Understanding the Risks, Mitigation, and Safety Measures Involved in Food Contamination

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Edited by

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Our Beloved Father and Mother

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PREFACE

This book, “Food Contamination: Understanding Risks, Mitigation, and Safety Measures” has described the different contaminants of food, their impacts, different safety measures, and regulations that are adopted to keep the food safe. This book aims to explore the extraneous chemical contamination of food from two sources: firstly, food-chain contaminants - the presence of plant toxicants of fungal metabolites in food, or the contamination of food from environmental sources (airborne, aquatic, and terrestrial); and secondly, food-production contaminants - contaminants of man-made origin brought about by a desire to facilitate food production and distribution. This volume includes 10 chapters that describe the introduction of food contaminants, their impacts and safety measures, classification of food contaminants, microbiological contamination of food, agrochemical role in food contamination, environmental contaminants in food, emerging contaminants of food, foodborne diseases, preservation of food, the safety of food and feed, and food protection and regulations. This work will be helpful for students, teachers, researchers, and scientists to know about the subject.

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CHAPTER 1

CONTAMINANTS IN FOOD: SOURCES, INFLUENCES, AND PROTECTIVE MEASURES

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Abstract: This segment covers food toxicity, including concerns about mycotoxin pollution, biological, mechanical, physical, and cross-contamination. The presence of microorganisms or derived toxic substances, such as mycotoxin, in foods that make them dangerous to humans, livestock, and crops are commonly referred to as food poisoning issues. Mycotoxins will hit food (from farm to fork) throughout the food supply chain. Regarding food protection, mycotoxin presents a risk to users of infected foods. Furthermore, the nature, origin, delivery processes, and occurrence of mycotoxin exposure must be identified to protect people and ensure public health.

Keywords: Contaminants, food toxicity, safety measures, and sources of contamination

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Introduction

The protection of food is a composite matter. From the common community to government and industry, it affects all segments of civilization. This book contains up-to-date information on important well-known food contaminants; their origins, impacts, and protection steps are also available. The information in this book is general and shortened in nature and is proposed for practical use. According to the FDA, contaminated foods contain an intrinsic natural ingredient that is not due to agricultural, industrial, environmental, or other contaminants; they are usually present in a quantity that is not part of the food itself, but they contain a quantity that may damage health. Knowledge about pathogenic microorganisms and their toxins is increasing day by day. After scientific approval that these microbes and their contaminants can cause foodborne disease, the FDA can think that microorganisms can cause food contamination. Microorganisms like bacteria and parasites, when contaminating the food, then they spoil them and this is not usable after that. These substances may be present in food because of many stages of its production, packaging, and storage. Certain environmental contaminants, like heavy metals and pesticides, may also spoil the food, which are not deliberately added to the foodstuff. Food may be contaminated during its production and distribution. During slaughtering, poultry and meat may be contaminated through intestinal fecal matter. If the water is contaminated with animal manure, and we use it to wash the fish and vegetables, it also contaminates the food. Food contamination can also be due to infected food handlers. Poor hygiene conditions at home are also a major factor in food contamination.

Processing toxins are produced during the fermentation and heating of food. Contaminants are lacking in uncooked foods and are created by chemical reactions of normal foodstuffs during handling. They cannot be fully escaped, but technological processes can be adjusted to minimize them in processed foods. Examples are trans-fat, poly-aromatic hydrocarbons, 4-hydroxynonenal, benzene, histamine, semicarbazide, furan, nitrosamine, ethyl carbamate, acrylamide, and mono-chloropropanediol. Food may also be contaminated by metal chips from processing equipment and using metal finding tools, these can be recognized. For decades, these food contaminants have been identified. Emerging food toxins like furan, 4-hydroxynonenal, benzene, acrylamide, perchlorate, perfluorooctanoic acid, and 3-monochloropropane-1,3-diol have been recently discovered.

