

## **Food Safety and Consumer Behavior in India and Japan: Comparative Literature Review**

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### **1. Introduction**

Food safety has become an increasingly important issue due to various factors such as globalization of the food supply and public demand for health protection. Recently, Japanese citizens have had great concerns regarding food safety issues.

Reflecting this situation in Japan, many studies on food safety have been conducted (Sawada, 2004). However, most only cover cases in Japan, and fewer studies have been conducted from a perspective of international comparison<sup>1</sup>. Nakashima (2005) compared food safety regulation systems between Japan and developed countries in the EU. Few studies have compared developed countries and developing countries. As the WHO (2002) points out, building capacity in food safety is essential especially in developing countries. The poor are the most susceptible to ill health. Foodborne disease has a significant impact not only on health but also on development. Moreover, globalization of the food trade and development of international food standards have raised awareness of the interaction between food safety and export potential for developing countries. Likewise, an increasing emphasis on quality and safety attributes can create social benefits; grading and standards systems could reduce the negative externalities of poor quality and unsafe food products. From this viewpoint, comparing studies in developing countries and developed countries is useful for identifying future research topics.

Furthermore, since receiving consumer concerns about food safety, many universities have engaged in research and education on food safety. In August 2010, the Department of Agricultural and Rural Management, Tamil Nadu Agricultural University, examined food safety and quality impacts on the buying behavior of consumers in collaboration with Ghent University, Belgium, under the EU FP7 project VEG-i-TRADE. This project took the focus on food safety through an intense multidisciplinary mode. In Japan, Kobe University established the Research Center for Food Safety and Security in April 2006,

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and in February 2007, the University of Tokyo opened the Research Center for Food Safety. In April 2015, Tohoku University launched the International Education and Research Center for Food and Agricultural Immunology (CFAI). This Center is performing research focused on food and agricultural immunology, while other university institutions are conducting research on general food safety. Agricultural immunology is a general term for new technologies that realize healthy fostering of agricultural and livestock products by strengthening immune functions. To disseminate such new technologies both in developing and developed countries, social scientific research is needed.

The aim of this study is to sort out an issue for future studies on food safety and the application of new technologies both in developing and developed countries. For this purpose, we review the literature of food safety and consumer behavior. To explore the possibility of new technology application in both developed and emerging countries, we examine the current situation and prior studies in India and Japan. A review of studies that discussed food safety and consumers was performed to address the following questions: (I) What kind of food commodities and risks are discussed so far? (II) How are the food safety issues analyzed? (III) Are there any country-specific tendencies in India and Japan?

The contents of this study are as follows: we describe the methodology in section 2; in section 3, we overview food safety-related accidents and lows; comparative literature reviews are shown in section 4; and we conclude in section 5.

## **2. Methodology**

First, we summarize the history of food security in both countries from the 1930s to the present. Within this period, we confirm the incidents related to food safety and the established laws for both India and Japan.

Then we compare literature from the viewpoint of product, food safety risk, and analytical method. For the literature of India, search engines like Google Scholar and databases like ProQuest, EBSCO, and CERA are used to find and select relevant papers. For the case of Japan, we used search engine Cinii and Google Scholar to specify food safety literature. We used keywords such as “food,” “safety,” and “consumers” for the search. In the beginning, we classify prior research on the target goods, then classify them from the viewpoint of the method and the target food risk, and compare the previous studies of both countries.

## **3. Timeline of Food Safety Issues**

Here we summarize major events related to food safety issues. Table 1 shows major accidents and government regulations on food security in India and Japan.

The left-hand side of Table 1 shows major incidents and regulations on food safety in India. Various orders were passed at several time intervals to monitor the safety and quality of foods as per the sanitary and phytosanitary requirements of the country. Foods that are consumed by

the public should comply with local regulations and laws to gain access to the market. It all started with the Agricultural Produce (Grading and Marketing) Act of 1937, which standardized the grading for agricultural and allied goods. The AGMARK Quality certification was later introduced through this act as a regulatory measure for ensuring quality and purity of products to compete in world trade. The Bureau of Indian Standards Act is also a milestone in the regulatory framework of the country. It promoted the harmonious development of standardization, marking and quality certification. In 2006, the Food Safety and Standards Act was passed.

