

Sensory and Microbial Quality of Chicken as Affected by Irradiation and Postirradiation Storage at 4.0°C

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ABSTRACT

Chickens were subjected to gamma irradiation doses of 2.5, 5.0, 7.5, and 10.0 kGy using a semi-commercial gamma irradiation facility. The irradiated and unirradiated (control) chickens were stored at 4.0°C, and samples were drawn at day 0 and at 3-day intervals up to 21 days for sensory and microbiological analyses. All irradiation doses (2.5 to 10.0 kGy) had little effect on the sensory acceptability (appearance, odor, texture, taste) of both raw and cooked chicken (breast and thigh). Irradiation extended the time during which these characteristics were acceptable. Moreover, juiciness and tenderness of cooked chicken were only slightly affected by irradiation, and chickens were not rejected even after 21 days of storage. A dose of 2.5 kGy seemed adequate to extend the shelf life of chicken by 12 days, and increasing the dose level above 2.5 kGy gave little if any additional benefit as far as total and psychrotrophic bacterial counts are concerned. Moreover, the dose of 2.5 kGy was enough to destroy *Salmonella*, *Yersinia*, and *Campylobacter* species and coliforms. The study also showed that yeasts of the genera *Candida*, *Saccharomyces*, and *Alternaria* started to grow on day 12 in samples treated with ≥ 5.0 kGy, but not in samples treated with < 5.0 kGy.

Key words: Gamma irradiation, chicken, microbial quality, sensory evaluation

The United States Food and Drug Administration approved on 2 May 1990 the treatment of poultry with ionizing radiation for the control of *Salmonella* and other foodborne pathogens (8). Moreover, poultry meat was considered by a WHO/FAO/IAEA expert committee as a food product with relatively high initial bacterial load, as it typically leaves the processing line with a total bacterial count between 5×10^5 and 10^7 per square centimeter (38); this food product is therefore highly perishable. Poultry meat can be satisfactorily decontaminated of spoilage microorganisms (37) and be rendered free of *Salmonella* and other pathogens (39) by the use of ionizing radiation. Cho et al. (4) stated that gamma irradiation could extend the shelf life of chicken by 2 to 4 weeks. The eating quality of leg meat

irradiated with 3.7 kGy was satisfactory for at least 1 week and decreased after about 3 weeks (3). However, breast meat exhibited changes but was satisfactory for eating for about 3 weeks, and a decrease in quality was noticed after about 4 weeks of storage. Klinger et al. (20) reported that chicken irradiated with ionizing radiation (2 to 4.5 kGy) became free of salmonellae, coliforms, and staphylococci and had bacterial counts that were reduced and dependent on irradiation dose. Moreover, extensive taste panel tests showed that the sensory quality of chicken meat after irradiation with about 3.7 kGy did not differ from that of control samples. However, with postirradiation storage of the meat at chill temperature the sensory quality decreased to an unacceptable level in about 3 to 4 weeks. El-Husseiny et al. (7) reported that the rate of increase in number of spoilage microorganisms of various groups in irradiated chicken was lower than in the unirradiated control. No growth of pathogens was observed after treatment with 3.0 or 5.0 kGy. Hanis et al. (10) reported that chicken was free of *Serratia marcescens* and *Salmonella typhimurium* after treatment with radiation doses of 2.5 to 5.0 and 10.0 kGy, respectively.

Local production of poultry in Saudi Arabia was 339,887 and 347,144 tons in the year 1993 and 1994, respectively (29, 30) and is expected to increase in the coming years. Food irradiation offers a means of extending shelf life and increasing the safety of chicken consumed. The need for this technology is obvious because poultry is usually contaminated by several pathogenic microorganisms such as *Salmonella*, *Campylobacter*, and *Yersinia*. This study was part of a series of studies to establish rules and regulations on application of gamma irradiation in Saudi Arabia. The objective of this work was to study the effects of gamma irradiation treatment at different doses and post-irradiation storage at 4.0°C on the sensory and microbial quality of chicken.

MATERIALS AND METHODS

Preparation and irradiation of chicken

Chicken samples were purchased from a local poultry plant in Qassim (330 km north of Riyadh) and transported in an air-conditioned van within 6 h of slaughtering to the Meat Laboratory

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