The chemicals present in the environment are called environmental contaminants; in which food is developed, collected, stored, elated, filled, handled, and used. When food is exposed to the environment, toxifications occur. Probable contamination sources are water (arsenic and mercury), packing materials (tin, bisphenol A, Lead, benzophenone, and semicarbazide), soil (nitrate, perchlorate, and cadmium), air (radionuclides), processing materials (cleaning and sanitizing agent, lubricant, and copper) and naturally taking place containment (ciguatera, grayanotoxins, tetrodotoxins, pyrolizidine alkaloid, phytohaemaglutinine, and scombrotoxins). Food toxin causes foodborne illnesses that affect a predictable seventy-six million citizens in the United States each year, while 325,000 lead to hospitalizations and death occur about 5,000. Hence, for good nutrition, it is an important component that people should be aware of possible sources of food contamination.

Chemical, physical, and microbial causes are significant sources of pollution. Physical toxins are part of food; they do not modify food but can make it hard for customers. They would not ruin food but would become a cause of damage if eaten much as broken pieces of glass or metal sometimes grow into food. Rodents and larvae are secondary sources. Two major issues arise: first, they extinguish vast amounts of food, second, they introduce bacteria to foods. Rodents and insects scrape the surface of vegetables and fruits and bacteria invade the food from this opening and spoil it. At any point in processing, they will contaminate food. We use chemicals that suggest chemical toxicity if we want to keep rats and insects under control.

An important route of chemical contamination that affects human beings is seafood consumption (Usero et al., 2004). Among the groups of pollutants highly toxic are heavy metals and PCBs, they accumulate in the tissues of marine organisms, and through the food chain, they reach human beings which cause serious health hazards (Aschner 2002). Several methods have been developed to check the toxicity of this chemical, for this purpose target hazard quotient (THQ) is used for non-cancer risk assessment. By this method, the toxic level of any chemical that affects human health can be determined easily (Darnerud et al. 2006).

When unnecessary changes occur in food, then food is reflected to be ruined, while chemical and physical pollutants do not alter the food itself. Enzymes and microorganisms work to spoil food and make food unpleasant to eat. Foods spoiling the most common bacteria are *Clostridium Botulinum* (They produce toxins in food responsible for botulism, and cause paralytic nerve illness), *and Escherichia coli.* (They are found in poultry, fruit, and vegetables; they cause 61 deaths in the United States every year*, Salmonella typhimurium* (They contaminate

meats, poultry, eggs, or milk products), *Shigella* (They contaminate salads, raw vegetables, poultry, meat, and milk), *Staphylococcus aureus.* (They are found in Poultry, potatoes, eggs, and sandwich fillings), *Vibrio cholera.* (These can be transmitted by food and water and cause cholera disease), *Vibrio vulnificus.* (These cause foodborne illness from contaminated seafood), while water is polluted by *Clostridium Perfringens, E. coli,* and *Enterococci,* and milk is contaminated by *Lactococcus cremoris*.

"Entamoeba histolytica (causes amebic dysentery, characterized by extreme diarrhea) contains parasites that pollute the food. It is transferred by infected water and is often referred to as "traveler's dysentery" due to its popularity in developed countries, *Giardia duodenalis* (A microscopic parasite that lives in humans and the intestines of animals) is found in every region of the world and causes waterborne and foodborne illness, *Cryptosporidium parvum.* (Found in herd animals like cows, sheep, and goat intestines), *Toxoplasma gondii* (Found in undercooked meats, like pork, and lamb, and in drinking untreated water), *Trichinella spiralis.*(It is a roundworm found in the intestine its larvae transfer from the digestive tract and form cysts in body muscles in the United States, pollution is most prominent where undercooked pork is disbursed), *Taenia saginatajsolium* (They are uncommon, but they cause contamination) (Gerba and Smith 2005a; Rogers and Haines 2005; Sobsey et al. 2006; Pappas et al. 2008; Bowman 2009).

Pathogens of animal origin that can be transmitted to humans are referred to as "zoonotic" and contain viruses, prions, protozoa, helminths, and bacteria. Others may infect one species of cattle, and others, in addition to human beings, may infect many types of animals. Such diseases can have severe problems and draw concern as outbreaks occur (Cotruvo et al. 2004). These diseases are difficult to eradicate from cattle and poultry since some have a resistant stage and some are endemic in their life cycle (Sobsey et al. 2006). Such bacteria can transport themselves to land and surface water.

