

## Commentary

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# Food safety in India: a public health priority

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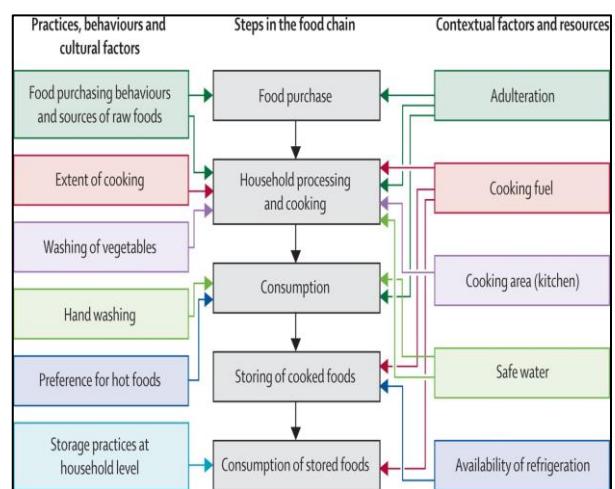
## INTRODUCTION

Access to sufficient amounts of safe and nutritious food is the key to sustain life and promote good health. It is an essential component of our survival. Healthy and nutritious food leads to a healthy workforce and hence, improving the economy of any country. With advances in fields of medicine, environment, agriculture we are progressing towards modernization and hybrid food and food products which are proposed to be healthy for us but all new technology increases cost of products which sometimes leads to compromise on the safety and effectiveness. Unsafe food creates a vicious circle of disease and malnutrition, particularly affecting infants, young children, elderly and sick. The food borne diseases impede socioeconomic development of any country by increasing expenditure on health system and affecting national economies, tourism and trade. Food borne disease is defined as any disease usually either infectious or toxic in nature, caused by agents that enter the body through ingestion of food.<sup>1</sup> Food safety is intricately associated with food security and nutrition. Various hazards make food injurious to health. These hazards arise from improper agricultural practices, poor sanitation and hygiene conditions at all stages of the food development ranging from lack of preventive controls in food processing operation, misuse of food additives and chemicals coupled with inappropriate storage and handling.

### Major food borne illnesses and its causes

Food borne illnesses are usually caused by infectious organisms like bacteria, viruses, protozoa and toxins in chemicals which contaminate food, water and soil in

which food is grown. These pathogens lead to diarrhea and other deadly diseases like meningitis. Common pathogens involved in food borne infections are salmonella, shigella, bacillus cereus, campylobacter species and rota virus (especially in children). Most of the chemicals usually cause food poisoning. Incidents of food poisoning are more common in India during various cultural and religious events when food is prepared in bulk as it becomes difficult to maintain hygiene during preparation and storage of food. Hence, majority of the outbreaks occur in these settings.



**Figure 1: Consumer practices, behaviours, and cultural and contextual factors that affect food safety.**

A study conducted by Walker et al found that enteric pathogens cause approximately 1.7 billion episodes of diarrhea per year in children <5 years children and account for 10-15% of all deaths in this age group.<sup>2</sup>

Diarrhea is second leading cause of death in under-5 children. Children in developing countries like India are early and most frequently exposed to contaminated food, water, soil and fomites.<sup>3</sup> This frequent exposure leads to frequent episodes of acute diarrhea and asymptomatic gut infection in children causing debilitating diseases like chronic malnutrition, enteropathy and stunting.<sup>4</sup>

According to a report by WHO, food borne gastroenteritis by salmonella is a global public health problem.<sup>5</sup> *Salmonella enterica* (S. Weltevreden) has emerged as a dominant food borne pathogen in South-East Asian countries like India, isolated from vegetables, meat and seafoods and has caused serious outbreaks, one of them being in a hostel in Pune where this organism was isolated from the food prepared in hostel canteen.<sup>6</sup> Among shigella species *shigella dysentrie* and *sonnei* are the most common pathogens causing the diarrheal illness. *Shigella dysenteriae* caused major outbreak in West Bengal during the year 2003.<sup>7</sup> *Shigella sonnei* led to two major outbreaks in 2009 (Kerala) and 2010 (Maharashtra).<sup>8</sup>

