EFFECT OF ELECTRON BEAM IRRADIATION ON MINERAL CONTENTS OF MIXED FRUIT JAM AND JELLY PRODUCTS

5.1 INTRODUCTION

The dietary minerals are raise in concern among consumers and health specialists, due to the continuous research highlighting the benefits of their adequate and balanced intakes. Minerals are normally classified as macro and micronutrients, based on the relative concentration of each nutrient are adequate for normal tissue function. The macronutrient includes potassium, calcium, magnesium, nitrogen and phosphorus and their concentrations in plant tissues range from 1000 to 15000 μg per gram of dry weight. The concentrations of micronutrients usually found in plant tissues are 100 to 10000-fold lower than those of macronutrients. Mineral micronutrients considered essential in human nutrition includes iron, manganese, copper, cobalt, zinc, sodium, chlorine, iodine, fluorine, sulfur and selenium (Vicente et al., 2009).

In general, vegetables and fruits are considered nutrient dense foods in that they provide substantial amounts of nutrients, such as minerals and vitamins. Minerals have direct effects on human health and play an important role in human nutrition. The adequate intake of minerals through foods derived from agricultural products where they coexist with other essential nutrients and it contributes to overall human health. The Dietary Approaches to Stop Hypertension (DASH) emphasize fruit, vegetable and low-fat dairy product consumption as a source of minerals. In the DASH dietary pattern, fruits and juices contribute an average of 5.8%, 17.3%, 33.0% and 6.6% to the intakes of calcium, magnesium, potassium and zinc, respectively (Lin et al., 2003).
Micronutrient deficiencies remain major public health problems in developing countries in both rural and urban areas with deficiencies of vitamin A, iron and iodine (ACC/SCN, 1992; Rossi-Espagnat et al., 1991). Inadequate in consumptions of micronutrients have been associated with severe malnutrition, increased disease conditions and mental impairment (Mannay and Shadaksharaswany, 2005; Dosumu et al., 2009). More than two billion peoples, over 30% of the world population are anemic due to iron deficiency (World Health Organization, 2009).

Fruits are important natural food and are very good sources of several vitamins, minerals, phytochemicals, antioxidants and dietary fibres, all of which are essential for healthy life (Lamikanra, 2002). Nowadays various postharvest strategies for increasing the mineral intake from fruits is being implemented. These include increasing consumption of fresh fruits and preserved the fruits by processed into products like jam, jelly, marmalades, candy, squash and increasing levels of essential nutrients through fortification methods, improving nutrients bioavailability and retention of nutrients. The different nutrients and phytochemicals in fruits, including minerals, may be responsible for reduction of cardiovascular diseases (Ignarro et al., 2007). Fruits and fruit based products are good source of minerals such as potassium, magnesium, phosphorus, calcium, iron and they are vital for the human body growth and development (Worthington, 2001). Mixed fruit jams and jellies are prepared from combination of different fruit pulps which is a rich source of carbohydrates, vitamins, minerals and dietary fibers that are essential components for normal growth and development. Therefore, in this study the effect of electron beam irradiation on minerals like phosphorus, potassium, sodium, calcium and iron values of jam and jelly products were analyzed.
5.2 MATERIALS AND METHODS

5.2.1 Preparation of Sample for Mineral Analysis

Ashing of the dried food products and digestion with acids may become necessary for removing the organic contents of the products which is interferes in the quantitative analysis of minerals (Mazumdar and Majumder, 2003).

5.2.1.1 Materials Required

Nitric acid, Sulphuric acid, Perchloric acid (70%), Muffle furnace, Crucible

5.2.1.2 Procedure

- Five gram of dried sample was weighed and it was taken in crucible
- Ashed in muffle furnace (Temperature does not exceeding 600°C)
- The ash was taken in digestion flask and heated with digestion mixture till the solution becomes colourless
- Then it was cooled to room temperature
- The digested material made upto a known volume with distilled water

5.2.2 Phosphorous

5.2.2.1 Principle

Phosphorus is estimated by reacting with molybdic acid to form phosphomolybdate complex. It is reduced to form a blue coloured solution of molybdenum complex on reaction with amino-naphthosulphonic acid. The colour intensity of the solution is measured calorimetrically (Mazumdar and Majumder, 2003).
5.2.2.2 Materials Required

Sodium Sulphite (15%), Sodium bisulphate (20%), Fiske and Subbarow reagent, Ammonium molybdate (2.5%), 10N Sulphuric acid, Potassium dihydrogen phosphate

5.2.2.3 Procedure

1. 1 ml of digested material was taken in a separate test tube and made upto 1 ml with distilled water
2. 2 ml of 2.5% Ammonium molybdate solution and 1 ml of Fiske and Subbarow reagent was added and it was allowed to stand for 10 min for colour development
3. The blue colour appears due to the reaction between added chemicals and phosphorous which is present in the sample
4. It was read at 640 nm in spectrophotometer against a blank
5. The phosphorous present in the sample was calculated from the phosphorus standard graph

5.2.3 Potassium

5.2.3.1 Principle

In estimation of potassium, sample is first atomized by oxy-hydrogen or oxy-acetylene flames. The atoms of potassium which are excited by the flame, it emits radiation at a specific wavelength (766.5 nm). The amount of radiation emitted is measured in a flame photometer is directly proportional to the amount of potassium present in the sample (AOAC, 1984).
5.2.3.2 Materials Required

Potassium chloride (for calibration), Flame photometer

5.2.3.3 Procedure

- An aliquot of digested material was atomized in a pre-calibrated flame photometer
- For estimation of amount of potassium present in the sample, the percentage of light emission of injected sample was measured in flame photometer at a specific wavelength for potassium (766.5 nm) against blank

5.2.4 Sodium

5.2.4.1 Principle

In estimation of sodium, sample is first atomized by oxy-hydrogen or oxy-acetylene flames. The atoms of sodium which are excited by the flame, it emits radiation at a specific wavelength (589 nm). The amount of radiation emitted is measured in a flame photometer is directly proportional to the amount of sodium present in the sample (AOAC, 1984).

