Chapter 6
Food Laws and Regulations Related to Food Security

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Introduction

Food is the basis for sustaining a healthy life. A nation's growth resides in its healthy living population that contributes flawlessly to achieve overall growth. The journey of food from "Production to consumption," "Farm to fork," "Unstable to the table," and "Boat to the throat" are the activities where these agencies abide by their laws and regulations. Globally, the average food supply is 2881 kcal/person/day against the average dietary energy requirement of 2353 kcal/person/day (FAO, 2014). Every country requires laws and regulations to produce wholesome food commodities and prohibits the sale of unsafe food products that would jeopardize living beings. With the increase in population, the demand for agricultural Production has also increased. However, the increment in the Production of agricultural products is associated with the broader utilization of chemicals. During food transport, its protection and storage also depend on the usage of chemicals. The chances of contamination are increased with the processing of foods in large quantities.

Import and export of food commodities need regulations at national as well as international levels. These laws and regulations, along with food control organizations, ensure the safety of food commodities that are imported, exported, and produced at a domestic level. Food safety regulations are increasingly witnessed skeptically from an economic point of view and provided with the performance and information criteria, generating pressure for effective laws and regulations. Food safety regulations, however, unabatedly focus on process-based requirements and ensure that product liability systems efficiently support food producers, processors,

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and distributors to deliver products comprising safe acceptance. A nation experiences food shortage due to various unfathomable reasons at micro and macro levels, such as environmental degradation, disruptions in food supply chains, and unfavorable food production due to severe weather conditions, economic crises, and various diseases (FSSAI, 2020). Climate change, such as heat waves, cold waves, droughts, and floods, also aggravates food security and Production (Szabo et al., 2016, 2018). Lesk et al. (2016) estimated that droughts and heat waves could lead to an approximately 10% decrease in crop production nationally (Lesk et al., 2016).

The social and economic impacts of the 2020 Covid-19 pandemic hit developing countries more severely. In India, the pandemic situation led to disruptions in the food value and agriculture chain, leaving the population with food scarcity. The WHO guided people with preventive measures wearing face masks in public, frequently washing hands, periodically using sanitizer and social distancing. Lately, people also gotten vaccinated against this pandemic variant. The FDA and WHO issued guidelines for food business operators to combat the novel coronavirus. In India, FSSAI issued the same guidelines for food business operators to reduce the risk of their proliferation (Gopalan & Misra, 2020). The FSSAI and international organizations implemented the guidelines about healthy and nutrient-rich foods for home quarantines and for people who were at risk of getting COVID-19. FSSAI released preventive measures for food hygiene and business regulations (Gopalan & Misra, 2020). However, The COVID-19 pandemic has been observed to result in global poverty unevenly and lead to an economic slowdown. The pandemic negatively affects global food supply and security (SDG-2) and might be persistent. (Parmeshmwar et al., 2020).

Pesticide poisoning has become a significant concern for its deteriorating effect on living populations worldwide. In developing countries, disproportionate deaths are caused by pesticides and their residues due to their misuse, poorer regulation, a deficit in surveillance systems, inadequate, inaccessible information systems, etc. Protective measures are limited for pesticide users and applicators (FAO, 2003). The United Nations Food and Agricultural Organization (FAO) developed the International Code of Conduct (1985) on pesticide distribution and application to create harmonic agreements between pesticide-exporting and importing countries.

Structure of Food Law

The primary food law ensures consumers pure and wholesome foods and that the food is safe and produced under sanitary conditions (Radomir, 2009). Food law includes all rules and regulations, and rather than doctrinal distinctions, it focuses on societal applications. It consolidates public, private, national, international, criminal, and administrative provisions (Vander Meulen, 2014). An essential part of this law is defining it in various terms, including food, natural food, imitation food, food additives, adulteration, pesticide residues, food contaminants, and so on (Radomir, 2009).

In most countries, the Adulteration of Food and Drink Act of 1860 and the Food and Drug Act of 1872 have had a significant impact, which manifests the central position of 'adulteration' in the present era (Vander Meulen, 2014). The United Nations (UN) focuses on human rights. The FAO and WHO include risk assessment and management. The World Trade Organization (WTO) significantly applies food standards in trade and resolving disputes. The WHO operates risk communication structures and is highly influential in incident management. International food law is a meta-framework (Vander Meulen, 2011). Food Law can be divided into two parts: a fundamental food law, and regulations.

The fundamental food law carries broad principles, while regulations include detailed provisions that govern the products of different categories and come under each set of regulatory authorities. The primary food control law includes food standards with hygienic provisions, food additives, tolerance against chemicals, etc. Detailed provisions are necessary to effectively administer enlightened compliance with the fundamental food law. The legislative branch of the government passes the fundamental law, and the executive or administering agency elaborates the detailed regulations and puts the law into effect. Including the specifications of food processing and standards, hygienic practices, food additives and pesticides, packaging, labeling, and prompt regulatory revisions become necessary because of new scientific knowledge. Such modifications can be made much more expedited by executive agencies rather than using legislative bodies (Radomir, 2009).

Food standards are part of the regulations in some countries, while in other countries, they are legislated separately. Regardless of being a part of regulation or separate legislation, food standards become part of the enforcement structure, thereby implementing a food law. The following points should be taken into consideration while including the principles in the fundamental food law:

- Scope of the law and its primary purpose.
- Definition of basic concepts.
- Competence in law implementation.
- Inspection and analytical procedures.
- Enforcement and penalty procedures.
- Rules and regulations for additives, pesticides, and contaminants.
- Packaging and labeling.
- Procedures for preparing and amending the regulations for implementing the law (Reddy et al., 2017).