For an illness to occur, a health expert cannot estimate how many virus particles a person must take because it is difficult to identify them in food. For any disease to develop, experts do not know that viruses must persist in digestive enzymes and stomach acid. At room temperature, viruses can live for 8 weeks on stainless steel and glass, 2 weeks or even months on low-humidity foods, and 4 ° C on meat for 8–14 days. Through multiple processes, such as livestock transmission, diseases penetrate the food chain. Due to the slight genetic variation in a small percentage of the microbe, a new strain of microbes emerges. For example, when antibodies

are given to chickens, most bacteria are destroyed, but there is no difference between small numbers of bacteria. This makes them firmer and allows them to persist. A new strain of bacteria forms when these bacteria reproduce, which are resistant to antibiotics. The most important thing to consider is how these bacteria get into the food chain.

There are two major pollution strategies in which pathogens penetrate food. First, the animal can move the pathogen; second, through an inappropriate manner of handling. For certain bacteria, animals are carriers. Protein-containing foods provide an atmosphere in which microbes can expand and multiply. Many warm-blooded beasts have bacteria that thrive in and on them. Animals transfer these bacteria to food materials. One approach is to encourage food items to come into contact with animal waste. This parasite can invade the digestive tract, causing death and illness. Eggs, beef, and milk are often associated with disease-causing foods. For this, there are three main explanations.

First, these materials provide a medium in which microbes can survive. Secondly, these are traditional foods that are typically absorbed into food in the United States. Third, many people are unsure how to treat certain diets to prevent sickness. When food is contaminated, poor treatment can allow replication of microbes and their sources when consumed. Improper treatment, cross-pollution, misuse of time and temperature, and inadequate personal hygiene are broken into three categories. It can also pollute food crops with these pathogens. Due to a source of animal agriculture, an important outbreak of human disease was concerned (Pachepsky et al. 2012; Rogers and Haines 2005).

Agrochemicals can be divided into a class, that is, biocides and fertilizers. When they reach the wrong targets, they cause contamination because they are poisonous materials. The continuous use of chemicals originates in soil, water, and air and sometimes in mother's milk. The pesticide devastates the enzyme and then inhibits the oxidation mechanism of energy generation and causes cell formation. Dichloro-di-phenyl-tri-chloroethylene (DDT) is the most popular compound that is used to destroy rodents and save the lives of millions of people in poverty. However, its overuse has induced pollution of the environment.

From the application area to remote areas, the toxic effects of DDT have been shifted. However, the threat of DDT hazards is decreasing. Some remedial measures must be developed to decrease the threats of agrochemicals. Usage of specially calibrated and designed spraying and dusting equipment to magnetize spray drops and minimize drift losses, likely through electrostatic spraying. Excavation of new products that can replace toxic synthetic biocides in the basic study (Sunitha et al., 2012).

We need different minerals day and night. For body function to be carried out, we need about 70 different minerals. However, others do not agree that there are two main types of minerals: inorganic and organic. Natural minerals are alive and can carry cells to live. These involve carbon and their electron/s spin clockwise much as our bodies, along with the fact that these cells can form an ionic bond with bodies and can quickly break down into substances to assist bodywork. Inorganic rocks, lacking carbon, are non-living and do not carry cells to live. They are handled as toxins by the body, kept tightly, and cannot be broken down quickly. There's a counter-clockwise electron/s spin. During the normal water cycle that is during evaporation, it may be isolated from water by which water extracts itself and the inorganic chemicals behind it.

Polycyclic aromatic hydrocarbons are the most common among organic substances. It is assumed that they are carcinogenic and mutagenic. They play an important role in hazardous products due to their distribution and toxicity. Such types of compounds are formed due to the incomplete combustion of organic matter. They are fat-soluble and used in coal furnace exhaust gases, car fumes, and mineral oil heating. Moreover, these materials can be produced by frying, roasting, burning, baking, and drying during food preparation and processing. During the drying process, the adulteration of vegetable oils with polycyclic aromatic hydrocarbons can result from the contact of oil seeds with combustion fumes. The key causes of food waste are water, air, sediment, and soil.

Tumors cause several deaths globally, and it is believed that diet plays an important role in cancer etiology. There is a link between diet and cancer, and food contaminants have been widely deliberated, and official hazard assessments are regularly performed by government and international organizations. Human hazards danger assessment consists of two parts. Firstly, it is to control adverse consequences of an exacting exposure, secondly; to decide the variety of coverage that puts a person in danger of an unfavorable penalty.

