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FOOD IRRADIATION: A REVIEW OF ITS USE IN PRESERVATION OF FRUITS AND VEGETABLES

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ABSTRACT

This review explores food irradiation as a nonthermal, energy saving method for preserving fruits and vegetables. The process involves exposing food to ionizing and non-ionizing radiations, enhancing shelf life and safety. The potential of this underutilized technology is discussed, highlighting the need for further research and consumer education.

KEYWORDS: Non-thermal preservation, radioactive, food safety, shelf life.

APPROACH
Current knowledge of how ionizing and non-ionizing radiations affect several aspects of fruits and vegetables is discussed in this overview.

I. INTRODUCTION

Modern food technologies are a powerful tool for preventing global food-borne outbreaks, which have severely disrupted the social fabric and economy. Post-harvest losses and microbial contamination are the main sources of these food-borne illnesses since processors struggle to extend their shelf life and make them available primarily in the off-season for future usage (Wakholi et al., 2015). The inactivation of enzymes and the long-term removal of harmful bacteria that cause food spoilage are accomplished through thermal methods of food preservation (Koca et al., 2018). The significant energy used by these techniques raises the expense of preservation (Barba et al., 2017). Food is exposed to a specified dose of non-ionizing radiations, such as UV, visible light, infrared, radio waves, or ionizing radiations, such as gamma rays, X-rays, and accelerated electron beams, to kill germs such as viruses, bacteria, etc. Food irradiation is one sort of non-thermal approach. Food's flavor, color, nutritional value, and other qualities are only slightly impacted by it (Kalaiselvan et al., 2018).
Irradiation of food is a processing and preservation method that produces outcomes comparable to pasteurization or freezing. In the field of food processing, food irradiation is a well-known and proven technique. The food is subjected to radiation or ionizing energy doses throughout this process. Irradiation increases a product's shelf life at low levels. This method eliminates insects, mold, germs, and other potentially hazardous microorganisms at greater dosages. Years of research investigations have established its safety and led to specialists both domestically and internationally recognizing it (Ehlermann, 2016)**.**The Joint Food and Agricultural Organization/International Atomic Energy Agency/World Health Organization (FAO/IAEA/WHO) Study Group on High-Dose Irradiation (JSGHDI) found in 1997 that food irradiated with doses greater than 10 kilograys (kGy) is safe and wholesome.

II. History of food irradiation

With a century and a half of history, food irradiation was developed as a safe food technique and technology during the latter part of the 1800s. (Molins, 2001). Although it has been extensively researched and developed, this is the most advanced minimum processing technique that is least used in Europe. While food is frequently exposed to radiation, such as microwaves, the term "food irradiation" refers to a process in which the food is exposed to ionizing energy using gamma photons released by 60Co (or very rarely, 137Cs) radioisotopes, machine-generated X-rays (also known as "Bremsstrahlung") of up to 5 MeV, or accelerated electrons with a maximum kinetic energy of 10 MeV. (Farkas, 2004).

III. Food irradiation and radioactivity

Irradiated food isn't radioactive, unlike what many people believe. The radioactive fallout that results from an accident like a nuclear one is significantly different from the radiation that is used to produce food. The radioactive sources that are allowed during food processing do not produce gamma, electrons, or x-rays with energies high enough to render food radioactive. After treatment, the meal contains no trace of radioactive energy.
Three internationally renowned organizations that favor food irradiation include the World Health Organization (WHO), the American Dietetic Association, and the Scientific Committee of the European Union.

IV. Mode of action of types of radiation

a) Non-ionizing radiation

Non-ionizing radiation is a type of energy that is generated by a device that can emit electromagnetic waves of a specific wavelength and travel through space. Because these radiations have insufficient energy to stimulate a molecule or an atomic electron and are generally not dangerous, no modifications are usually made (Pathak et al., 2018). Non-ionizing radiation sources include extremely low frequency (ELF), radio frequency, infrared, and ultraviolet (UV).

Non-ionizing radiations (UV)

The use of ultraviolet radiation in food processing has also emerged as one of the most advantageous methods with significant commercialization potential (de la Pea, 2019; Jermann et al., 2015; Morales). Numerous studies have shown that using ultraviolet irradiation as a non-thermal method of food preservation yields effective results. UV light is classified into four types based on wavelength: UV-A, UV-B, UV-C, and UV-V.

V. Food irradiation technique

Ionizing radiation is used to treat food, which can come in the form of gamma rays, a high-energy electron beam, or potent x-rays. Although they have far more intensity and penetration than microwaves, gamma rays, and x-rays are types of radiation that resemble them in certain ways.
Similar to microwaves in a microwave oven, the rays pass through the food, but there is little to no heating of the food. Food does not become radioactive when exposed to gamma rays. Electron beams and x-rays are created with electricity that can be turned on and off, and they do not require radioactive material.
Organisms that spoil foods, such as insects, molds, and bacteria, including some important food-poisoning bacteria, can be killed in both cases. Viruses cannot be killed by irradiating food.

VI. Several benefits of food irradiation

Some advantages of this kind of food processing include:
a) Increased shelf life of specific products
b) Fewer food spoilage
c) A reduction in the risk of food-borne illnesses brought on by microorganisms like Campylobacter and E. salmonella is Listeria and E. coli (especially in meat, poultry, and fish)
d) Reduces the need for insecticides
e) Fewer additives, such as preservatives and antioxidants, are required.
f) There is less chance of exporting or importing food products that include insect pests.
g) Fewer hazardous chemical treatments are required, such as those that are applied to some spices to kill microorganisms.
h) As an alternative to the currently used ozone-depleting gas for sanitizing imported fruits, grains, and vegetables
i) Reduced sprouting of potatoes, onions, herbs, and spices.

VII. Effects of irradiation on food

Eggs and dairy products cannot be radioactively treated since the process alters their flavor or texture. Produce, cereals, meats (including chicken), spices, and fruits can all be radioactively treated.

Radiation merely modifies the food's chemical composition somewhat, but it can reduce the amount of nutrients in particular foods by depleting certain B-group vitamins. Similar losses happen when food is prepared or preserved using more conventional and well-known techniques, including canning or blanching. Impact of ionizing gamma and X-ray radiation on various fruits and vegetables physicochemical, nutritional, and microbiological characteristics

The discovery of radioactivity in 1895 led to the development of the use of ionizing radiation for the preservation of food (Harder et al., 2016). Recent research has examined the use of gamma radiation to irradiate food as a technology to prevent food deterioration without compromising the food's safety, quality, or nutritional content (Fernandes et al., 2017). Hence, gamma irradiation appears to be a chemical-free and effective way in a variety of non-thermal methods for food preservation.

VIII. Future of food irradiation

A greater understanding of food irradiation technology's potential role in preventing food-borne illnesses and spoiling, as well as a willingness to pay for food safety processing, are crucial to reversing the slow adoption of this technology (Mossel & Drake, 1990). All involved parties should embrace the technique more broadly if food irradiation laws continue to advance, especially in the European Union.

Food irradiation presents a promising method for preserving fruits and vegetables. While it has been shown to enhance shelf life and safety, it remains underutilized. Further research is needed to establish its safety and efforts should be made to increase consumer awareness and acceptance.

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X. Conflict of interest

There are no conflicts of interest.

XI. References

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