*Bacillus cereus* is another organism commonly found in food and food products. It produces endotoxins and spores which are resistant to heat and hence, survive in cooked food. Milk and milk products serve as a major source of food poisoning by *Bacillus cereus*. Study by Bedi et al reported an overall incidence of 53.8% of *B. cereus* in raw milk, burfi and skimmed milk powder samples and in 20% of the positive samples, the level of *B. cereus* contamination was more than 105 cfu/g.<sup>9</sup> Another study by Anamika et al found that a total of 81 samples out of 120 samples of khoa, paneer and mushroom obtained from local and standard shops in Ranchi, Jharkhand, India, were contaminated with *B. cereus*.<sup>10</sup> Also, Hafiz et al found that Meat samples (mutton tikka and chutney samples) collected from Kashmir valley, India showed 45% prevalence of *B. cereus* in mutton tikka and 32.5% in the chutney samples.<sup>11</sup>

Milk and milk products are used as main dietary source by Indians and so any infection caused by consumption of these products will lead to a major public health problem.<sup>12</sup>

*Campylobacter* is one of the common organisms found in milk and milk products causing gastrointestinal disorders mainly affecting infants, elderly people, patients with underlying disease and immune-compromised individuals.<sup>13</sup> It also causes severe illness in the form of Gullian Barre syndrome, meningitis, hemolytic uremic syndrome and reactive arthritis. A study by Modi et al showed that 2.91% prevalence of *Campylobacter* was observed in total of 240 samples processed comprising 150 raw milk, 30 cheese, 30 paneer and 30 ice-cream and none of the milk products were contaminated with *C. Jejuni*.<sup>14</sup> Similar results were also found in many other studies like Kazemeini et al with prevalence of 2.5 % and Wysok et al with prevalence of 4.6%.<sup>15,16</sup>

Viruses are also responsible for causing food borne illnesses. A study by Girish et al in 2002 reported food borne disease outbreak caused by Norwalk-Like Virus (NLV) in India.<sup>17</sup> This was the first report of a food borne outbreak attributable to NLVs from India. It occurred in the nurses hostel of a civic hospital in Delhi. All the affected 130 nurses had eaten sandwiches at the party. NLV was detected in the six stool samples collected from the affected persons.

### **Food poisoning due to adulteration**

Food adulteration is a major public health hazard, which affects the quality of life of people.<sup>1</sup> In order to ensure the quality of food available to the consumers, the Government of India had enacted several legislations, including the Prevention of Food Adulteration Act (PFA). Some of the common food adulterants and diseases caused by them (Table 1).

**Table 1: Various foods and pathogens that have been isolated from them.<sup>1</sup>**

Food item	Organisms
<b>Milk</b>	<i>Listeria monocytogenes</i> , <i>Yersinia enterocolitic</i> <i>Bacillus cereus</i> , <i>Streptococcus faecalis</i> , <i>Escherichia coli</i>
<b>Meat</b>	<i>Bacillus cereus</i> , <i>Escherichia coli</i> , <i>Staphylococcus aureus</i> , <i>Vibrio parahaemolyticus</i>
<b>Beef sample</b>	<i>Escherichia coli</i> 0157:H7
<b>Sweets</b>	<i>Salmonella Newport</i> , <i>Salmonella enteritidis</i>
<b>Dahi/yoghurt/khoa</b>	<i>Escherichia coli</i> , <i>Enterobacter aerogenes</i> <i>Salmonella Newport</i> , <i>Salmonella enteritidis</i> , <i>Fecal coliforms</i>
<b>Prawns</b>	<i>Vibrio parahaemolyticus</i>
<b>Cooked and uncooked rice</b>	<i>Bacillus cereus</i>
<b>Poultry</b>	<i>Campylobacter jejuni</i> , <i>Salmonella</i> <i>bornum</i>
<b>Fish</b>	<i>S. aureus</i> , <i>E. coli</i>
<b>Tamarind</b>	<i>Salmonella</i> , <i>Staphylococcus</i> , <i>Shigella</i>
<b>Butter milk</b>	<i>Yersina enterocolitica</i>
<b>Samosa</b>	<i>S. aureus</i>