Food law prohibits importing and distributing adulterated food commodities and falsely labeled food products. The adequate implementation of such a law promotes fair trade practices through compliance with its basic provisions, which can keep the manufacturer and dealer from unfair competition and lead to the development of the food industry since quality control tends to promote fathomable acceptance of foods at the commercial level. As per the US Food, Drug, and Cosmetic Act, a food exhibits adulteration if:

- It is contaminated with toxic substances that make it injurious to health.
- A raw agricultural commodity contains pesticide residues that are not legalized by the US Environmental Protection Agency (EPA) or in excess of tolerances established by the US EPA regulations.
- Any part of the food is decomposed (Radomir, 2009).

The fundamental food law should describe the exact content of offenses that can lead to penal action. Such offenses may be:

- Deliberately adulterate the food product.
- Marketing of foods containing unlawful or unauthorized constituents.
- Fraudulent use of labels and trademarks.
- Poorly satisfying standards laid down by the law.
- Hygienic requirement violation (Radomir, 2009).

The FAO and WHO have introduced a Model Food Law (FAO, 2018). The contents of the Model Food Law can act as a template for developing the national law.

FAO/WHO Model Food Law Contents

I. Preliminary
   (a) Short title and commencement
   (b) Interpretation

II. General provisions
   (a) Prohibition of poisonous or adulterated food
   (b) Deception
   (c) Food standards
   (d) Production of food under insanitary conditions

III. Importation and warranty
   (a) Import
   (b) Warranty
   (c) Defences

IV. Regulations regarding food safety and standards
   (a) Regulations

V. Administration and enforcement
   (a) Food Standards Board
   (b) Role of authorized officers and their duties for official laboratories
   (c) Ministry authority in obtaining particulars of specific food ingredients

VI. Legal procedure

(a) Role of the judiciary to cancel the illegal license and to dispose of the articles
(b) Prosecution
(c) Penalties
(d) Certificates of analysis (FAO, 2018)

Food Safety Regulations

Food safety regulations generally include the following measures:

- General rules and regulations
- Food safety standards
- Hygiene
- Food additives
- Pesticides and their residues
- Food packaging and labeling
- Food advertisement (Radomir, 2009)

Food safety controls and regulations are most prominent in developed countries but can also be observed in developing countries. Food safety regulations are attributed to many aspects, including the measures employed in the establishment of regulations, the private and public food safety control system relations, the government approach, the private parties' response to a regulation, and the food safety regulation implications in trade (Jairath & Purohit, 2013). Regulatory decisions should be constant across different food safety aspects, for example, food safety protection from the environment in transportation. The risk assessment principle has been preserved in the procedures for operating international standard organizations, for example, Codex Alimentarius and the SPS (sanitary and phytosanitary) Agreement of the World Trade Organization (WTO).

There are fast-developing food safety aspects, for example, genetically modified organisms, for which the scientific understanding level needs to be revised to embark on thorough risk analysis. There is no declaration that can manifest the performance of the government in such circumstances. However, it has been suggested that precautionary measures should be adopted to determine an accurate protection level. The economic justification or rationalization for food security measures is based on the social optimum risk level, at which the marginal costs and benefits of changing different food safety levels are equated. It has become operational by analyzing regulatory impact, which is systematically a measured assessment of the costs and benefits of suggested regulations. It was popularised by the OECD (Organization for Economic Cooperation and Development), among which most members applied regulatory impact analysis in some form.

The Public Sector's Role in Developing and Developed Countries

Standards of Food Safety

Food safety standards positively contribute to making consumers concerned over food safety, social coverage of food safety failure, globalization of food value chains, and food testing technology and epidemiology innovations (ITC, 2020). To satisfy the exportation requirements, food standards followed by developing countries are similar to those applied in developed countries (Hoffmann et al., 2019).

Food Safety Levels and International Trade

Several global public capacity levels implicate that substandard food may be exported illegally to countries with a deficit of vincible border inspection systems in enforcing food safety regulations. A research study has evaluated the effective Prohibition of Chinese milk products enacted in Tanzania during melamine poisoning in China. They analyzed that the Prohibition did not keep contaminated milk powder from being commercially sold through various channels (Manning & Soon, 2016; Schoder, 2010). Trade increasingly affects the safety of food commodities available to customers when the imported food is better than the native food in terms of its sanitary quality. It has been evaluated that the percentage of aflatoxin present in corn imported from the USA and Argentina is nearly seven times lower than that in corn produced in Indonesia (Minot et al., 2015; Tangendjaja et al., 2016).

Strict food regulation and controls in export markets enhance the food security and safety roles of enterprises that serve domestic market needs. This implies that exporters' compliance with strict food security measures may positively affect the food supply at the domestic level (Hoffmann et al., 2019). However, it has been shown that the HACCP systems adopted by fish exporters in Brazil did not show any enhancement in food safety at the domestic level (Donovan et al., 2001).