Two significant complementary programs; the International Agency for Research on Cancer (IARC) and the U.S. National Toxicology Program (NTP) occur to categorize whether exact toxins of food cause carcinogenic threats to human beings. Four main types of carcinogenic substances, such as natural foodstuffs, can be avoided, for example, grain contamination with aflatoxins, natural products in food, for example, salted fish, and anthropogenic chemicals already present in food, for example, 2,3,7,8-tetra-chloro-di-benzo-p-dioxin amass in foodstuff. Certain carcinogenic agents that hold the highest level of evidence for

food pollution are alcoholic beverages, 2,3,7,8-tetra-chloro-di-benzo-p-dioxin, aflatoxins, and salted fish.

Agents responsible for the modest stage of confirmation of food pollution are hot mate, nitrosamine, acetaldehyde, benzo [a] pyrene and N-nitroso-dimethylamine, while those with a lower stage of evidence are ochratoxin A, bracken fern, fumonisin B1, DDT, 2-amino-1-methyl-phenyl-imidazo (Gerba and Smith 2005b; Rogers and Haines 2005) [b]pyridine, coffee, acrylamide, pickled vegetable and fumonisin toxin. The addition of confirmations sufficient to cause to be found on pollutants of food and human tumor threat is an intimidating duty. Once renowned, removal of contact can be started by government rules, personal nutritional changes, and food manufacturer initiatives (Rogers and Haines, 2005; Abnet, 2007; Balan et al., 2020).

Food is a composite mixture of naturally occurring molecules, but sometimes several drugs, microbial toxins, certain preservatives, and pesticides are added to it, resulting in the food being contaminated. Analysis of food contamination is difficult due to the addition of these substances. For difficult food matrices, there is a need to implement a rapid and cost-effective residue method. For this purpose, bioanalytic methods are implemented, which are cost-effective and sensitive. Bioanalysis methods such as immunoaffinity chromatography, immunoassay, and immunogens are provided in sequence concerning the company and absorption of contaminants that affect an individual's physical condition and surroundings. Foodborne diseases all over the world are a growing public health concern. Therefore, a reliable and consistent estimation of the global burden incurred by the ingestion of food contaminated by microorganisms and chemicals must be given. To this end, basic but efficient immunochemical approaches may provide evidence in non-laboratory settings to assess the efficacy of food protection. This procedure can be used for sample preparation and identification (Van Emon 2016).

The technique of immunoaffinity chromatography will provide sample enhancement and clear-out before immunoassay detection. The high amount of organic solvents consumed and the limited sample volume approval. It is possible to combine the resulting extract with immunochemical detection. This procedure has been a standard technique for the analysis of mycotoxins in foods and has even been used to process toxins, pesticides, and veterinary residues (Van 2016; Li et al., 2009). Many immunoassay techniques have been reported for the detection of contaminants and pesticide residues. The enzyme-linked immunosorbent

assay (ELISA) is the most popular among them. It can be used to check food security from uncooked stuff production (Baranowska et al. 2008).

Another tool is a biosensor that aims to support the need for accelerated monitoring that can detect the presence of pesticide residues in drinks and food products before sales to customers. Numerous forms of immunosensors have been used for pesticide notification, such as surface plasmon resonance, evanescent wave, chemiluminescence, and fluorescence (Ramón-Azcón et al. 2009; Helmecke et al., 2020). By online finding and providing immediate and unplanned food allergen quantifications, this biosensor will affect the food safety software. Because of these allergens, there is a persistent risk to food safety because they are normal proteins in the world. An allergic expression of a systemic reaction, gastrointestinal, cutaneous, including lethal anaphylactic shock may be caused by a negligible amount of food allergens.

A new and rapidly rising field that involves manufacturing, dispensation, structure application, strategy, and control of the shape and size of systems on a nanometre scale is nanotechnology. In the market nanofood-linked foodstuff is already in and the doubt about possible hazards is high but the science-based variations of the narrow structure are high (Ramón-Azcón et al. 2009). Until the research is prioritized, all regulators and scientists should be mindful of the use of nanotechnology. Nanotechnology is classified into applications such as nanosensors, pesticide supplements, and packing materials in more than a few projects. An indicator of the likelihood of interaction with free nanoparticles for any application provided to consumers.

