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Chemical pollution of foods: a review

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ABSTRACT

The term food contamination indicates that food and or water contains what makes it unfit for human or animal consumption, whether it is harmful micro-organisms, toxic chemicals or food contaminated with lethal radioactive materials, which may result in eating food infecting the consumer with diseases, the most famous of which are diseases related to food poisoning. Food contamination problems are among the most directly affecting human health problems. Food contaminants can be classified into chemical, physical, and biological pollutants. In this review, we aim to explain the chemical pollutants to foods. Information on these chemical pollutants would enable us to avoid and manage food contaminants for better health and wellbeing.

Key Words: Food contamination, toxic chemicals, Disease and Human health

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I. Introduction

Contamination of food refers to food that has been contaminated by another material-physical, biological, or chemical. Biological contamination refers to food contaminated by the organisms or substances that they are producing. This includes human-produced biological matter, rats, insects, and microorganisms. Typically, bacteria and viruses are the two main causes of bacterial contamination which can contribute to some of the most common forms of food poisoning including salmonella, E. coli, listeria, which noroviruses. While physical contamination comes when a foreign object contaminates food. This can happen at any point in the manufacturing process and may involve Band-Aids, steel wool, or plastic parts. An individual who unintentionally absorbs the foreign object can be harmed by physical contamination. The additional risk associated with the physical contamination is that the foreign object could carry biological contamination. On the other hand, chemical contamination refers to food contaminated with a natural or man-made chemical substance. These contaminants are especially hazardous since they expose people to any number of toxic substances, some of which can be fatal. Chemicals can also contaminate food at any stage in the food chain, whether the food is produced in or during the manufacturing process by pesticides transferred from the soil. To help protect against chemical contamination it is important to store chemicals separately from foods. Another type of contamination is the cross-contamination of food. Cross-contamination occurs when biological, physical, or chemical contaminants enter food, making eating unsafe, and putting people at risk for food-

borne illness. Cross-contamination is a huge problem for food businesses, which is why it is so important to train food safety and hygiene for everyone who handles food in business places (AIFS, 2020).

Non-bacterial food contamination means any chemical substance that may reach the food during the production or circulation process or may be added to the food imposing its preservation, or it may be naturally present in the food, which represents a risk to the health of the food consumer in the event of its consumption (Stasinou et al. 2014). These are those who consider that chemical pollution in general and food contamination, in particular, is a price that must be paid for the accomplishments achieved by the industrial explosion, which has taken enormous proportions in recent years, and which has evolved from mere localized filth to become a general polluter of the whole nature of the extent of its effects in a way that does not identify in past decades. It can be predicted sometimes, because of its slow and continuous proliferation, whether with air, water or soil besides food, and not subject to the natural, automatic phenomena of self-technology, unlike biological pollution as a source of fermentation, rot, and microbial reproduction that deals with itself, given the self-technique, for example, the main source of pollution - thanks to the sun's rays, which quickly put an end to the multiplication of pathogens, which makes these forms of pollution remain confined to their place of origin, especially in close proximity to human populations (Bao et al., 2012). However, heavy metal salts, pesticides, hormones, antibiotics, sedatives, Industrial dyes and preservatives, rotten oils, etc. could be a potential source of chemical pollutants in foods. Therefore, this review article synthesized the food contaminants that could potentially harm human health.

II. Literature Review

In this review article, we have compiled information associated with chemical pollutants of foods. Different chemical pollutants that could be potentially dangerous for health are discussed below.

Heavy metal salts

Heavy metals could be a range of materials, including arsenic, antimony, lead, phosphorous, etc. Food could be contaminated with heavy metals in various ways: because of cooking food that is already contaminated by heavy metal in the process of food production and or food chain, keeping it for a longer period, or eating it in metal containers that do not meet the necessary health conditions. Food contaminated with heavy metal will cause severe damage to the person who is taking/feeding it. Contamination of food with arsenic salts may increase the levels of sedimentation in the skin, leading to carcinogenicity (Mahmood and Malik, 2014). The food production chain and food quality must be assessed before any food is exposed to consumers.