Food Safety as per International Perspective

The International Standard ISO 22003 defines a food safety and management system (FSMS) as a set of interrelated elements in establishing and achieving the objectives of directing and controlling food security and safety organizations. The critical elements FSMS includes are:

- Good practices
- HACCP (Hazard Analysis and Critical Control Point)
- Management system
- Regulatory requirements and communication

Globally, most food industries employ HACCP to achieve food safety. However, it is impossible to encounter all the issues regarding food safety, such as issues caused by agrochemicals, pollutants, natural toxins, etc., through HACCP alone. Besides HACCP, FSMS has become more popular at national and international levels since it systematically adopts new scientific measures and appropriate food safety regulations enforced by the National Food Authority (Attrey, 2017).

Government's Role in Regulating and Enforcing Food Safety

The supply of safe food is associated with both reproductive knowledge and the enforcement of equitable law. New laws and regulations must be made effective intermittently to protect unabated provisions of food products that are wholesome and safe for the living population. The all-embracing goal of the Food and Drug Administration (FDA) in most countries is to be responsible for compliance with food safety laws ensuring three main objectives of protecting public health.

1. Citizens must be updated with the nutritive components of essential food products.
2. Ensuring a safe food supply by enforcing the existing laws on the food industry.
3. Investigate the toxic compounds in order to eliminate them and monitor the food supply chain regularly to prosecute economic fraud.

It is necessary to bring out the enforcement of the laws once they are enacted to ensure compliance by the entire food industry, which also includes such industries connected with the food source, packaging, labeling, transportation, distribution, and retail. Resources and authority are given to FDA to write down the regulations and assemble employees and consultants, to inform, enforce, and eliminate any risk related to food safety. The governmental authorities associated with the supply of potential food tend to be given resources and authorities to discharge the duty of informing, enforcing, and eliminating as described above.

The collaboration of other government agencies is also required in addition to FDA. The US Environmental Protection Agency (EPA) promotes pure drinking water, nonpolluted air, and nontoxic natural resources; the US Department of Agriculture (USDA) ensures plant and animal well-being and wholesome food services; the Immigration and Customs Enforcement of the US Department of Justice are also included in banning the contaminated and illegal substances. Therefore, sharing the information and database between authorized agencies is a means of necessity for food safety enforcement (Johnson, 2015).

Reproductive knowledge is the primary basis for setting the protocols to enforce food safety regulations equitably and informing, enforcing, and eliminating unwholesome food commodities. Risk assessment is a scientific process that concerns food contamination from a fair perspective. The scientific risk calculation favorably estimates the actual risk involving available and current information.

Tools and Programs Ensuring the Security of Food Supply

Generally, 95% assurance of detection of microbial or chemical agents present in food is provided by periodic food monitoring if it occurs in more than 1% of product lots. The food monitoring system investigates and controls the movement of potentially contaminated products. The executive branch of the government authorizes the field inspectors with the power of the agency. Some food products are anonymously monitored and tested if they have false labeling. Contaminants must be retested in individual samples and handed over to more than one laboratory separately to assure fairness if used beyond their permissible limit.

The food safety officer inspects food products from the package to its distribution and storage. The discretionary report of the "accidental" exposure program has done a fair job in various countries. The various products of food possibly get contaminated with pesticides, natural, microbial, industrial, or chemical toxicants. In such cases, the manufacturer probably reports to FDA which in turn refers a trained consultant to provide assistance to the food industry. Consultant fees are paid by the company owner that depends on the nature and extent of the consultation.

The Food Safety and Inspection Service (FSIS) in the US ensures the implementation of the current and future safety of the food supply. Regular, surveillance, monitoring, and voluntary reporting are all included in risk management that tends to declutter the problems and promise a safe food supply (FDA, 2017). The US FDA has initiated the Hazard Analysis & Critical Control Points System to target the risks related to food safety more adequately, and the inspecting resources' allocation would be enhanced further (FDA, 2017).

Food Security in India from the FSSAI Perspective

India encounters various challenges in its quest for food safety (Umali-Deininger & Sur, 2007). Contaminants at the farm level, such as pesticides and toxic waste, and contaminants at manufacture-level, such as using additives in excess amounts, chemicals, adulterants, unhygienic processing of food, etc., make it unsafe for consumption (Fung et al., 2018). Therefore, every step sets a challenge to food safety regulation enforcement. In India, food safety was encompassed under 8 acts and orders by the authority of various food ministries and departments (Reddy et al., 2017). However, all the standards, regulations, and enforcement procedures required a single reference point (Sushila, 2020). In 2006, the Food Safety and Standards Act (FSSA) was enacted and it replaced eight laws that were operational before (Johnson, 2015).

1. The Prevention of Food Adulteration Act, 1954 (37 of 1954)
2. The Fruit Products Order, 1955
3. The Meat Food Products Order, 1973
4. The Vegetable Oil Products (Control) Order, 1947
5. The Edible Oils Packaging (Regulation) Order, 1998

6. The Solvent Extracted Oil, de-oiled Meal, and Edible Flour (Control) Order, 1967.
7. The Milk and Milk Products Order, 1992.
8. Any other order issued under the Essential Commodities Act, 1955 (10 of 1955) relating to food.

FSSAI governs compliance with food regulations in India, enacted by the FSS Act, 2006, and operationalized with Food Safety and Standards Rules, 2011 notification, along with six regulations that were enacted on 5th August 2011 (Dhara et al., 2021). It governs the regulation from food manufacturing to import with prescribed food standards. It prohibits misleading advertisements, and illegal trade practices for promoting sales. It brings awareness among consumers and ensures wholesome food to consumers (Goswami & Mulherker, 2012).

