase rice from Japan, South Korea, Thailand, and America because of better safety for an acceptable price.

3.5.3. Attention to unsafe food reports

Consumers' attention to unsafe food reports may not only reflect their anxieties about food safety, but also help consumers to avoid unsafe food. In our interviews, most respondents agree that there are more reports about economically motivated food safety events than in the past, and consumers are more anxious about unsafe food. In Table 3, 58% of respondents are very concerned about unsafe food events reported by TV, newspapers and the Internet, which covered a variety of unsafe food events, such as adulteration and unsafe environments of food production and processing. Their concerns increase with the birth of their first child (Qiao et al. 2012), with major diseases or death of family members or friends, or more life experiences of suffering unsafe food consumption. Fourteen percent of respondents are occasionally concerned about them through casual conversation or via social media, while 28% of respondents are not concerned about it. Existing research also shows that a growing concern is the introduction of hazards by deliberate human actions known as food fraud or economically motivated adulteration (Everstine et al, 2013; Moore et al., 2012; Tähkääpää et al.,

Table 3

Attention to unsafe food reports

Degree of concern	Respondent numbers	Source	Content
Very concerned	83	CCTV News channel and 315 programme, city channel and rural channel programme of local television stations, newspaper and Internet news.	<ul style="list-style-type: none"> • Adulteration of food (such as the illegal use of discarded animal parts in cooking oil, pork contained clenbuterol); • Poor and dirty production and processing environment; • Unsafe children's food (such as toxic milk and the illegal use of additional agents in children's snacks).
Occasionally concerned	20	Casual conversation or social media	
Not concerned	39	—	

Source: author's calculation.

2015; Zhang & Xue, 2016). In addition, when our survey respondents were asked about unsafe food reports, most said they know which grains are unsafe through reports about unsafe food events and thus to avoid them.

4. Conclusions

Anxieties about food grain safety in China are prominent and widespread. This was evident on analyzing the attitudes of 142 grain consumers in 29 provinces of China in 2016. In order to study consumer anxiety towards grain quality and safety we utilized semi-structured interviews. In general the results suggest that anxiety about food grains pervades the grain system encompassing production, processing and consumption, expressed through the mandarin words *dān xīn* (担心) or *hài pà* (害怕) in our interviews. The causes of anxiety are varied ranging from poor knowledge and inability to identify grain quality to high incidence of food-related chronic diseases and cancer, polluted ecological environments, inept government, social media fanning the flames of food scandals and causing panic by manufacturing fake news.

Rural respondents were less anxious about grain quality than those from cities. The main reason is that rural residents have more knowledge about local grain planting and processing than those who live in cities, especially those rural participants who plant grains for their families. Another reason is that less awareness and knowledge of health or nutrition distort rural residents' judgment of the quality of grain. For example, most rural respondents' answers in our interviews, especially the elderly, indicated that they have little knowledge about nutrition and GM food. But rural residents are also anxious about grain quality, because they suffer worsening pollution of water and land, and a proliferation of pesticides and fertilizers. Faced with this problem, there is little they could do about it, so they hope the government will solve it, although they do not know what the current government has done about it.

It is also worth noting that most respondents' attitudes to GM food resulted from negative reports about GM in social media, despite positive reports from official sources. It reflects the way that public confidence in information from official sources has been undermined by several major food scandals, which exposed that the government's regulation of risk before the event was not in place or neglected. Concerns about food system governance were also expressed. On the other hand, consumers hold cautious views about new technology resulting from a lack of relevant knowledge and because, from a

historical perspective, most of them have experienced the reform of agricultural technology and experienced the two sides of reforms such as the Green Revolution.

A more consistent finding was that respondents felt powerless about grain quality and safety, although they wanted to solve it by themselves. They had no equipment or scientific methods to judge grain quality, but they also did not get enough support from the government. They could only use their accumulated daily experience to judge food quality subjectively. Although they realize that good taste does not mean good quality, most of them prefer to purchase grains with good taste. In the meantime, price, appearance and mouthfeel instead of safety, are considered as the three most important aspects for consumers, even though they are anxious about food safety.

