Mycopath (2014) 12(1): 53-57 **Research Article**

Influence of gamma radiation on nutrient contents of canned tomato paste

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Abstract

Irradiation is a vital tool for preventing canned tomato paste from spoilage as well as increasing its demand as sterilized food. In the present study, canned tomato paste was irradiated at two different doses i.e. 1 and 3 kGy. A dose of 3 kGy was considered as an optimized dose after comparing results with reported articles. The colour of samples radiated with either 1 or 3 kGy remained stable. The contents of moisture, ash, protein, carbohydrate and total soluble solid of the gamma-irradiated canned tomato paste were better as compared to control samples. Samples irradiated at 3 kGy showed more shelf life than that of 1 kGy and control. Hence it can be inferred from the present study that gamma radiation can be used as a tool of sterilizing the canned food material at optimized dose without significant altering its nutrient content.

Keywords: Gamma radiation, nutrient content, proximate analysis, tomato

Introduction

Tomato (*Lycopersicon esculentum* L.) is one of the most widely eaten fruit and vegetable, being the second most important vegetable crop throughout the world (Crozier *et al*., 2006). Tomato belongs to the group of perishable fruits, hence easily subjected to spoilage by both bacteria and fungi due to its high water content (Alabi and Esan, 2013). Tomatoes contain approximately 93 to 95% water and 5 to 7% total solids (TSS) (Barrett *et al*., 1998). Proximate analysis of different vegetables was made and moisture content of 93.5 g 100 g^{-1}, protein 0.9 g 100 g^{-1}, carbohydrates 3.9 g 100 g^{-1}, and ash 0.9 g 100 g^{-1} was recorded (Hanif *et al*., 2006). It was also found that canned tomato paste (100 g^{-1}) contained 90.79 g, 1.36 g, 6.86 g and 0.95 g water, protein, carbohydrate , and ash, respectively(Padovani *et al*., 2007). To avoid microbial degradation it is imperative to increase shelf-life of fruits. It has been documented that shelf-life of many fruits and vegetables, meat, poultry, fish and seafood can be considerably prolonged by treatment with combinations of low-dose irradiation (Sebastiao *et al*., 2002). The microbial shelf life of irradiated tomatoes was enhanced by irradiation (Prakash *et al*., 2002). It was later investigated that canned tomatoes could be stored for five days after exposing it to certain temperature (Robinson and Kolavalli, 2010). Furthermore, tomatoes exposed to irradiation at dose of 1-2 kGy could increase shelf life of fruit (Trumbo *et a*l., 2013). The present study was aimed to increase the shelf life of canned tomato paste and to enhance hygienic quality of food. Therefore, the study was done to investigate the optimize dose of gamma radiation to increase the shelf life of canned tomato paste.

Materials and Methods

Collection of sample and experimental site

The samples of the canned tomato paste were taken from the different departmental stores centered in the local market of Lahore. The samples were sent to Pakistan Radiation Services for gamma-irradiation and then the proximate analysis of canned tomato paste was done at Food Biotechnology Lab in Lahore College for Women University**.**

Proximate analysis

AOAC (2005) official method was used for proximate analysis of canned tomato paste. Canned tomato paste was analyzed to find out moisture content, ash, fat, protein, fiber carbohydrates, and protein. Moisture content was determined by using hot-air oven method and ash test was performed by using the Muffle furnace. Fat composition was determined by Soxhlet reflux apparatus. Protein content was determined by Kjeldhal method. TSS was analyzed by using

Refractometer. Carbohydrates were determined by method of differentiation.

Statistical analysis

All experiments were arranged in completely randomized design and data was analyzed using Costat software data (mean $\pm$ SE) and then data was selected from five replicates based on Duncan's Multiple Range Test (Steel *et al*., 1997).

Result and Discussion

In control sample color did not change but fungus started to grow on it on 3rd day in week 1. Sample that was irradiated with dose 1 kGy showed color variation from red to pale red and fungus growth was observed on 4th day of irradiation. Sample irradiated with dose 3 kGy the color varied from red to orange yellow and then finally blackish red color. Fungus growth was started to grow on 15th day after irradiation.

Physicochemical properties of canned tomato paste depend upon the presence of carotenoids present in it and these carotenes may also affect the color of food (Wilkerson *et al*., 2013). In the present work, the color of sample radiated with dose 3 kGy remained stable during 1st and 2nd week. During current research work in 1st and 2nd week the color of sample radiated with dose 3 kGy remained stable. Hence 3 kGy dose was optimized.