FSSAI Standards

FSSAI frames the regulations and signifies standards for all food products inspected by 21 Scientific Panels and one Scientific Committee consisting of various independent experts and scientists (FSSAI, 2021). Food standards are re-evaluated to consider the food science and nutrition developments occurred lately and also considered different consumption patterns, new additives and products, advanced processing and technology, analytical methods, the manifestation of new risks, and feedback from all stakeholders. FSSAI notified 21 regulations for effectively implementing the FSS Act, 2006, through which different food standards and control of food business by issuing licenses, prohibiting and restricting certain product selling, fixing maximum contamination levels, sampling procedures, imported products, approving non-specific food and ingredients, food safety auditing, recognition and notification of laboratories, packaging, and distribution of balanced diets for children in school, infant food, labeling, packaged product display, etc. are mentioned (Dhara et al., 2021).

The Bureau of Indian Standards (BIS) follows ISO 22000: 2005, which allows all types of food chain organizations to implement FSMS, which is a little more comprehensible than the HACCP. FSSAI and the State Food Authorities maintain a system of controls involving risk communication, food safety surveillance, and other monitoring activities that cover all the food business stages. The Act also encourages the Food Authority to conduct food safety audits based on FSMS (Attrey, 2017).

Registration and Licensing

The food business operators must register under FSSAI as per their Production or capacity to start any food business. By registering under FSSAI, food business operators must conform to all FSSAI regulations. FSSAI has unabatedly been

facilitating ease of carrying out business, such as implementing cloud-based technology and an open-source Food Safety Compliance System environment to issue licenses (Dhara et al., 2021).

Food Testing

Food testing needs a group of laboratories carrying basic modern analytical facilities and technical manpower. Hence, FSSAI consolidates systematic education and capacity building among employees, regulators, and the general public (FSSA, 2006). It notifies NABL accredited laboratories to carry out food product analysis. There are 190 notified and 19 referral food testing laboratories, and 12 laboratories has been recognised as National Reference Laboratory (NRL) and 2 laboratories as Ancillary National Reference Laboratory (ANRL) out of these 209 laboratories in setting up the procedures and validating testing methods, developing new methods and ensuring proficient testing in the food laboratories. It has launched an online portal named as Indian Food Laboratories Network, where various stakeholders can manage all food testing activities online. It has also empowered its staff by recruiting several posts, including Central Food Safety Officers (CFO). Furthermore, Central Licensing Authority (CLA), which was associated with State Authority, can take legal action if any food business operator (FBO) does not conform with the FSS Act, 2006 and its regulations (Dhara et al., 2021).

Eat Right India Movement

The Eat Right India movement assures the national population of safe and wholesome food. It comprises various programs. The main motive of the initiatives of Eat Right India movement is to demand and supply wholesome food commodities in a safe manner. The initiative related to supply develop food business capacity buildings to promote self-compliance, while the demand-based initiatives motivate consumers to demand safe and sutainable food. FSSAI has initiated a Food Safety Training and Certification (FoSTaC) program that ensures the availability of a trained and certified Food Safety Supervisor (FSS) in every food business premise. Eat Right Station, BHOG (Blissful Hygienic Offering to God), Clean Street Food Hub, and Clean and Fresh Fruit and Vegetable Markets are picked out to many sellers. The scheme of Hygiene Rating has been initiated for establishing food services such as restaurants and cafeterias, bakeries and confectionaries, and meat shops. FSSAI works on developing awareness among consumers, testing adulteration, and ensuring healthy choices. The efforts to sustainably produce and consume food commodities are made to promote eco-friendly food practices and rituals (Dhara et al., 2021).

Food Securities

The exponential rise in population has led to increased food demand, which was met by combined scientific and technological advances, institutional intervention, government policy, business investment, etc. (Cole et al., 2018). FSSAI plays a significant role in controlling the Import of food products. Moreover, FSSAI has initiated an Indian Food Sharing Alliance (IFSA) to resolve wastage of food and hunger crisis issues by integrating, food recovery organizations, agencies, and NGOs. Programs such as integrated child development services (ICDS), mid-day meals, food-for-work (FFW), public distribution system (PDS), antyodaya anna yojana (AAY), etc. have also been encouraged to increase the nutritional values of food products with micronutrients to cut down malnutrition among the population (Dhara et al., 2021).

Challenges of FSSAI

FSSAI is still struggling with adequately implementing the FSS Act, of 2006, even though carrying a legal framework. The regulatory staff is insufficient at the state and central levels. Food Safety Officers, the pillars of the FSSAI, are fewer in number than desired. Furthermore, more laboratories are needed in the country. The number of laboratories per million people in India is much lower than in the United Kingdom, Germany, the United States, etc. There is also an urgency of upgrading the food testing laboratories. There are a multitude number of unorganized sectors that requires accessible internet facilities, which makes them unaware of the rules and regulations made under FSSAI (Dhara et al., 2021).

Reddy et al. (2020) evaluated the food safety standards followed by street-food sellers in Hyderabad and Delhi in 2017 after getting introduced to the FSS Act, of 2006. They found that only about 1/3 of the street-food sellers had registration under this act to carry out their shops, and most food sellers were not conforming to basic food safety principles that include using aprons, water, and soap for cleaning utensils, and many were deficit in refrigeration facilities (Reddy et al., 2020).