Pesticides and Insecticides

Vegetables and fruits treated with pesticides during agricultural practices and management could be contaminated, as these pesticides are usually concentrated in plant tissues. This, in turn, results in severe poisoning cases for those who eat them, especially if they are not washed well before consuming fresh vegetables and fruits. The severity of poisoning resulting from these pesticides varies according to the type and concentration of the pesticide. Examples of these contaminated pesticides include insecticides known as DDT (dichloro-diphenyl-trichloroethane), toxaphene, and dieldrin. Toxaphene is a rapidly dispersing pesticide with fatty tissue, and it produces ulcers. It may cause cancerous injuries to tissues that contain a high concentration of fat, such as the liver. The use of agrochemicals such as insecticide and pesticides should be controlled in agricultural production to avoid foods to be contaminated with pesticides.

Dieldrin is also one of the most dangerous food contaminants, and it is one of the most famous pesticides that have been used in the United States for a long time, due to its high efficiency in eliminating grain insects, and even its harmful effects to humans have been proven and due to the seriousness of the pollution effect of pesticides on meat, millions of chickens were destroyed in Mississippi in 1974 (as a result of contamination of their meat with high concentrations of those pesticides, whose amount of pollution exceeded five times the permissible limits, in order to avoid the excitement of cancer in the bodies of those who feed on that meat that was polluted (Carvalho, 2017)).

Hormones

Hormones are organic compounds that naturally form in the body to affect a certain biological process. Breeders of cows, sheep, and chicken may use hormones to fatten their animals, either by injecting animals with the estrogen hormone or similar substances or by adding it to their feed. The excessive concentration of these hormones (carried to the person within their diet) causes cancerous tumors in different parts of the body, as well as leading to endocrine function and affect fertility, as a result of the increase in the hormonal level accompanying the feeding of foods contaminated with high concentrations of them.

Antibiotic

Breeders of animals used to inject their animals with large quantities of antibiotics, especially penicillin, in order to cheapen its price and its high efficiency in protecting animals from infection with many diseases resulting from raising them in unsanitary conditions. Where penicillin causes an increase in the weight of the animal, as a result of its stimulation of secretions of the sexual glands, and its activation of the secretion of thyroxin from the thyroid gland.

Therefore, animal breeders resort to the use of these antibiotics, but repeated injections of animals into them lead to an increase in their concentration in their fats, meat, and milk, and then they are transferred to the human body (which they feed on), so the effectiveness of its effect with antibiotics decreases when it is used in treatment (Rathe et al. 2017).

Sedatives

Some animal husbandry resorted to injecting calves and sheep with sedatives hours before slaughtering them, in order to thirst and drink large quantities of water and gain weight. The World Health Organization (WHO) has warned against the use of these sedatives, as they have harmful effects on the nerves of humans who eat contaminated meat.

Rotten oils and grease

The human consumption of boiled oils (several times) in his diet leads to many diseases, such as liver cancer, and its enlargement. The results of the research have shown that the repeated boiling process of edible oil - in the presence of an abundance of oxygen - leads to the formation of peroxides and fatty acids that cause its acidity to rise and its hydroxides increased. Scientific experiments have proven that giving experimental animals repeated doses of boiled oil has multiple damages, such as roughness and ulceration of the skin, increased fat, increased liver and heart rate, loss of appetite, weight loss, and hair loss. Mineral oils derived from petroleum are considered to have very serious pollution effects, as oil wastes pollute water, and from there to human and animal food chains.

Industrial dyes and preservatives

Food is contaminated with many industrial dyes, for example, design dye, red dyes used in candy, pickles, syrups, and soft water. The results of many researches show that increasing the proportion of these industrial dyes and increasing their accumulation in the body is closely related to liver tumors. It is also worth noting the importance of being careful when using preservatives to extend the life of preserved foodstuffs, as increasing the concentration of these preservatives in foods beyond certain limits makes it a source of poisoning to the human being fed with them (Rathe et al. 2017).

III. Concluding remarks

Heavy metals in food items, pesticides, and insecticides during agricultural production, hormones, antibiotics, rotten oils, and sedatives – these all can be detrimental for human and animal health issues. Certain regulations and standards are much needed to control the use of these food contaminants so that health issues could be avoided not only for humans but also for animals. While industrial effluents (i.e. dyes and preservatives) can mix-up with soil and water and can end up into the food chain. Therefore environmental sanitation and strict industrial regulations are needed for both the developing and developed nations worldwide.

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