We conclude that anxieties about food grain safety in China are entangled with a variety of perceptions and attitudes: grain production, grain processing, GM food, changes in grain quality, and choice between domestic and foreign grains, unsafe food events, media reports and food system governance. While increasing animal food production and the consumption of convenience food has resulted in sharply rising rates of obesity and diabetes, Chinese people are gradually realizing that grain-based diets may be better for their health. But grain production is facing enormous challenges such as pollution as a result of China's urban-rural dual economic structure. In this context, anxieties about food grain safety will exist for a long time requiring further research in the future. Future research should aim to clarify the factors that cause anxieties about food grain safety and how best to reduce anxieties. Further research on anxieties about food grain safety in China may also shed light on the common perception of China's uniqueness in comparison with food related anxieties elsewhere in the world.

Acknowledgments

This research was supported by Major Project of the National Social Science Fund of China (NSSF, No.12&ZD052) and Philosophy and Social Science Fund Project of Hunan Province (PSSF, No.13YBA143) in China. We would like to thank our participants who made time for our research during their very busy schedules. Finally, we wish to thank our reviewers and editors for their very constructive and helpful suggestions.

References

- Briggs, J. (2009). Green Revolution, in R. Kitchin & N.J. Thrift eds. *International Encyclopedia of Human Geography*, Amsterdam, Elsevier, 634-638.
- Chinese Statistical Yearbook (2014). Available at: <http://www.stats.gov.cn/tjsj/ndsj/2014/indexeh.htm>
- Cui Xiaolin. (2010). *Who is vying for Wuchang rice? Industry puzzles in the area of origin after 'adulterated door'*. China Economic Weekly: <http://www.chinanews.com/life/2010/07-27/2428438.shtml>.
- De Boer, M., McCarthy, M., Brennan, M., Kelly, A.L. & Ritson, C. (2015). Public understanding of food risk issues and food risk messages on the Island of Ireland: the views of food safety experts. *Journal of Food Safety*, 25, 241–265.
- Everstine, K., Spink, J. & Kennedy, S. (2013). Economically motivated adulteration (EMA) of food: common characteristics of EMA incidents. *Journal of Food Protection*, 76, 723-735.
- Feng Liangxuan, Qin Zhenhong, Zhou Hui & Laing Fanli. (2012). Empirical research on consumers' willingness to buy GM food: a case study in Chongqing City of China. *Journal of Nanjing Agricultural University (Social Science)*, 12,1-6.
- Fu Lili. (2016). *72.8% of respondents do not accept now when 65% of respondents accepted GM foods ten years ago*: <http://news.sohu.com/20160516/n449667436.shtml>.
- Gong, Q. & Jackson, P. (2012). Consuming anxiety? Parenting practices in China after the infant formula scandal. *Food, Culture & Society*, 15, 557-578.
- Hunt A, (1999). Anxiety and social explanation: some anxieties about anxiety. *Journal of Social History*, 32, 509-528.
- Jackson, P. (2015). *Anxious appetites: food and consumer culture*. London: Bloomsbury.
- Jackson, P. & Everts, J. (2010). Anxiety as social practice. *Environment and Planning A*, 42, 2791-2806.
- Kan Feng. (2016). *Report of CASS said that most rumors appeared in WeChat and up to 70% people preferred to believe it*: <http://news.sohu.com/20160622/n455640665.shtml>.
- Kaur, K.D., Jha, A., Sabikhi, & Singh, A.K. (2014). Significance of coarse cereals in health and nutrition: a review. *Journal of Food Science Technology*, 51, 1429–1441.
- Ke, S., Cheng, X., Zhang, N. et al. (2015). Cadmium contamination of rice from various polluted areas of China and its potential risks to human health. *Environmental Monitoring and Assessment* 187, 408.
- Lam, H.M., Remais, J., Fung, M.C., Xu, L. & Sun, S.S.M. (2013). Food supply and food safety issues in China. *The Lancet*. 381, 2044–2053.
- Li, F. (2016). *Xue Rujun said: mainstream media should take responsibility to resist the rumor of food safety*. China Economy Online, http://www.ce.cn/cysc/sp/info/201606/23/t20160623_1312999.shtml.