FSSAI was set up to consolidate all food products. However, some products need a BIS license, such as dairy food for infants, milk cereal-based and processed cereal-based weaning food, packaged drinking and mineral water, etc., and AGMARK certification such as multi-source edible vegetable oil, fat spread, etc. besides FSSAI. Food business operators, including manufacturers, processors, retailers, wholesalers, distributors, consumers, and even officials, lack food safety awareness and also need to be better at understanding the rules and regulations that are updated constantly (Wertheim-Heck et al., 2015). The biggest challenges that are faced by food industries are poor information and clarity of regulations (Dhara et al., 2021).

Implications of COVID-19 on Global Food Security

The outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019 resulted in the widespread of a viral strain named COVID-19, causing severe respiratory illness. COVID-19 was declared a worldwide pandemic on 30 January 2020 by WHO. Until the WHO declaration, the global impacts of COVID-19 were only speculated upon, and many nations were unprepared to combat the pandemic. The government's decision on the management of the COVID-19 crisis and the variation in the strategic applications of cognizing, communicating, coordinating, and controlling became a predominant approach in facing the pandemic globally (Parmeshwar et al., 2020). Globally, various legislative approaches were exercised in minimizing public health vulnerability to pandemic exposure in which emergency laws were enacted for imposing lockdowns in nations and restricting domestic and international flights and travel, curfews, and limiting the available services, aimed to stop COVID-19 rise at the community level. However, the strict restrictions imposed on international trade transportation of raw materials aggravated the adverse impacts on Production as well as trade from local to global (FAO, 2003, 2020a, b; Laborde, 2020). The emigration of people from high labor-demanding areas increased the availability of labor for agricultural and allied activities. However, the increasing availability of laborers in agriculture for local or unskilled employment would have restricted their income, which was highly dependent on natural resources to generate low-value products. On the other hand, the areas intensively depend on agricultural labor demand for agricultural activities, livestock management, marketing, and creating agricultural infrastructure encountered labor shortages. The potential outcome noticeably affected the global food supply. The aggravating impacts of COVID-19 on the supply of food and associated food security components made the countries procure and protect stock and restrict international trade. Therefore, COVID-19 has been observed as an unprecedented public health crisis that significantly resulted in an economic slowdown, threatened food production, and potentially resulted in global supply threats. These effects and restrictions imposed on trade in major producing countries might have significant consequences for food security in trade-dependent nations. These effects could deteriorate global supply chains in 2020 and beyond. The potential threats to Production and restrictions on trade due to COVID-19 have been observed to decrease the supply of food in import-dependent, and vulnerable countries, which eventually affected international food trade (Parmeshwar et al., 2020).

COVID-19 Implications on Global Cereal Supply

The major exporting countries comprise approximately 70% of the cereal export and 45% of its Production worldwide. The USA is the largest cereal exporter, which accounts for nearly 16 and 18% of global Production and export, respectively. China

ranks among the top 10 cereal importers worldwide and is the largest cereal-producing country, accounting for 21% of Production globally. Production threats and restrictions on global food trade have significantly proved the impacts on importing countries. In 2020, COVID-19 caused a 24.8% decrease in the exportation of agricultural food products (Laborde et al., 2020). COVID-19 cases were observed to increase continuously, due to which the span of restrictions on trade also increased. Nearly about more than 2 million cases of COVID-19 were reported on the 5th of May, 2020, and approximately 29 countries restrict food trade, resulting in an approximately 5% decrease in food markets globally (IFRI, 2020; Laborde et al., 2020). Different countries-imposed restrictions on food trade, e.g., various food exports were banned by Eurasian Economic Unions, and new rice export contracts were suspended by Indian traders. Rice export permissions were suspended by Myanmar, Vietnam restricted the export of rice, the Russian Federation restricted the export of wheat and other cereals, Ukraine restricted the export of wheat, Sudan imposed a ban on the export of maize, sorghum, and various other countries have restricted trade, only to secure their supplies at a domestic level during and after the COVID-19 pandemic (ITC, 2020; Wertheim-Heck et al., 2015).

COVID-19 Implications on SDG-2 (Zero Hunger Goal)

The accessible sufficient quantities of sustainable food products is a key to achieving SDG-2. In 2019, the United Nations Economic and Social Council report on SDG-2 progress raised concern with regard to the increasing number of insufficiently nourished population from 784 million in 2015 to 821 million in 2019 and decreased government expenditures on agricultural aid. COVID-19 impacts on food security (Fig. 6.1) were observed to persist beyond 2020; this wave is still noticeable in the present era (UNESC, 2019).

The 2020 Global Report on Food Crises (GRFC) has reported that in more than 50 countries and territories, nearly 135 million people experienced acute food insecurity before the crises of COVID-19 (FSIN, 2020). One of the significant responses of worldwide countries to the health crisis caused by the pandemic was prioritizing ensuring their food supply (ITC, 2020). Covid-19 threatened global food security but immensely affected the countries dependent on food imports that were found to be most vulnerable to the trade restriction impacts. FAO proclaimed an advisory for the countries in order to resist import-export restrictions against this threat (FAO-Agri, 2020a; FAO-Coronavirus, 2020b). In developing countries, the cereal composition of food is estimated to be 159 kg/person/year (global average160), and cereals for all consumers are estimated to be 254 by 2030 (Alexandratos & Bruinsma, 2012).