### **Chemicals leading to food poisoning**

Most common chemicals causing disease are naturally occurring toxins and environmental pollutants. Naturally occurring toxins include mycotoxins, biotoxins, cyanogenic glycosides and toxins occurring in poisonous mushrooms. Staple foods like corn or cereals can contain high levels of mycotoxins, such as aflatoxin and ochratoxin, produced by mould on grain. A long-term exposure to these toxins can affect the immune system

and cause deadly disease like cancer.<sup>17</sup> Many toxic organic pollutants like polychlorinated biphenyls, dioxins are being produced continuously and being odourless, tasteless, colourless or light coloured and highly stable compounds they get accumulated in soil, air and enter human body.<sup>19</sup> Accumulation of PCBs in soil leads to contamination of vegetables and food chains. The close proximity of soils to humans may also lead to human exposure through the consumption of contaminated food and occupational exposure via ingestion, inhalation and dermal contact pathways. Human exposure to these compounds causes many adverse affects on endocrine system. They are also neurotoxic, mutagenic, and carcinogenic in the liver, biliary tract and skin.<sup>20</sup>

**Table 2: Common food adulterants and diseases caused by them.**

Adulterant (food item)	Disease
Argemone oil	Epidemic dropsy
Metalin yellow (color in food products like sweets)	methaemoglobinemia
Saw dust (tea)	Cancer
Sand, marbles, stone (in pulses, food grains)	Damage digestive tract
Lathyrus sativus (pulses)	Lathyrism
Copper, tin, zinc	Vomiting, diarrhea

Heavy metals such as mercury, lead, arsenic and cadmium enter the body through food by polluting soil, water and air and cause kidney and brain damage. A study by Jainshankar et al shows that heavy metals cause multi organ damage causing neurotoxicity, nephrotoxicity, skin toxicity and gastrointestinal toxicity ultimately leading to death.<sup>21</sup>

#### **The burden of food borne diseases**

Globally, increased incidence of food borne disease is being reported in association with the outbreaks and food contamination. These reports, however, are very limited and data from developing countries where populations are frequently being exposed to contaminated environment, are scarce. Hence, the true burden of food borne diseases cannot be estimated. Owing to an increase in international trade, migration and travel the spread of dangerous pathogens and contaminants in food also increases. So, local food borne disease outbreaks can become a potential threat to the entire globe. Through the globalization of food marketing and distribution, both accidentally and deliberately contaminated food products can affect the health of people in many countries at the same time.<sup>22</sup> One single contaminated food ingredient can lead to the recall of tons of food products causing considerable economic losses in production and from trade, as well as damage to the tourist industry. In a study conducted by National institute of disaster management, an outbreak of avian influenza in Bangalore in the year 2008, led to an import ban of Indian poultry products in the Middle East,

resulting in approximate loss of hundreds of thousands of US Dollars to the Indian economy.<sup>23</sup>

Approximately 600 million cases of illnesses are food borne. Among these vast majorities are diarrheal illnesses (50 million). These diarrheal agents cause around 2,30,000 deaths worldwide. The DALYs due to Food borne disease were 33 million, of which 54% were contributed by the diarrheal disease agents.<sup>24</sup>

The annual burden of food borne diseases in the South-East Asia Region leads to approximately 150 million cases causing 175000 deaths worldwide. *Campylobacter* species was the leading cause of food borne illness with an estimated burden of more than 20 million cases every year in the south east Asia. followed by *Shigella* and *Escherichia coli* with more than 19 million cases each. The leading cause of death due to food borne diseases in the Region were *salmonella typhi*, *norovirus* and hepatitis A.<sup>25</sup>

