

Commentary

Pest infestations and contaminants in foodstuffs: A major cause for the decline of India's contribution to the global food market

R U ABHISHEK, S THIPPESWAMY, K MANJUNATH and D C MOHANA*

Department of Microbiology & Biotechnology, Bangalore University, Jnana Bharathi, Bengaluru 560 056, India

(Received on 11 October 2014; Revised on 09 November 2014; Accepted on 10 November 2014)

Introduction

India is an agrarian country. The agricultural base is quite strong and can add to the economy, provided it reduces on farm losses, improves storage facilities and, through processing of food and value added products, impacts export potentials in the global market. Several Acts and orders prevail in India to safeguard food safety and health of the consumers. The Food Safety and Standards Act (FSSA) was introduced in 2006 to overcome the food safety problems and to give more importance to safety standards. This Act covers activities throughout the food distribution chain, from primary production through distribution to retail and catering. The Food Safety and Standards Authority of India (FSSAI) has been established under the FSSA-2006 as a statutory body for laying down science-based standards for articles of food, to regulate their manufacture, storage, distribution, sale and import, and to ensure availability of safe and wholesome food for human consumption (FSSA, 2006).

Recently, the European Union has banned imports of mangoes (particularly 'Alphonso') and some vegetables from India, because the consignments were infested with fruit flies. After mangoes, the EU may now impose a ban on betel leaves from India due to *Salmonella* contaminations. In 2013, FDA of United States put around 200 Indian firms on its red list due to *Salmonella*-infested

products being exported since 2009. The impact of food safety problems pertaining to India's export in the global food market are here.

In India, agriculture is the driving force for broad-based economic growth. Increased globalization and liberalization of markets, facilitated by the World Trade Organization (WTO), are opening new export markets for Indian agricultural products, both fresh and processed (Umali-Deininger and Sur, 2006). One of the major challenges for agriculture is the demand for production of more food for the growing population and to compensate for losses due to pests. During storage, food grains and products are severely destroyed by insects and other pests. Post-harvest losses and preservation of quality are essential steps to meet the growing demands. Poor harvesting practices, improper storage and less than optimal conditions during transportation, and processing can contribute to the fungal growth and increase the risk of mycotoxin production in food commodities, compromising the market quality.

India is the world's second largest producer of food next to China and has the potential of becoming number one in the world. India's agricultural base is quite strong but wastage is very high and processing of food products is very low (Singh *et al.*, 2012). If Indian agricultural exports are to be diversified, India has to comply with international food safety regulations, which is a challenging task. Concerns

*Author for Correspondence: E-mail: mohanadc@gmail.com

over numerous rejections of Indian agro-food exports on food safety grounds have generated greater domestic attention to pervasive food safety problems in the supply chain. Pest infestations, high levels of pesticide residues, presence of heavy metals and microbial contaminations are the varied problems. The economic impacts of food safety problems on India's export in the global food market are discussed below .

Insect Infestations in Fruits and Vegetables

India is the second largest producer of the fruits (10.23%) and vegetables (14.45%) in the world. Yet the country's share in the world trade of fruit and vegetable production is miniscule i.e., less than 1% and the commercial processing of fruits and vegetables is less than 2% (Sidhu, 2005). India, the world's largest producer of mangoes, grows about 15 million tons of the fruit, roughly 40% of the global production (BBC, 2014). According to the Agriculture & Processed Food Products Export Development Authority (APEDA, 2014), of the 55,600 metric tons of mangoes exported by India in 2012-2013, only about 3,890 metric tons were exported to countries of the EU. The EU imposed temporary ban on imports of Alphonso mangoes from India. The ban also covered shipments of Indian vegetables, including bitter gourd, snake gourd and eggplant, from May 2014 until December 2015 (BBC, 2014). The ban was issued after authorities in Brussels (Belgium) discovered 207 consignments infested with fruit flies. The committee of EU noted that, though the prohibited commodities represent less than 5% of the total fresh fruits and vegetables imported into the EU from India, the potential introduction of new pests could pose a threat to EU agriculture production. Nevertheless, despite being the largest producer of mangoes, India still struggles to build a momentum in rapidly-emerging export markets.

Microbial Contaminations of Spices and Herbal Materials

After the recent ban on the import of Alphonso mangoes over claims of a fruit fly infestation, the EU may now ban Indian betel leaves. The EU's Rapid Alert System for Food and Feed warned in its annual

report that there have been consistent reports of *Salmonella* contamination of betel leaves from India (Outlook News, 2014). The EU had already issued a ban on the import of betel leaves from Bangladesh in 2014.