The moisture content of the gamma-irradiated canned tomato paste was reduced with the passage of time (Fig. 1). The samples were observed for three weeks to check the moisture level. In control samples highest level of the moisture content (20 g 100 g^{-1}) was recorded. Samples irradiated with 1 kGy and 3 kGy showed low moisture content. The moisture content gradually decreased from 1 to 3 week and at dose 3 kGy samples retained the minimum moisture contents (Wang and Chao, 2003). Thus the moisture content in canned tomato paste was according to the already mentioned terms and conditions.

Ash content is used to determine the mineral content in the food. Results showed ash content was decreased with the passage of time (Fig. 2). Control showed the 2.25 g 100 g^{-1} ash content in first week, it decreased to 2.21 g 100 g^{-1} in the third week. In the same way it also decreased at 1 and 3 kGy. Dose 3 kGy showed the maximum ash content as compared to samples radiated with 1 kGy and control. Therefore, the dose of 3 kGy was found as best dose. It was reported that with increase in dose the ash content of sample increased and with increase in storage duration the ash content of the sample decreased. Bhat *et al*. (2008) findings revealed that ash content formation is dose dependent procedure.

Refractive index of a sample describes total soluble solid (TSS) present in food. The TTS was increased in canned tomato paste sample with increase in time period (Fig. 3). In control sample, the TSS was 1.42 brix%, which increased up to 1.48 brix% in week 3. At 1 kGy and 3 kGy TSS was also increased. Results showed that, there is an inverse relationship between TSS and moisture. It means that, when moisture decreased, the TSS increased (Mostafavi *et al*., 2013).

The results showed that by weeks the level of protein content in canned tomato paste was decreased (Fig. 3). The dose of 3 kGy showed the 1.9 g 100 g^{-1} of protein in week 1 that decreased to 1.80 g 100g^{-1} in week 2 and then to 1.69 g 100 g^{-1} in week 3. In the same way control sample and sample radiated with 1 kGy also showed declining effects. The dose 3 kGy showed the lowest amount of protein in the canned tomato paste which decreased to the 1.69 g100 g^{-1} in the third week from the 1.90 g 100 g^{-1} in first week. Mehta and Nair (2011) reported a reduction in protein content at higher doses.

No fat content was found in canned tomato paste. This phenomenon was repeated firstly with control sample, and then with sample radiated with dose 1 kGy and 3 kGy respectively. Tests were followed for three and no fat content was found in samples. Fat is 0 g100g^{-1} in canned tomato paste or if present only in trace amounts.

The results of the carbohydrates showed the declining of its level in the control sample. Results of dose 3kGy showed the 75.81g 100 g-1 carbohydrate content in first week and 75.25 g 100 g^{-1} in second week while it decreased to 74.37 g 100 g^{-1} in third week. Dose 3 kGy showed the highest level of the carbohydrates in the sample as compared to dose 1 kGy and control. Carbohydrates increased in sweet potatoes after gamma irradiation (Hayashi and Kawashima, 1982). Carbohydrate evaluation included the sum of all the other testing results. In current findings the carbohydrates level increased in the radiated canned tomato paste.

It is concluded that gamma irradiation dose of 3 kGy may be effectively used for the shelf life extension without causing the drastic changes in nutrient content of canned tomato paste.

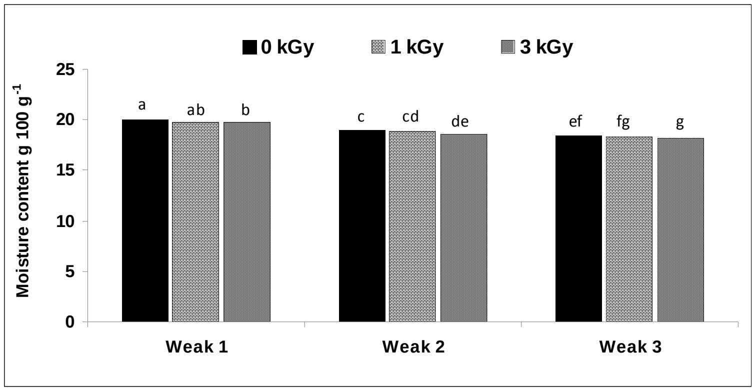

Fig. 1: Effect of gamma radiation on moisture content of canned tomato paste. Bars with different letters on their top show significant difference (P≤0.05) as determined by LSD Test.