Insoluble-free nanoparticles like agglomerates are attention to be of uppermost anxiety to customers' physical condition. Nanotechnology applications risk analysis in food more imminent is desired in ease of use of different types of foodstuff comprising engineered nanomaterials. For nanotechnology in the chain of agro-food production, different surveys were accompanied. Four steps are involved in this chain, first; agriculture production (Nanosensors), second; dispensation and manufacture (food preparation instruments, food production refrigerators, and storage containers), third; conservation (foodstuff packing substances), and fourth; functional food consumption (supplements). Recently in the chain of agrochemical food production, nanotechnology applications are giving attention to the growth of nano-sized food ingredients and additives, and bioactive molecule delivery systems (Morgan 2005).

Metals, as minerals, contain animal feed nutrients that must be the purest because these materials not only impact livestock welfare but also join the food chain. Deposited mineral rock is often a combination of

different inorganic types and can often contain various other minerals. Naturally occurring chemical compounds present in water, the atmosphere, and soil are mercury, cadmium, arsenic, and lead. Through ingesting water and food, individuals may be exposed to the climate (Bouwmeester et al. 2009).

In February 2015, the European Food Safety Authority (EFSA) published a declaration relating to the occurrence of nickel in foodstuffs, especially in drinking water and vegetables. In food, the healthy nickel amount is 2.8 micrograms per kilogram of body weight. While EFSA 2015 published an opinion about the existence of methylmercury in food. An important nutrient present in foodstuffs is naturally occurring Chromium III. It helps regulate regular levels of protein, glucose, and fat metabolism. For chromium in food, no safe limit has yet been mentioned. A widely occurring contaminant is arsenic (Tirado et al. 2010).

Inorganic arsenic consumption is the main source of cereal grains and their products, water in bottles, beer, vegetables, rice, and fish. The EFSA revised its study on the presence of arsenic in food in March 2014. Uranium is a naturally toxic metal that can be present in nature, foodstuffs, and water in varying amounts. EFSA has established that average dietary interaction with uranium has recently been below the acceptable daily consumption of common citizens and high consumers in Europe. Naturally occurring environmental contaminants are driven by human activity such as mining and are also generated (Cao et al. 2020). In April 2010, an estimate of the possible hazards of physical conditions connected to the occurrence of lead in food, vegetables, and tap water was available to pay the most for nutritional contact with lead for many European people.

Many factors such as global trade, socioeconomic, agricultural land use, technological development, and urbanization affect food safety. In the food chain at many stages, from the point of manufacture to consumption, food security hazards can be affected by changes in climate. Climate-linked factors like temperature change and precipitation patterns, ocean warming, the intensity of extreme weather, and acidification in many ways affect food safety. It may also influence socioeconomic features associated with food schemes, for instance, farming, animal production, demographics, and human actions, which all prejudiced food protection (Ghaderpoori et al. 2018).

One of the useful processes used to extract lead, copper, cadmium, and salt from drinking water and also to remove some other minerals is reverse osmosis. As compared to water, these particles have a larger size which can easily trap and escape from drinking water. From the water, it removes 99% of pollutants. The World Health Organization (WHO) has interpreted

that most of the healthy minerals that are highly important for the human body come from dietary supplements or food and mostly not from tap drinking water (Binnie, Kimber, and Smethurst 2002; Onakpa, Njan, and Kalu 2018).

Any quick safety can be used to minimize the risk of contamination, such as attempting to avoid eating raw meat and fish in hotels and salads where vegetables and meat share a similar surface during processing. We need to take some precautionary measures to protect food from contamination at home, such as raw food being stored separately from cooked food, hand washing and equipment properly, defrosting food securely, cooking food at a healthy temperature, and throwing food away if you are not sure the food is safe.

Food poisoning causes diarrhea and stomach pain. Ingestion of bacteria found in infected foods is typically spread by multiple means. Based on living creatures, signs tend to vary from hour to hour, remain in the body, and then multiply after consumption. Based on the effects they trigger, such as diarrhea or vomiting causing dehydration, various foodborne diseases need assorted care. For people of all ages, food poisoning is serious and life-threatening.