In India, majority of the outbreaks of food borne disease are unreported, unrecognized or un-investigated and may only be noticed after major health or economic damage has occurred. In such a condition controlling the outbreaks, detection and removal of foods leading to the problem, identification of the factors that contribute to the contamination, growth, survival and dissemination of the suspected agent, prevention of future outbreaks and strengthening of food safety policies and programmes is not possible.<sup>25</sup>

#### **Evolution of the world and food safety**

Due to Urbanization and changes in the habits of individuals nowadays we are relying a lot on the processed and readymade food being prepared in restaurants. Not only this, there is increased demand of a wide variety of foods, leading to compromise on the quality of food and increased incidence of food borne diseases. Also, as the world population grows, there is industrialization of agriculture and animal to meet the increasing demands of people creating new opportunities but at the same time new challenges for food safety.<sup>26</sup>

Change in the climate also has severe impact on food safety because change in temperature leads to alterations in food production, food storage and its distribution. This leads to increased burden and responsibility on the food producers and food handlers to ensure food safety. Serious food borne outbreaks have occurred worldwide making food safety a priority.

#### **Response to the problem**

##### **WHO response<sup>27</sup>**

WHO works to protect the health of consumers through providing: public health leadership, technical assistance

and cooperation, normative frameworks, science-based policy guidance, consolidated health-related data.

WHO developed a food safety programme in 1978 to address the issue of food borne disease and food hygiene. WHO was given a mandate by its member nations to make food safety a priority and take specific actions in this area. Multisectoral and multi disciplinary actions were taken to promote food safety at local, national and international Levels. In the year 2007, international health regulations were made to prevent and cater to any health risk due to food borne illness. Codex alimentareus is one of the oldest programmes of WHO.<sup>28</sup> Also known as "Food Code" it was established in 1963 by FAO (food and agricultural organization) and WHO to develop some international food standards to promote fair practices in food trade and consumer health. It lays down guidelines for safety and quality of food.

### ***Food safety and standard authority of India***

It was established under food and safety standards act 2006. Food safety and standard authority of India (FSSAI) lays down standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption. Ministry of health and family welfare is the administrative authority for FSSAI with head quarters in Delhi.<sup>29</sup>

### ***Functions of FSSAI<sup>29</sup>***

Prepare the standards and guidelines to regulate safety of food. Setting of limits for food additives, contaminants, residues, processing aids etc. Accreditation of certification bodies engaged in certification of FSMS. Procedure and enforcement of quality control. Accreditation of laboratories and their notifications to stakeholders. Method of sampling, analysis and exchange of information among enforcement authorities.

### ***The way forward***

The government of India must implement the present laws related to food safety as strictly as possible. Strict action must be taken against companies violating the prescribed standards of food safety. The consumers must also be made aware of the importance of food safety through increased IEC activities. In India, food safety has linkages with the Swachh Bharat initiative of the Indian government that promotes cleanliness and hygiene and also 'Make in India' campaign of the government. India has huge potential in the export of high value agricultural produce.<sup>30</sup> Midday meal programme and integrated child development programme are good initiatives on part of government to supply good quality food. These programs should be further strengthened.<sup>30</sup>

## **CONCLUSION**

Improving food safety is an essential element of food security. Thus, it is necessary that food safety forms an essential component of health based nutrition policies and nutrition education. It is required that all the disciplines act together and lead to improvement beginning from the quality of agriculture to food processing to food packing to food trade. Food safety should form an integral part of primary healthcare system in India. There is a need to increase awareness regarding recognition of food borne disease and its symptoms and development of effective food control measures. Food adulteration and low quality causes great loss to the economic development of any country. Thus, it needs some serious insight into this issue and further exploration is warranted.

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