



Effect of Gamma Irradiated Saffron Petal Ethanolic Extract on Viability of *Lacticaseibacillus paracasei* M4PM99 and Assessing their Antioxidant Properties in Probiotic Yogurt

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Abstract

BACKGROUND: Nowadays, the interest in functional food has dramatically increased. Herbal plants and functional foods have health-enhancing effects on consumers due to their medicinal, antioxidant, and nutritional properties. Probiotics are one of the most emerging and popular functional food products.

OBJECTIVES: This study aims to assess the effect of irradiated and non-irradiated saffron petal extract on the viability of *Lacticaseibacillus paracasei* (M4PM99) in probiotic yogurt.

METHODS The ethanolic extract of irradiated saffron petals with a 10 KGy dose of gamma ray at concentrations of 25, 50, and 75 mg/mL and non-irradiated extract at the same concentrations were used and their effect on the viability of *Lacticaseibacillus paracasei* and their antioxidant and physicochemical properties in set yogurt were studied. Probiotic survival, pH, acidity, content of total phenolic compounds, DPPH inhibition percentage, and sensory properties on days 0, 7, 14, and 21 were assessed.

RESULTS: Both irradiated and non-irradiated saffron extracts significantly increased the viability of probiotic bacteria compared to the control sample ($P < 0.05$). The addition of extracts was effective in increasing acidity and decreasing pH compared to the control ($P < 0.05$). With the increase in the amount of extract, the percentage of DPPH inhibition and phenolic compounds significantly increased in the irradiated samples ($P < 0.05$). The effect of storage time was also significant on these indicators, such that the antioxidant properties and phenolic compounds increased until the 14th day and then decreased ($P < 0.05$). In the sensory evaluation, in terms of taste, odor, and color, the lowest score was related to the sample containing 0.75% extract. No significant difference was observed in other concentrations compared to the control sample.

CONCLUSIONS: Saffron petal extract has a positive effect on the viability of probiotics during storage. Gamma irradiation has a significant effect on the amount of total phenolic compounds and the antioxidant activity of saffron petal extract. It can be used as a natural antioxidant in dairy products.

Keywords: Antioxidant properties, Irradiation, Probiotic, Saffron, Viability

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Figure Legends and Table Captions

Figure 1. FTIR diagram of non-irradiated (A) and irradiated (B) saffron petal extracts.

Figure 2. The average number of bacteria (cfu/g) in the samples during storage. ZP: irradiated extract, Z: non-irradiated extract.

Figure 3. The average acidity values (D) of the samples during the storage time. ZP: irradiated extract, Z: non-irradiated extract.

Figure 4. The average pH values of the samples during the storage time. ZP: irradiated extract, Z: non-irradiated extract.

Figure 5. The average total phenolic content (mg/g) in samples. C: control; SP-25: non-irradiated level 25; SP-50: non-irradiated level 50; SP-75: non-irradiated level 75; SP-G25: irradiated level 25; SP-G50: irradiated level 50; SP-G75: irradiated level 75.

Figure 6. The average of DPPH free radical-scavenging effect (%) in the samples. C: control; SP-25: non-irradiated level 25; SP-50: non-irradiated level 50; SP-75: non-irradiated level 75; SP-G25: irradiated level 25; SP-G50: irradiated level 50; SP-G75: irradiated level 75.

Figure 7. The average of sensory evaluation in the samples. C: control; SP-25: non-irradiated level 25; SP-50: non-irradiated level 50; SP-75: non-irradiated level 75; SP-G25: irradiated level 25; SP-G50: irradiated level 50; SP-G75: irradiated level 75.