However, developing countries are the most vulnerable with a cereal supply of about 38 to 153 kg/person/year at a domestic level. In sub-Saharan Africa, the hunger situation was observed as rigorously alarming in the Central African Republic,

Fig. 6.1 Potential factors affecting global food security. (Parmeshwar et al., 2020)

Chad, Yemen, Zambia, Madagascar, and Liberia in accordance with the World Hunger Index 2019 (Gopalan & Misra, 2020). While South and South East Asian countries, India, Pakistan, Afghanistan, Indonesia, Philippines, and Colombia had suffered severe hunger shocks. Most of the population in these countries relies on agriculture and daily-waged activities (Global Hunger Index, 2019). The COVID-19 economic slowdown in these countries, with increasing unemployment, decreasing income, and supply chain disruptions, could severely jeopardize food safety in poor societies. The pandemic is mainly causing food insecurity in developing countries. Potentially decreasing food production, depleting reservoirs, and trade restrictions have likely been observed to adversely affect food safety and security in 2020 and 2021 (Sumner et al., 2020).

The pandemic impact on food security may persist longer through slowing down of the economy, decreasing agricultural investments, government expenditures, and aiding farmers. The COVID-19 is expected to increase uneven poverty worldwide, adversely affect the progress made since the decades on diminishing poverty, and thereby affect progress towards the better achieving of SDG-2.

Food Safety in Developing Countries

The food market is in line with other markets regarding quality and safety attributes that are not observed. Most food safety hazard tests are expensive in terms of the food value, making examining food at each transaction nearly impossible. Therefore, food sellers and consumers need to be made aware of the food safety and security rules. Inappropriate information between sellers and consumers can cause market failure where food quality is not appropriately examined, adversely affecting agricultural and pharmaceutical sectors in developing countries (Björkman et al., 2013; Bold et al., 2017).

The asymmetric information with regard to food safety implies that public intervention through enforcing regulations against unsafe food buying and selling can enormously improve aggregate welfare. Cost analysis and positive impacts of combating foodborne illness in developing countries are scarcely sufficient, but presently analysis of high-level has estimated that higher investment is necessary (Jafee et al., 2018). A significant barrier to improving food safety in developing countries has been observed due to public institutions often confronting resource and capacity restrictions that reduce their effectiveness. The World Organisation for Animal Health has evaluated that out of 35 assessed developing countries, only two were adequate to identify and trace animal products, and around 6 developing countries could sufficiently inspect facilities regarding meat distribution, strict rules and regulations for veterinary drugs, and capable of ensuring the quality of laboratory where animal products are tested (Jafee et al., 2018). Moreover, awareness of food safety hazards and steps to mitigate such risks are being observed to be lesser where attainment of educational levels has been found low. In developing countries, less income and fewer awareness levels equally make a customer less voluntary to pay for food safety. Eventually, food security and safety should be prioritized by the government or markets (Humphrey, 2017).

In developing countries, the food safety testing costs are exceptionally high with regard to food transaction value because of the availability of smaller firms in the food sector, consumption of food products of low value, and smaller transaction volumes. There needs to be more systematic information on food safety testing costs. Equipment costs and consumables of the laboratory may be higher in relation to less demand in the market for the products due to increased scale of distribution and import duties. Although less information on both sides of the market can only be resolved by decreasing the costs of food safety testing. Unsymmetric information can be resolved if well-aware consumers demand a product of high quality.

In developing countries, the low willingness of a consumer for paying, as well as the deficit in auditing firms of food safety and deficient independent food testing laboratories, reduce the value of combating market failure caused by unsymmetric information. Moreover, food markets in developing countries are generally governed by the informal sector, operating outside of the control of regulations. In the formal food sector, the market share tends to remain at its minimum, particularly for fresh food commodities (Attrey, 2017; Frayne et al., 2010; Grace et al. 2015;

Manning & Soon, 2016; Tangendjaja et al., 2016). Strict regulations and high taxes in developing countries are enforced in the formal sector, thereby reducing the incentives of firms, which suggests that the attempts to improve food safety and security by the enforcement of regulations could have outcomes that are unintentional so as to decelerate the formalization in the agricultural food sector (Fajnzylber et al., 2011).

Pesticide Contamination in Food and Its Control

The widespread problem of pesticide-contaminated food products in India is considered extremely difficult to rectify. Many factors are highly responsible for pesticide penetration in food commodities. Since India is a country of agriculturalists, where a major population is employed in the agriculture sector (Singh et al., 2013), this basic characteristic makes India vulnerable to pesticides (Abhilash & Singh, 2009). Indian farmers are mostly less aware of using pesticides in a proper way and the time of harvesting (Kumari, 2008). It causes premature harvesting, and therefore, many pesticide residues in crops are found. Despite being banned from marketing, pesticides freely available in the market are toxic in nature, which vehemently violates public safety laws. Many research scientists and individual organizations have tested such pesticide residues in Indian food products and submitted their reports to higher authorities (Pronczukd, 2008). In spite of this, negligible strict measures have been taken for prevention. India needs an advanced approach to keep pesticides from further contaminating food products. Pesticide-causing diseases occur at an increasing rate in developing countries compared to developed countries. One of the major causes of this incongruity is the need for more clarity in transferring regulatory information from the countries that export pesticides to the pesticide-importing countries (Ecobichon, 2001).