For consumers in North America, the U.S. government initially announced the idea of food protection. The 1908 Federal Chemical, Cosmetic, and Food Act banned the computation of any hazardous substance in foodstuffs, and the 1938 Food Additive modification mandates that all additives be checked as nontoxic before food inclusion (Yang et al. 2020). The Food Safety Council was established in 1976 in the US, and its mission was to extend the requirements for calculating food distribution safety. In response to scientific research related to food, the Security Council developed some rules (Francis 1979).

Food safety is very basic for awakening consumers. On the other hand, proceeding to humanizing, it is significant to recognize the food security issues related to customers. Depending on the type of food safety issues, the consumer's attitudes toward food protection can be differentiated. Regarding the safety of food six factors dominated which scientists proposed like the issue of spoilage (microbial contamination), issue of chemicals (hormones in milk and food), regulatory issues (food inspection and labeling), and issues of health (Cholesterol contents), pretended practices (weight-reducing diet) and ideal circumstances (Hopper 1977; Wilcock et al. 2004; Afonne and Ifediba 2020).

To maintain and monitor a safe food supply, government organizations, and food industries should work together. The Hazard Analysis and Critical Control Point (HACCP) is a well-organized food

safety mechanism that reduces the risk of foodborne illness and requires routine inspections. For a healthy food supply, the cooperation and knowledge of all involved in the handling of food are important. Several technological and scientific inventions that are predictable to engage in recreation are the main position in serving to appreciate and to contract with food protection challenges pretended by the change of climate. Possible applications in the food and agriculture sector include new molecular biological approaches such as nucleic acid sequence assessments and genomic-based methods to distinguish multifaceted microbial communities and their connections, genetically modified crops, especially in those areas that are mostly affected by salinized soils and drought-fast pathogen and pollutant discovery using narrative techniques like nanotechnologies and new filtration strategy that can eliminate a range of microbiological and chemical pollutants from water and soil and finally from foods (Lake et al. 2012).

Supportable concentrations of food contaminants and appropriate levels of daily intake in human foods are calculated in animal studies based on the No Detected Adverse Effect Level (NOAEL). The maximum toxin concentration permitted by law is often at the stage of toxicological tolerance since such levels can often be sensitively obtained by good farming and processing practices. Several potential steps are being enforced by regulatory authorities to tackle risks associated with foodborne viruses.

- In 2011, EFSA released a summary of the "scientific perspective on reporting current information on the incidence and control of foodborne viruses" in print.
- The CODEX Food Hygiene Committee (CCFH) is now working on a guideline that is now available for final implementation.
- A traditional technique for the discovery of the norovirus and hepatitis A virus in foodstuffs is expected to be published this year by an expert working group formed by the European Committee for Standardisation (CEN).
- Regulation (EC) No 2073/2005 of the European Commission of 15 November 2005 specifies that food items should not contain microorganisms, their contaminants, and their metabolites in quantities that pose an intolerable risk to human health and underlines those approaches are needed for the identification of foodborne viruses.

Conclusion

Food contamination has become a serious issue with possible health risks in its path. Most food contamination occurs due to natural poisons and pollutants or as a result of food processing, packing, preparation, storage, and transportation. The detection of such pollutants is becoming easier as technology develops. There are, however, several pollutants that are currently unknown, and study is ongoing in this area. Although the government has taken necessary steps to reduce individual exposure to food pollutants, more needs to be done to reduce health risks and diseases associated with chemical food contamination.

Conflict of Interest

The author declares no conflict of interest, financial or otherwise.

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CHAPTER 2

FOOD CONTAMINANTS CLASSIFICATION

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Abstract: Environmental contamination by chemicals poses a major threat to human health and is a critical global food safety problem. Several groups of these substances include metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), perfluorinated compounds (PFCs), persistent organic pollutants (POPs), radioactive materials, waste electricity, pharmaceuticals, products for personal care (PPCPs), plastics, and nanoparticles. Some of these come naturally in the atmosphere, while others come from anthropogenic sources. They contaminate our food and drinking water, including fruits, livestock, and fish. An evaluation of the possible risks associated with this must be performed. Tracking pollution levels, and implementing control mechanisms, including remedial measures and recognition of sociopolitical implications, is critical to providing cleaner food worldwide. Food toxicity is a matter of considerable concern, as serious health risks result from the high concentration of chemicals found in edibles. Shielding the public from the magnitude of the harmfulness of infected foods has been a difficult challenge. The sources, forms, and health effects of chemical pollution in food are illustrated in this report. The pollution of food could be caused by natural pollutants in the atmosphere or artificially introduced by humans.