Table 1. Timeline of events related to food safety

Year	India	Japan
1937	Agricultural Produce (Grading and Marketing) Act	
1947	Vegetable Oil Products (Control) Order	Food Sanitation Act
1950		JAS Law and JAS System
1954	Prevention of Food Adulteration Act	
1955	Fruit Products Order	
1967	Solvent Extracted Oil, De-Oiled Meal and Edible Flour (Control) Order,	
1973	Meat Food Products Order	
1986	Bureau of Indian Standards Act	
1988	Edible Oils Packaging (Regulation) Order	
1992	Milk and Milk Products Order	
1996		O157 food poisoning
2000		Snow brand milk poisoning Amendment JAS law
2001		BSE beef
2002		Mislabeled scandal of beef Food Safety Basic Act Inauguration of Food Safety Commission
2003	Worms in Cadbury Dairy Milk	
2006	Food Safety and Standards Act (FSSA)	
2006	Food Safety and Standards Authority of India (FSSAI), Statutory body under FSSA	
2012	Worms in KFC Fried Chicken Sandwich	
2015	Nestle Maggi Recall	

Source: Created by authors

The Food Safety and Standards Authority of India (FSSAI), introduced as a statutory body under FSSA, consolidates various acts and orders that have hitherto handled food-related issues in various ministries and departments. It regulates manufacturing, storage, distribution, sale, and import to ensure availability of safe and wholesome food for human consumption. This also promotes awareness among the people of safe and quality food consumption.

The right-hand side of Table 1 shows major incidents and regulations on food safety in Japan. In 1947, the Food Sanitation Act was promulgated to prevent sanitation hazards resulting from eating and drinking. The JAS (Japanese Agricultural Standard) Law and JAS System was introduced in 1950. “JAS Law” is the short name for “The Law Concerning Standardization, etc. of Agricultural and Forestry Products” and the JAS system ensures that foods and drinks have a certain quality and are produced by specific methods. These laws have been regulating food safety in Japan.

In 1996, an O157 food poisoning outbreak happened. On May 28, food poisoning was reported in three elementary schools and one kindergarten in Kuji town in Okayama Prefecture. Starting with this report, the epidemic caused by the O157 afflicted more than 8,000 people and killed eight in Japan. Further, in late June 2000, products of Snow Brand Milk Products Co. caused an outbreak of food poisoning. A valve was contaminated with toxin-producing bacteria and was pinpointed as the cause of the food poisoning that made more than 13,000 consumers ill.

In September 2001, a cow infected with BSE was found in Chiba Prefecture. Following this food safety problem, another food scandal occurred in 2002 in which a company falsely labeled beef produced on Japan's northern island of Hokkaido, where BSE had been discovered, as beef from the southern city of Kumamoto.

In 2003, the Food Safety Basic Act was established, which changed the legal system for food safety in Japan. The purpose of this act is to comprehensively promote policies to ensure food safety by establishing basic principles; clarifying the responsibilities of the national and local governments, food-related business operators, and the roles of consumers; and establishing a basic direction for policy formulation. Based on this law, the Food Safety Commission was established to undertake risk assessment of foods.

## **4. Comparative Literature Review**

### **4.1 Case of India**

The citations in Table 2 depict that the studies were reviewed in such a fashion that it covers the major foods among the food basket of Indian consumers. Two papers cover fruits and vegetables, which are the most commonly consumed foods, along with an addition of paper on grains. Meat and seafood were covered in four papers, two for each. Interestingly, two papers had information specific to nutrients, majorly proteins. Foods and groceries were studied with the help of three papers while five other papers were related to dairy, seaweed,

etc. Indian consumers own a food basket that normally contains a unit of each of the food items listed.

Table 2. Literature in India, sorted by commodity

Commodity	Author	year	Language	Note
Grain	Kaur I and Singh S	2014	English	Cereals
Vegetable	Viswanathan P and Kaur R	2000	English	Raw vegetables
Fruits	Durgesh PM, et.al	2008	English	Fresh fruit juice
Meat	Senthilkumar T and Muralidhar V	2016	English	Meat products
	Rajasekar and Reddy	2005	English	Meat products
Seafood	Padmaja R, et.al	2004	English	Shrimp
	Geethalakshmi V, et.al	2013	English	Value-added fish
Nutrient specific	Janet R, et.al	2016	English	Animal-based protein, plant-based protein
	Amarendra AR	2016	English	Protein, fat
Food and grocery	Jabir Ali, et.al	2010	English	Grocery, general food products
	Kriti Bardhan Gupta	2009	English	Food products in general
	Manisha C, et.al	2011	English	Street foods - food safety knowledge
Other	5 studies			Dairy, Seaweed, etc.