India is the world's largest producer, consumer and exporter of spices. The US is one of the world's largest spice importers, and accounts for more than 80% of the total US spice supply, of which 19% is from India. In 2013, FDA of US released a three-year study report, which indicated that nearly 9% of imported spices from India were contaminated with *Salmonella*, so it had put around 200 Indian firms on its red list due to supply of *Salmonella*-contaminated products (Economic Times, 2013). In 2004-05, India's spice exports totaled US\$399 million, however, it has encountered a number of food safety problems in its spice exports including high pesticide residues, aflatoxin contamination and the use of prohibited food colorants (Umali-Deininger and Sur, 2006). Between 1998 and 2000, Indian dry chili exports also faced rejection in Germany, Italy, Spain and the UK due to the presence of aflatoxin. In 1987, the FDA blocked shipments of black pepper from India due to *Salmonella* contaminations. The ban was lifted two years later, after that the Government of India began a compulsory testing programme for spices and food products before exporting them (Jaffee, 2005).

Two of the largest producers of raw materials of herbal medicines are China and India. India seems to be lagging behind in the herbal medicine category, with less than 2% of global market share, while China occupies nearly 30% of the market (Dubey *et al.*, 2008). India is a land of herbal medicines and herbs are valued for their pleiotropic medicinal properties. Unfortunately, they are often contaminated with high levels of microbes and if untreated, the herbs will result in rapid spoilage. The improper post harvest technology coupled with humid climatic conditions make the raw materials of herbal drugs prone to infestations. The fungal contaminants would reduce the quality of raw materials thereby affecting their medicinal efficacy and also its market potentials. There are reports on aflatoxin contaminated herbal raw materials imported from India (Aziz *et al.*, 1998;

Singh *et al.*, 2008). With regard to aflatoxin, the specific standards and level of regulatory attention to these standards vary among countries. The setting of standards is science based and needs to be aligned with Codex standards where ever possible. Most countries have no specific standards for aflatoxin in spices. However, the prevailing standards for food raw materials apparently are being applied to spices as well. These standards range from 30 ppb in India, to 20 ppb in the US, and to 10 ppb (5 ppb for aflatoxin B₁) in the EU (Jaffee, 2005). Microbial contamination of herbal materials, in addition to heavy metals, is a major impediment for decline of India's export to the global market.

Pesticide Residues and Synthetic Chemicals in Food Materials

The pesticide residue is a substance or mixture of substances in food, feed, soil, water and air originating from the use of pesticides and includes the specified degradation and conversion products, metabolites, reaction products and impurities. If the credits of pesticides include enhanced economic potential in terms of increased production of food, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and environment. There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment. For determining the extent of pesticide contamination in the food stuffs, several countries established programs to monitor the pesticide residues in products of plant origin. In the mid-nineties, Indian dry chili exports faced several rejections including rejections in Spain due to pesticide residue in excess of permissible maximum residue limits, and in the US due to residues of quinalphos, a pesticide not registered in the US (Jaffee, 2005). The Centre for Science and Environment (CSE, 2006) reported the presence of an average of three to five different pesticides in soft drinks available in Indian market, the levels of pesticide residue were far higher than the Bureau of Indian Standards (BIS) norms. Of the analysed organochlorine and organophosphorus pesticides in the soft drink samples, lindane, chlorpyrifos,

heptachlor and malathion were most commonly found. Long exposure to these chemicals can cause cancer, a decrease in sperm count, damage to the central nervous system, birth defects and stomach-related disorders.

Several synthetic chemicals have been used as artificial colorants in ground spices and sausages. Sudan dyes are synthetically produced red azo-dyes, and their degradation products are considered to be carcinogens and teratogens. Due to this fact, the EU and the US do not permit the use of these colors as food-additives. However, in some countries, these dyes are still occasionally used in order to intensify the color of bell pepper and chili powders. In 2003, exports of chili and curry powders faced problems due to the use of the prohibited red dye Sudan 1. In 2005, a huge recall of some 600 food products took place in the UK because of the detection of Sudan 1. The source of the Sudan 1 dye in the food products was traced to chili powder that was imported from India in 2002. It was estimated that this recall and associated expenses cost the UK and other European food manufacturers around •200 million (Jaffee, 2005). Westerners are particularly vulnerable to contaminated spices because pepper and other spices are added at the table after cooking. Contaminated spices present fewer problems when added during cooking, as is typical in the cuisine of India and other Asian countries.

Some synthetic chemicals have been used for artificial ripening of fruits. For example, calcium carbide is used to artificially ripen the fruits, which has been reported for its toxicity in humans. The use of calcium carbide for ripening fruits has been banned by the Government of India under the Food Safety and Standards Act (FSSA-2006) and Food Safety and Standards Regulations (FSSR-2011), but it is still being used illegally (PIB, 2013). In India, it is mainly used for ripening of mangoes, bananas, apples, *etc.*

Need of Quality Control

India needs to follow good agriculture practices (GAPs) to ensure the use of correct raw materials and cover the entire life cycle of the product such as harvesting, processing, transportation and storage,

which facilitates acceptability by the global community.