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Important contributors to food pollution are the stages of food production, packaging, transport, and storage. The risks to human health from these chemical toxins are severe, ranging from moderate gastroenteritis to fatal cases of liver, kidney, and neurological syndromes. While, by recommending minimum limits that are suitable for human consumption, the government controls certain chemicals in eatables. Preventive steps must still be taken to completely reduce food contamination. Therefore, it is important to inspect and assess a range of foods for the presence of chemical pollutants. The preventive steps related to issues with food contamination are presented and addressed.

Keywords: Food classification, Food description, POP, PFC

Introduction

Food contaminant refers to any components that are not added to the food to enhance the taste, but they are added during different processing or food handling (EC), OJ L. 2006`; 364: 5. #52). Food contamination discusses the occurrence of destructive chemicals and microbes in food which can cause user ailments. A distinct problem is inherently reformed constituents of food present from naturally adapted species; often bring up a form of food pollution. Chemical pollutants affect health and persistent usage causes tumors. Material toxins existing in foods most often are not affected by current treatment (Partridge and Murphy 2004).

Chemical toxins should be graded consistently with their origin of exposure and the process through which they access the food substance. Chemical toxins can exist in foods primarily as a consequence of consumption of agrochemicals, cross-contamination, or development during food manufacturing, for instance, remains of pesticides and veterinary products, emissions from natural sources (air, soil, and water pollution), passage from food packaging materials, incidence or uncleanness by natural pollutants, or consumption of unapproved food spices and ingredients (Sorrentino, Gorrasi, and Vittoria 2007).

Food safety has been a top health concern worldwide as the globalization of food supply has increased (Fu and Ying 2016; Xu 2016). One of the most serious food safety issues is chemical contamination in food. Environmental pollutants (e.g., heavy metals, mycotoxins), process contaminants (e.g., acrylamide, heterocyclic amines), residues (e.g., pesticides, antibiotics, veterinary medications), and unauthorized adulterants are among the principal chemical contaminants (e.g., food colorants) (Dusemund et al. 2017), (Rather et al. 2017).

Environmental toxins may be industrial or other elements found in soil, water, and air. They will move through the food chain and even bioaccumulate. Samples of chemical toxins that have been added to the food chain consist of "dioxins" (poly-chlorinated dibenzodioxins and dibenzofurans), poly-chlorinated bi-phenyls (PCBs), poly-brominated di-phenyl ethers, residual chlorinated pesticides (e.g., heptachlor, DDT, mirex, aldrin, dieldrin, chlordane), polycyclic aromatic hydrocarbons (PAHs), heavy metals, poly-fluorinated substances, perchlorate, pharmacological and personal care foodstuffs or halo-acetic acids and other water decontamination derivatives (Snow et al. 2009).

During production, certain harmful or unwanted composites such as roasting, heating, grilling, hydrolysis or fermentation, baking, and consistency may be produced in foodstuffs. These toxins can be found naturally in the entire food matrix, for example, if the Maillard reaction between amino acid asparagine and the reduction of sugar is designed to reduce acrylamide (particularly in potato and cereal-based heat-treated products). In contrast, nitroamines can be produced by combining natural foods with food spices, for example, in some processing chemicals. During acid hydrolysis of soya, wheat, and other vegetable protein products, carcinogenic chlorine and genotoxic chlorine-propanols such as 3-Monochloro-propane-1,2 diol (3-MCPD). Direct combinations of foodstuffs and packaging materials can lead to chemical pollution caused by the movement in foodstuffs of certain elements. The cases of migrants concerned with health can include bisphenol-A or plastic products phthalates, four methyl benzophenone, and two-isopropyl-thioxanthone mineral oil, inks, or semicarbazide, which are added to cover metal surfaces with glass packaging in plastic gaskets (Duncan 2011).

This chapter addresses the classification of food contaminants based on their origins such as chemical food contaminants, physical food contaminants, microbial food contaminants, food processing contaminants, environmental contaminants, and other emerging food contaminants.