Source: Created by authors

Table 3. Literature in India, sorted by method

Method	Author	Year	Language	Note
Conjoint analysis	Geethalakshmi V, et.al	2013	English	Value-added fish
Focus group discussion	Kriti BG	2009	English	Consumer behavior, food quality and safety
	Rao SM, et.al	2008	English	Food safety - adolescents - food products
Expert opinion	Somnath C	2010	English	Organic food products
Rank correlation	Reetika G and VK Jain	2014	English	Branded food products
Factor analysis	Justin and Jyoti	2012	English	Organic foods
Cluster analysis	Justin and Jyoti	2012	English	Organic foods
	Goyal and Singh	2007	English	Fast food
Scaling techniques	Havish and Aparajita	2015	English	Labelling
	Sudipta M	2015	English	Green food products
Ex-post facto research design	Kavitha and Ajithkumar	2014	English	Consumption pattern - meat
Food choice variables	Kaur and Singh	2013	English	Traditional vs. convenient food
Other	8 studies			Interview, logit regression, multivariate statistical tools, chi-square analysis, ANOVA

Source: Created by authors

Table 3 explains the review of past studies that are sorted based on analytical methodology. Social studies cover a vast range of tools and techniques for a better prediction and understanding of the collected data. Food safety is a qualitative concept and proper attention and care has to be imposed in reviewing the studies for choosing the methods. Regarding this, several studies were collected and analyzed. Out of these, the major methods used are conjoint analysis, focus group discussions, expert opinion, rank correlation, factor analysis, cluster analysis, food choice variables, scaling techniques, etc. The past literature covered major studies on organic foods, food safety, green foods, labeling, etc. which give greater insights into the growing acceptance and demand for food safety and quality in India.

The data from Table 4 depicts the major recorded food risk outbreaks by way of food poisoning, new technology introductions in food processing, and various other food contaminations. Food poisoning due to *Yersinia Enterocolitica* and Norwalk-like viruses in buttermilk and sandwiches were listed. The introduction of GM crops and cloned animal products were studied through four major studies. Organophosphorus, *Staphylococcus* spp, food colors, pathogens, and microbes were recorded as the major food contaminants that lead to food risk in Indian conditions.

Table 4. Literature in India sorted by risk

Risk	Author	year	Note
Food poisoning	Abraham M, et.al	1997	<i>Yersinia Enterocolitica</i> Butter milk in a feast
	Girish R, et.al	2002	Norwalk-like Viruses - salad sandwiches
New technology	Vijesh and Matin	2008	GM foods - Bt brinjal, pesticide residues
	Alok A, et.al	2007	GM Wheat
	John and Amit	2008	GM foods acceptance
	Meena HR, et.al	2016	Cloned animal food products
Food contaminants	Acharya and Shah	1999	Benzoic acid, coal-tar dyes, coliforms
	Bhanti and Taneja	2007	Vegetables-Organophosphorous residual contamination
	Padmaja R, et.al	2004	<i>Staphylococcus</i> spp - shrimp
	Padmaja R, et.al	2004	Food colors - exceeded permissible limits
	Viswananthan and Kaur	2001	Pathogens - salad vegetables
	Preeti k, et.al	2016	Chow mein - Street food - microbes
Other	6 studies		Food quality, misleading advertisements, packaging technologies

Source: Created by authors

## 4.2 Case of Japan

Table 5 shows the prior studies on food safety issues in Japan. In this table, prior studies are classified based on the goods to be analyzed. Of the 32 papers, 14 analyzed for specific goods. The breakdown of the goods is fruits and vegetables, beef, milk, pork, rice, and egg. There are five studies targeting fruits and vegetables, reflecting the growing interest

in organic cultivation and the increase in imported products due to trade liberalization. Because of BSE and food disguising problems, there are three studies targeting beef. In addition, there are two research studies on milk, reflecting the scandal of a milk company.

Table 5. Literature in Japan, sorted by commodity

Commodity	Author	Year	Language	Note
Fruits and vegetables	Nishi et. al	2008	Japanese	Impact of consumers' value
	Morikawa	2007	Japanese	Effectiveness of the traceability
	Nakamura et.al	2007	Japanese	Imported apples
	Kameyama and Goda	2009	Japanese	Fresh vegetable: traceability
	Matsuoka et. al	2013	Japanese	Pesticide-free citrus
Beef	Aizaki et. al	2006	Japanese	BSE beef
	Sawada et. al	2009	Japanese	Beef raised with safety measures
	Sato et. al	2005	Japanese	BSE beef
Milk	Hosono	2003	Japanese	Milk attributes, safety and nutrition
	Chae et. al	2003	Japanese	Milk attributes, safety
Pork	Saito et. al	2009	Japanese	Pork raised with recycled food waste
Rice	Aizaki	2005	Japanese	Ecologically friendly rice
Egg	Maruyama et. al	2004	Japanese	Salmonella-free egg