The advanced technologies in the countries might make them the leaders in developing and registering pesticides and disseminating information to less sophisticated stakeholders. Furthermore, pesticide users in importing countries need appropriate training and education to handle, apply, and store pesticides. A standard regulatory system would effectively regulate pesticides worldwide. However, an international regulatory system that binds all countries may only be applicable later. Regional organizations contribute by offering a successful model to develop a single regional unit for promoting the safe and positive use of pesticides. Registration of pesticides at the regional level and regulation activities would improve the agricultural product trade and keep the environment from pesticide hazards.

The FAO developed the International Code of Conduct on Distribution and Use of Pesticides in collaboration with the WHO, International Labor Organization (ILO), United Nations Environment Programme (UNEP), International Group of National Associations of Manufacturers of Agrochemical Products (GIFAP) (Donovan et al., 2001). The main purpose of this code was to harmonize pesticide-exporting and importing countries. Various banned pesticides were exported to

developing countries prior to this code, which is deficient in technical, legal, and administrative resources to have access to pesticide toxicity. The code provides a Prior Informed Consent (PIC) portion updating the country with information on pesticides that are imported (Kesavachandran et al., 2009). The code is, however, intended and legally unbound. It was set up to act as a temporary measure until local governments developed authenticated rules and regulations (Donovan et al., 2001).

One of the critical initiatives for the management of pesticides is the FAO/WHO Joint Meeting on Pesticide Management (JMPM) and the Annual Session of the FAO Panel of Experts on Pesticide Management. The JMPM was set up to harmonize FAO and WHO for adequate pesticide management. The annual meeting encountered FAO and WHO with the regulation and pesticide management and made them implement the International Code of Conduct on Pesticide Management (FAO/WHO, 2010, 2013). The Codex Pesticides Residues in Food Online Database includes the maximum residue limits (MRL) and extraneous maximum residue limits (EMRL) for the adoption of pesticides by the CAC (Codex, 2013). Globally, different authenticated organizations and scientific databases address various issues regarding the use of pesticides, their health effects, and environmental shocks. Codes implemented on the basis of databases and MRL potentially curtail the harmful effects of pesticides. Kumari (2008) found that washing and blanching vegetables lead to around 22–60% reduction in pesticide residues. While Peeling leads to a 70–100% reduction in pesticide residues. The washing and boiling of the vegetables affect different factors of pesticide residues (Fig. 6.2) (Kumari, 2008).

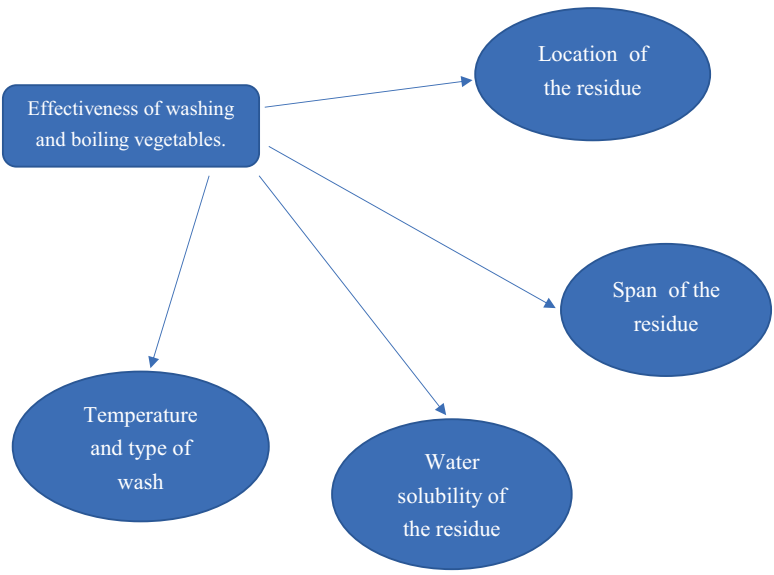

Fig. 6.2 Effectiveness of washing and boiling vegetables on the different factors of pesticide residue. (Kumari, 2008)

Good Agricultural Practices for Pesticide Residue Management

(i) Keep a record of chemicals. Store all chemicals in their respective containers. Do not store herbicides along with other pesticides.
(ii) Only allowable pesticides with recommended dosage and frequency should be used at an appropriate time. Banned pesticides should not be used.
(iii) Education and training should be given to use pesticides properly. The lack of knowledge can lead to residue problems.
(iv) Dispose of unused pesticide solutions which are generated by cleaning spray pumps to avoid pollution since they contain pesticide residue.
(v) Indiscriminate use of pesticides should be avoided.
(vi) Follow an Integrated Pest Management System.
(vii) Religiously follow the waiting period before the time of harvest.
(viii) Prepare healthy soil with compost and mulch in order to reduce pest effects.
(ix) Fruits and vegetables should be thoroughly washed with tap water.
(x) Decrease the drifting of spray in orchards by reducing pressure, using nozzles with larger diameters, and pesticides of a less volatile nature.
(xi) Read the labels of the product carefully before applying and mixing any pesticide as mentioned (Shailesh et al., 2013).

Women: One of the Important Pillars of Food Safety and Security

The first pillar of food safety and security is the Production of food in a sustainable manner. In sub-Saharan Africa, women comprise nearly 70–80% of household production of food, whereas, in Asia and Latin America, they account for 65% and 45% of food production in households, despite unequal access to inputs, land, and information. Women farmers can receive equal or higher yields than men farmers if they are provided equal accessible resources and human capital. Laws governing their rights to land vary widely. In sub-Saharan Africa, where women are prominently responsible for food production, their rights to use land are generally limited. Some irrigation projects have limited their rights to land (Battersby & Crush, 2014). Despite their prominent Role in agriculture, women are denied an appropriate agricultural extension share and other services. During COVID-19, food insecurity among women was approximately 10% higher than among men and even more so in developing countries (FAO/WHO, 2018). Had women in rural areas the same exposure to productive activities as men, agricultural Production and farming would have been increased, and nearly 150 million more human population could have been fed.