Chemical Food Contaminants

Chemical food pollutants are elements that neither occur naturally in the usual raw substances used for food processing nor are added to the daily production method. Specimens are chemical toxins or chemicals that originate from the industrial cultivation of crops or animals or from inadequate processing of the food product itself. More troublesome is the classification of those complexes produced during routine manufacturing, such as yields of thermal processes containing flavoring food products. In

these circumstances, it is common to practice the name of certain compound pollutants that are known for their antagonistic effects such as acrylamide, while components that enter the food-specific flavor, for instance, Maillard products developed during roasting, baking, etc. are not characterized as pollutants. From a toxicological viewpoint, this difference is not necessarily clear-cut. Important classes of chemical contaminants are metals, for example, mercury or lead, chronic organic pollutants, for instance, polychlorinated biphenyls, and similar pollutants, which are often found in indefinite forms of food deriving from background amounts of these complexes in our setting. Moreover, natural pollutants like microbes or plants, and complexes formed during the thermal treatment of food are of great concern. As a whole, a scientific risk assessment needs to be performed for every known toxin. This includes a toxicity investigation and epidemiological assessment. On these grounds, legislative and/or technical interventions will also restore the situation. The most relevant circumstances for a scientific risk evaluation and fruitful employment of legislation are highly proven food quality management, food toxicology, and nutritional epidemiology (Schrenk 2004). The public's assessment of chemical dangers is also influenced by how scientific data is interpreted (Taarup-Esbensen 2019). Epistemic doubts (e.g., concerning a chemical's inherent qualities or toxicity) frequently persist in toxicological health risk assessment, prohibiting decisive judgments about whether a chemical is a risk (Jansen et al. 2020).

Agrochemicals

The agrochemicals in agriculture and animal husbandry are chemicals to increase production and reduce costs. Such agents include pesticides (e.g. pesticides, herbicides, and rodenticides), regulatory plant growth, veterinary medicines (e.g. nitrofuran, fluoroquinolones, green malachite, chloramphenicol), and cattle somatotropin. According to the World Health Organization (WHO), there are three million cases of pesticide poisoning in underdeveloped countries. Long-term detrimental consequences on nutritional security, and human and animal health have resulted from the extensive and indiscriminate use of agrochemicals, which has harmed soil biodiversity, agricultural sustainability, and food safety (Meena et al. 2020; Meena et al. 2016).

Pesticides and Carcinogens

There are many cases of banned pesticides or cancer-causing agents detected in foods.

- In China in 2006 Greenpeace indicated that 25 percent of the agricultural commodities surveyed were found to contain banned pesticides. Over 70% of tomatoes tested confirmed that Lindane was banned, and almost 40% of the testers had three or more types of pesticides in their combinations. In this examination, fruits were also confirmed. Strawberries, young tester, and tangerines have been found to contain highly poisonous methamidophos as poisonous forbidden pesticides. The fruits can also be found on the market in Hong Kong. Greenpeace announced that fruit grown in Hong Kong as of 2006 is not subject to inclusive control (CSR 2006).
- In the Vietnamese national Pho, dish and the Vietnamese food scare broke in 2007, the cancer-causing agent called formaldehyde was detected. Also, reported forbidden pesticides were fruit and vegetables. "Santé agencies acknowledged that Vietnamese soy sauce, the second-largest sauce in the country, has been full of carcinogenic substances since at least 2001" (Snow et al. 2009). In Asian salsa, the cancer-causing agent is 3-MCPD and its 1,3-DCP metabolite, a persistent delinquent that disrupted many areas before 2000.
- Indonesia food scare in 2005, cancer-causing agent, formaldehyde was used for preservation in salted fish, tofu, noodles, and meatballs.
- Chinese milk scandal, 2008.

Veterinary Drug Residue

Veterinary medicines compared to pesticides are agrochemicals that go through a formal registration process after their extreme residue/tolerance limits in foods derived from animals are established. Exposure to veterinary medicines (i.e., soil, water, and sediment) by humans is feasible through many forms including (1) the use of crop materials to mount elements from the soil with exposure to polluted manure and slurry; (2) the use of veterinary drugs in food chains; (3) fish for handling in aquaculture; and (4) human exposure to human veterinary medicines Exposure is feasible. The intake of dust from intensively raised livestock facilities can also lead to communications. The main veterinary medicines classes include coccidiostats, anthelmintics, immunizations, non-steroidal