Source: Created by authors

Table 6. Literature in Japan, sorted by method

Method	Author	Year	Language	note
Conjoint analysis	Kurishima et. al	2010	Japanese	Information provision
	Hangui	2013	Japanese	Information provision
	Aizaki et. al	2006	Japanese	Information provision
	Aizaki	2005	Japanese	Cultivation method
	Andreas and Yabe	2003	Japanese	Production method
	Hosono	2003	Japanese	Labeling and nutrition
	Kameyama and Goda	2009	Japanese	Cultivation method
	Kurihara et. al	2010	Japanese	Japan, USA, China, Ireland
	Kurihara et al	2008	Japanese	Japan and US
	Niiyama	2002	Japanese	Japan and EU
Experimental auction	Maruyama et. al	2004	Japanese	Network type auction
Covariance structure	Sato et. al	2005	Japanese	Knowledge on food safety
Case study	Uozaki	2003	Japanese	Consumers' co-op
Security system overview	Nagamatsu and Matsuki	2003	English	Agri-food chains

Source: Created by authors

Table 6 shows the classification based on the analytical method for the prior research in Japan. Seven studies use conjoint analysis to measure the impact of information on characteristics of agricultural products on purchasing behavior of consumers. Three studies

analyze food safety from the viewpoint of international comparison. Kurihara et al. (2008) and Kurihara et al. (2010) compare safety consciousness with consumers in the listed countries in the table. Niiyama (2002) compares the traceability systems in food chain for the case of the EU and Japan.

Table 7. Literature in Japan, sorted by risk

Risk keyword	Author	Year	Language
Traceability	Kameyama and Aida	2009	Japanese
	Morikawa	2007	Japanese
	Tagami	2004	Japanese
	Niiyama	2002	Japanese
Radioactive materials	Hangui	2013	Japanese
	Koyama	2013	Japanese
	Ooki	2013	Japanese
	Ujiie	2013	Japanese
Chemical-free	Aizaki	2005	Japanese
	Matsuoka et. al	2013	Japanese
	Tsuruoka	2012	Japanese
BSE	Aizaki et. al	2006	Japanese
	Sato et. al	2005	Japanese
Genetically modified content	Andreas and Yabe	2003	Japanese
Recycled food waste feed	Saito et. al	2009	Japanese
Food poisoning	Chae et. al	2003	Japanese
Salmonella contamination	Maruyama et. al	2004	Japanese

Source: Created by authors

Table 7 shows the classification based on the food risk keyword. Reflecting the increasing concern for traceability, four studies discussed traceability of food. After the Japan earthquake and tsunami of 2011, consumers have great concerns regarding radioactive materials and food safety. Therefore, four studies focused on these issues. As awareness of environmental preservation increases, it is an essential task for agricultural development in Japan to clarify the added value of chemical-free cultivation. Hence, three studies listed in the table discuss the possibility of chemical-free cultivation. Other keywords include BSE, genetically modified content, recycled food waste feed, food poisoning, and salmonella contamination.

## 5. Conclusion

To explore the possibility of new technology applications in both developed and emerging countries, we examine the current situation and prior studies in India and Japan.

Regarding food commodity, past studies in both countries focused on commonly consumed food such as vegetables, fruits, meat, and grains. In addition, researchers in both countries are conducting research that reflects scandals related to food safety. Some of them are global concerns, such as studies on GM foods, and others are country-specific, such as



radioactive materials in Japan.

Looking at the methodology used, conjoint analysis is one of the major methodologies in both countries, and other statistical analyses are also used to examine consumers' behavior. However, experimental auction method is not common in the papers. Only one exception is Maruyama et al. (2004), which uses network type auction. Experimental auction is a useful method for measuring willingness-to-pay for commodity non-market goods. Research using this experimental auction method is expected to obtain new knowledge. However, since we need to prepare products that can actually be purchased for auction, product availability might be a problem.

The aim of this study is to sort out an issue for future studies on food safety and the application of new technology. From this viewpoint, if we focus on new technology-related literature, there are only a few studies that focus on genetically modified foods. In other words, no research has been done on new technologies currently in progress. One reason is the collaboration between scientific researchers and social science researchers was limited. Therefore, it would be meaningful to go beyond this difficulty by collaborating with researchers from natural and social sciences and verifying consumer attitudes towards food using new food technologies developed by scientific institutions or universities.

## Endnotes

<sup>1</sup> Jonker et al. (2005) discussed food safety and quality standards in Japan from the perspective of suppliers of developing countries.

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