The usage of pesticide is necessary but dissemination of information regarding food safety, pesticide handling and GAPs among farmers is also a dire need and education of farmers by agricultural extension work is the need of the hour.

Irradiation is a physical treatment in which food is exposed to a defined dose of ionising radiation. It is used on foods in more than 40 countries worldwide. Irradiation of foods can control insect infestation, reduce the numbers of pathogenic or spoilage microorganisms, and delay or eliminate natural biological processes such as ripening, germination or sprouting in fresh food. Like all preservation methods, irradiation should supplement rather than replace good food hygiene, handling and preparation practices. In India, irradiation is being used for mangoes to control insects, spices for decontamination, fresh meat and chicken for decontamination of pathogens, raisins, figs and dried dates to control insects and fresh sea foods for shelf-life extension.

Food safety regulations and the perception of risk are different among countries. Many countries have set maximum levels for certain contaminants with a view to reduce their presence in foods to the lowest levels. For fresh fruits and vegetables, it is necessary to comply with maximum limits on metals particularly lead and cadmium, along with control of insect infestations. For spices and nuts – aflatoxins, ochratoxin and *Salmonella* contaminations, and for soy products – cadmium are generally suggested. Similarly in seeds and cereals – aflatoxins, ochratoxin, *Fusarium*, lead and cadmium are to be

checked. In addition, pesticide residues and synthetic chemicals like colorants and preservatives need careful appraisal.

Conclusion

The safety concerns over quality of food materials are mainly due to their potential infestation by various pests, natural contaminants and added chemicals. Practices used in harvesting, handling, storage, production and distribution make them subject to contaminants, which may be responsible for spoilage. Pesticide residues and synthetic chemicals in food significantly impact human and animal health. Though, some pesticides are banned, their persistence in various food commodities is still existing. Food safety control strategies, therefore, need proper regulation in the interest of human, animal and plant health and environment.

The necessity of finding acceptable ‘natural’ bioactive alternatives to ‘artificial’ chemical treatments is of great interest. Natural products have a narrow target range, show limited field persistence, and have a shorter shelf life and no residual threats. Moreover, good agricultural practices and household processes are important and effective tools in minimizing pesticide residues in food commodities. Organic farming is a good alternative solution. Weaknesses in food safety systems can create a high cost to society and economy of the country. Improving food safety systems and regulations are very necessary to meet domestic and export requirements. The production of quality and safe food products is today’s requirement in the market. The question of quality of Indian products in the global food market is of concern to all stakeholders.

References

- APEDA (2014) http://agriexchange.apeda.gov.in/product_profile/exp_f_india.aspx?categorycode=0204
- Aziz NH, Youssef YA, El-Fouly MZ and Moussa LA (1998) Contamination of some common medicinal plant samples and spices by fungi and their mycotoxins *Bot Bull Acad Sin* **39** 279-285
- BBC News (2014) <http://www.bbc.com/news/business-27238239>
- Dubey NK, Kumar A, Singh P and Shukla R (2008) Microbial contamination of raw materials: A major reason for the decline of India’s share in the global herbal market *Curr Sci* **95** 717-718
- Economic Times (2013) http://articles.economictimes.indiatimes.com/2013-09-01/news/41663340_1_indian-spices-salmonella-abdominal-cramp

- FSSAI (2006) Food Safety and Standards Act, 2006 <http://www.fssai.gov.in/Portals/0/Pdf/FOOD-ACT.pdf>
- Jaffee S (2005) Agriculture and Rural Development Discussion Paper. World Bank, Washington DC
- Outlook News (2014) <http://www.outlookindia.com/news/article/After-Mangoes-Now-Indian-Paan-May-Be-Banned-by-EU/844585>
- PIB (2013) Press Information Bureau, Government of India <http://pib.nic.in/newsite/erelease.aspx?relid=93021>
- Sidhu MS (2005) Fruit and vegetable processing industry in India: An appraisal of the post-reform period *Econ Polit Weekly* 3056-3061
- Singh P, Srivastava B, Kumar A and Dubey NK (2008) Fungal contamination of raw materials of some herbal drugs and recommendation of *Cinnamomum camphora* oil as herbal fungitoxicant *Microb Ecol* **56** 555-560
- Singh SP, Tegegne F and Ekenem E (2012) The food processing industry in India: challenges and opportunities *J Food Distr Res* **43** 81-89
- Umali-Deininger D and Sur M (2006) Food safety in a globalizing world: Opportunities and challenges for India. International Association of Agricultural Economists Conference, Gold Coast, Australia, 1-37.