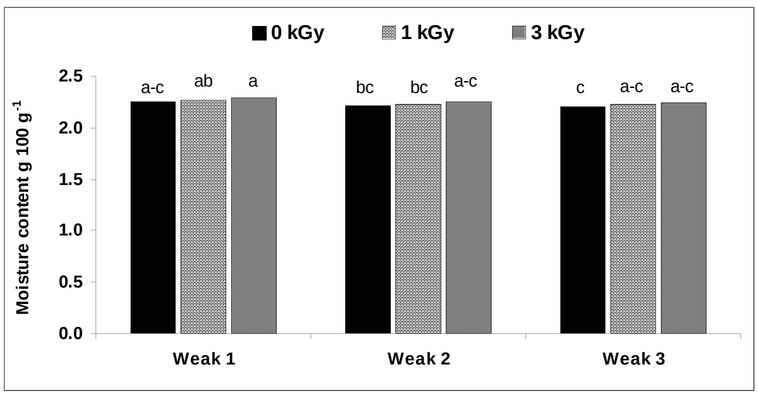

Fig. 2: Effect of gamma radiation on ash content of canned tomato paste. Bars with different letters on their top show significant difference (P≤0.05) as determined by LSD Test.

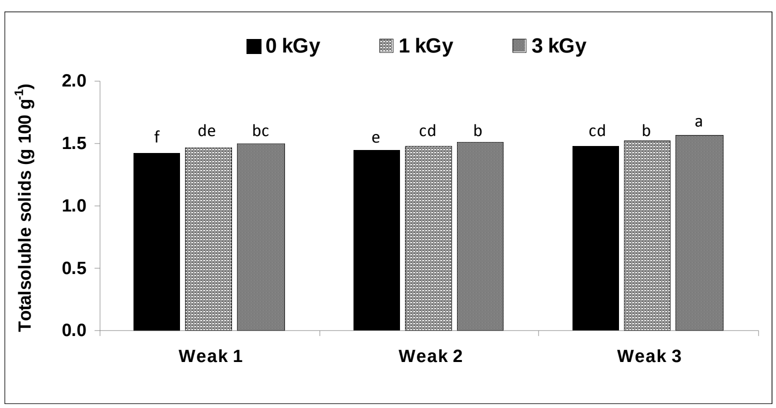

Fig. 3: Effect of gamma radiation on total soluble solids content of canned tomato paste. Bars with different letters on their top show significant difference (P≤0.05) as determined by LSD Test.

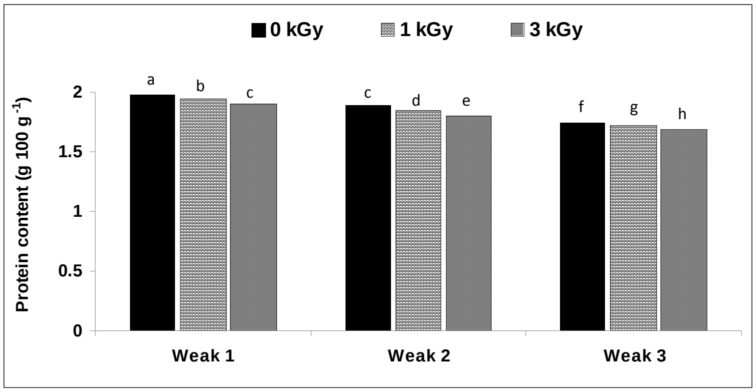

Fig. 4: Effect of gamma radiation on protein content of canned tomato paste. Bars with different letters on their top show significant difference (P≤0.05) as determined by LSD Test.

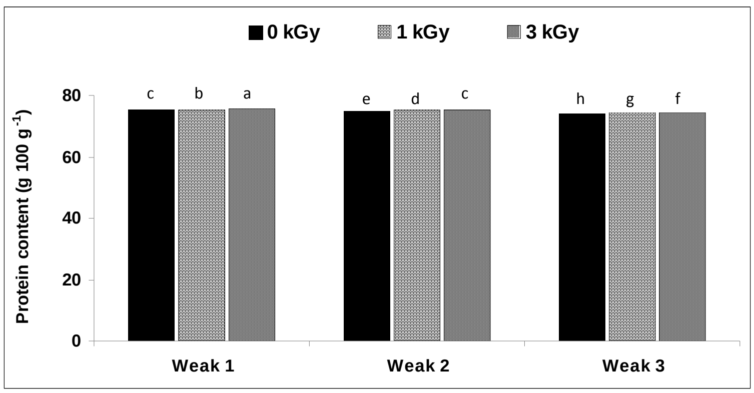

Fig. 5: Effect of gamma radiation on carbohydrates content of canned tomato paste. Bars with different letters on their top show significant difference (P≤0.05) as determined by LSD Test.

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