- Li, G.Q. (2013). On Chinese supervision of grain quality safety from 'cadmium rice' event in Guangdong. *Journal of Henan University of Technology (Social Science)*, 9, 20-23.
- Li, Z.Q., Wu, J.Z. & Wang, D. (2012). Change analysis and demand forecast of grain consumption in China. *Food and Nutrition in China*, 3, 38-42.
- Lu, Y., Song, S., Wang, R. et al. (2015). Impacts of soil and water pollution on food safety and health risks in China. *Environment International*, 77, 5–15.
- Mao Xuefei, Tang Xiaoyan, Wang Yan & Wang Min. (2013). Sources and control measures about heavy metal pollution prevention of crop products from "cadmium rice" event. *Quality and Safety of Agro-Products*, 2013, 4,57-59.
- Moore, J.C., Spink, J., & Lipp, M. (2012). Development and applications of a database of food ingredient fraud and economically motivated adulteration from 1980 to 2010. *Journal of Food Science*, 77, 118-116.
- Naseem, A., Mhlanga, S., Diagne, A., Adegbola, P.Y. & Midingoyi, G.S.K. (2013). Economic analysis of consumer choices based on rice attributes in the food markets of West Africa - the case of Benin. *Food Security*, 5, 575-589.
- National Bureau of Statistics of the People's Republic of China (2016): 2015 National Economic and Social Development Statistics Bulletin in China, 2015:
http://www.stats.gov.cn/tjsj/zxfb/201602/t20160229_1323991.html.
- Peng, Y., Li, J., Xia, H., Qi, S., & Li, J. (2015). The effects of food safety issues released by we media on consumers' awareness and purchasing behavior: a case study in China. *Food Policy*, 51, 44-52.
- Qiao, G., Guo, T. & Klein, K. (2010). Melamine in Chinese milk products and consumer confidence. *Appetite*. 55, 190–195.
- Qiao, G., Guo, T., & Klein, K. (2012). Melamine and other food safety and health scares in China: comparing households with and without young children. *Food Control*, 26, 378-386.
- Roberts, W. (2013). *The no-nonsense guide to world food*. Oxford: New Internationalist Publications.
- Rutsaert, P., Demont, M., & Verbeke, W. (2013). Consumer preference for rice in Africa. In M. C. S. Wopereis, D. Johnson, N. Ahmadi, E. Tollens, & A. Jalloh (Eds.), *Realizing Africa's rice promise*. Wallingford: CABI Publishing, 294-302).
- Shiva, V. (2016) *The violence of the green revolution: Third world agriculture, ecology, and politics*. Lexington, KY: University Press of Kentucky.
- Tähkäpää, S., Maijala, R., Korkeala, H., & Nevas, M. (2015). Patterns of food frauds and adulterations reported in the EU rapid alert systems for food and feed and in Finland. *Food Control*, 47, 175-184.
- Tanaka, Y., Sakamoto, Y., & Matsuka, T. (2013). Toward a social-technological system that inactivates false rumors through the critical thinking of crowds, in 46th Hawaii International Conference on System Sciences, 649-658.

- Unnevehr, L.J. (1986). Consumer demand for rice grain quality and returns to research for Quality Improvement in Southeast Asia. *American Journal of Agricultural Economics*, 68, 634-641.
- Wang Lin. (2016). *Why food rumor was spread madly in networking*. China Youth Daily (June 18, 2016).
- Wei Pansheng. (2012). *Moldy rice was whitened and brightened after processing*. CCTV News on July 4: <http://news.cntv.cn/20120704/111853.shtml>.
- Xinhua News Agency. (2013). *How do we do when rice containing cadmium has been coming?* Available from <http://www.xinhuanet.com/gzgdml/>.
- Xiong Zhiqiang. (2012). *What does it mean about the per capita food consumption approaching 500 kg?* China Land and Resources News. Available from: http://www.mlr.gov.cn/xwdt/xwpl/201202/t20120221_1065790.htm.
- Zhang, W. & Xue, J. (2016). Economically motivated food fraud and adulteration in China: An analysis based on 1553 media reports. *Food Control*, 67, 192-198.
- Zhong, F. & Yi, X. (2010). The consumers' degree of concern and differences of purchase behavior on food safety: a case study in Nanjing vegetable market. *Journal of Nanjing Agricultural University (Social Science)*, 10, 19-26.
- Zhu, L. (2005). *You can't eat too much even though whole grains is good*: http://news.xinhuanet.com/health/2005-01/11/content_2443648.htm.
- Zong, H. (2013). *It is very difficult to forget 'shadow' from cadmium rice in rice market of Guangzhou Province*. Shenzhen Special Zone Daily (May 23, 2013).