FAO states that in developing countries, women account for 43% of the agricultural workforce. Food safety is not just attributed to food availability, nor to be accessed by financial resources. People must also have accessible quality and

nutritious food to ensure food security. Various types of research show that gender inequalities threaten the ability to sustain food and nutritional food security (Carmen, 2017). One potential remedy is to give agricultural training to women and increase their number as agricultural extension agents. This practice would rip out the cultural restrictions against the extension of male folk and the interaction of female farmers. It would also enable women to share information among themselves in the groups. Agricultural research institutes also need to implement their indigenous knowledge in farming systems. Educating women about basic agricultural practices would increase agricultural productivity and income (Carmen, 2017).

The second pillar of food safety is access to available food economically. Various studies have found that improvements in household welfare depend on who earns along with the level of household income. It has been found that women are likely to spend their income out of proportion on food for their family members. Moreover, improvements in the health of children and nutrition status are more strongly attributed to women's incomes. The third pillar is to achieve nutrition security which includes adequate energy, protein, minerals, and micronutrients for the family and also depends on an adequate quantity of household food and factors, including child health care and accessible purified water and sanitation (Carmen, 2017).

The exclusive sphere of activity of women is to ensure the nutrition security of the household via food and other resources. Protecting the nutrition status of females is vital to provide a head start for the nutrition status of children. Improving the pre-pregnancy status of nutrition, increase in weight during pregnancy, lactation diet, Production of breastmilk, and better-nourished mothers increase birth weight in infants and improve children's health. However, women's nutrition status is endangered when they are treated as shock absorbers for the household by the liquidity of the status of their nutrition in meagre seasons. Moreover, it has been found that in South Asia, a strong pro-male and pro-adult bias within the family in distributing food and other resources also tends to deteriorate the health of women and their status of nutrition.

Conclusions

The demand for food products is increased at higher risk of contamination, including animal food and fresh produce, and there exists limited government for identifying outbreaks, implying that force on the food security and safety system is growing unabatedly. Consumer demand for food safety has been estimated by various research studies. The government possesses limited capacity for enforcing the regulations, and independent food safety and testing laboratories are rare. Surveillance of food is used for investigating and potentially controlling contaminated products in food. Various food laws have been implemented to ensure food safety worldwide. The hunger problem worldwide cannot be resolved only by improving productivity but also resolved by the developed science-intensive technologies that favor manufactured product preservation, the development of various logistic schemes, and

agricultural Production. Ensuring food safety and supply needs official policies and legislative measures to provide a unified national action and strategies framework.

COVID-19 has led to severe and unprecedented disruptions in local as well as global supply of food. However, major cereal producers show an increment in the supply of cereals domestically. COVID-19 led to restrictions on trade and prices that eventually affected agricultural income and GDP. Various restrictions and regulatory activities have been imposed worldwide to control the pandemic situation. Recently vaccination has also been done to combat the pandemic. However, particular attention should be paid to ensuring the safety and security of food in the present era and beyond. Persist initiatives assisting purchasing power of households and enhancing the options of trade should be prioritized in different government policies.

The use of pesticides is growing worldwide, and various countries are looking for different ways in order to educate consumers about the advantages of chemical pesticides without being threatened by their application. Various countries often import required chemicals to increase the Production of home food and export different yields of crops. Due to deficient infrastructure and forces, some countries are clinging to various information, including labeling, using patterns, application rates, material safety data sheets, etc., provided by international manufacturing agencies. There are international codes of conduct for promoting cooperative efforts and shared responsibilities among parties. Many countries also have specific rules and regulations for the utilization of pesticides. Pest management is one of the significant inputs in the Production of agriculture. Therefore, this area grabs great attention to economizing Production, providing safe foods, and lowering medical expenses for combating various ailments. In addition, alternative measures for pest management should also be explored to consume, Import, and export safe products in the future.

National and international organizations must take crucial steps to permit women to accomplish their potential in the generation of food safety and security. They need to enhance the physical and human capital of women. The ability of women in the Production of food can be increased by enhancing their access to resources, information, and technology. Educating and training women would increase productivity in the present and future eras.

In conclusion, food safety and nutrition are connected by a close nexus. Unsafe food leads to various diseases and malnutrition among the living population, as the food supply chain crosses many national and regional borders. The collaboration between the government, producer, supplier, distributor, and consumer would eventually ensure food safety in the present era. The introduction of the FSSA could boost domestic and international consumer confidence and make the nation meet international food security standards. However, its implementation yet faces various challenges. There is still a lack of general awareness of the hazards that are associated with unsafe food practices, and thus the safety procedures and methodologies are yet to be followed. The poor infrastructure of testing laboratories, insufficient technical expertise, and skilled manpower for legislating the rules are still of great concern. Problems in tracing the products from the manufacturing to the processing unit are one of the implementation challenges of FSSAI in the present era. The

NGOs can spread awareness publicly about food contamination and the use of safe food. Thus, these organizations can act as an essential connection between the government and the people and direct the masses in various activities to protect the environment.

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