5.2.4.2 Materials Required

Sodium chloride (for calibration), Flame photometer

5.2.4.3 Procedure

- An aliquot of digested material was atomized in a pre-calibrated flame photometer
- For estimation of amount of sodium present in the sample, the percentage of light emission of injected sample was measured in flame photometer at a specific wavelength for sodium (589 nm) against blank
5.2.5. Calcium

5.2.5.1 Principle

The titrimetric estimation of calcium is performed by precipitating it as calcium oxalate. The precipitate is dissolved in the sulphuric acid and the amount of calcium dissolved in the acid is determined by titrating against a standard potassium permanganate solution (Mazumdar and Majumder, 2003).

5.2.5.2 Materials Required

Ammonium oxalate, Methyl Red (0.5%), Ethanol (80%) and Potassium permanganate (0.01N)

5.2.5.3 Procedure

- The digested material was taken in a conical flask and 10 ml of saturated Ammonium oxalate was added followed by few drops of Methyl red indicator and shaken well
- The mixture was made into slightly alkaline with addition Ammonia liquor and it was immediately turned to acidic by using Acetic acid
- The mixture was heated at 70°C and then it was allowed to stand for room temperature for overnight
- The mixture was centrifuged, discarded the supernatant and pellet was dissolved with Sulphuric acid
- The extract was made upto a known volume with Sulphuric acid and from this, a known volume of aliquot was taken in a conical flask
- The burette was filled with 0.01N Potassium permanganate solution and titration was done
- The end point was determined by appearance of pink colour and persist for few minutes
5.2.5.4 Calculation

1 ml of 0.01 N KMnO₄ solution is equivalent to 0.002 g of calcium. Therefore, the amount of calcium present in the sample,

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\text{Amount of calcium present} = \frac{\text{Average burette reading for sample} \times 0.002 \times \text{Total volume of extract}}{\text{Volume of aliquot taken for estimation} \times \text{Weight of sample}} \times 100
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5.2.6 Iron

5.2.6.1 Principle

In estimation of iron, it is first brought to ferric form by the use of Potassium persulphate as oxidizing agent. After conversion, it is reacted with Potassium thiocyanate to form red coloured ferric thiocyanate complex. The intensity of the colour appeared is then measured calorimetrically (Mazumdar and Majumder, 2003).

5.2.6.2 Materials Required

Potassium persulphate, Potassium thiocyanate (3N), Ferrous ammonium sulphate, Potassium permanganate, Sulfuric acid.

5.2.6.3 Procedure

- Digested material (1 ml) was taken in a test tube to which 5 ml of Conc. Sulphuric acid was added and mixed well
- Then the addition of 1 ml of Potassium per sulphate and 2 ml of 3N Potassium thio cyanate solutions were made
- Test tubes were allowed to stand 10 minutes for colour development and the colour intensity of solution was read at 440 nm in spectrophotometer
- The amount of iron present in the sample was calculated from the iron standard graph (Majumdar and Majumder, 2003)
5.3 RESULTS

5.3.1 Phosphorous

5.3.1.1 Phosphorus Values of Mixed Fruit Jam

The phosphorus values of electron beam irradiated mixed fruit jam were tested and it was presented in Fig. 5.1. The phosphorus values of jam were recorded in the range of 47.28 to 49.05 mg/100g of sample. After irradiation, no significant differences were observed in the phosphorus values of jam. After irradiation, the phosphorus values of jam were found to be 48.66, 48.39, 48.77, 48.42, 48.51 mg/100g of sample for control and irradiated samples (2.5 kGy, 5 kGy, 7.5 kGy, 10 kGy), respectively. The phosphorus values of jam were slightly decreased based on the storage period and irradiation doses received. At the 3rd month of storage it was recorded as 48.92, 48.26, 49.05, 48.09, 47.34 mg/100g of sample. At the 6th month of storage, 48.88, 48.32, 48.77, 48.25, 47.55 mg/100g of sample and 9th month of storage, 48.82, 48.35, 48.79, 48.27, 47.32 mg/100g of sample. At the end of storage, the phosphorus values of jam were recorded as 48.82, 48.33, 48.73, 48.23, 47.28 mg/100g of sample for control and irradiated samples 2.5 kGy, 5 kGy, 7.5 kGy, 10 kGy, respectively.

5.3.1.2 Phosphorus Values of Mixed Fruit Jelly

The effect of electron beam irradiation on phosphorus values of mixed fruit jelly was studied. It was given in Fig. 5.2. It was ranged from 48.42 to 48.99 mg/100g of sample in jelly. After irradiation of jelly, the phosphorus values were slightly increased with increase in the radiation doses and it was recorded as 48.54, 48.58, 48.56, 48.70, 48.93 mg/100g of sample in control and 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. During storage the increasing and decreasing values were recorded but not in significant manner. The values for further storage period were 48.89, 48.54, 48.99, 48.80, 48.86 mg/100g of sample for 3rd month, 48.87, 48.56, 48.91, 48.81, 48.88 mg/100g of sample for 6th month in control and 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. The phosphorus values for 9th and 12th month of storage was 48.65, 48.54, 48.91, 48.76, 48.83 mg/100g of sample and 48.65, 48.42, 48.61, 48.54, 48.77 mg/100g of sample, respectively.
Fig. 5.1 Effect of electron beam irradiation on the phosphorus values of mixed fruit jam

Fig. 5.2 Effect of electron beam irradiation on the phosphorus values of mixed fruit jelly
5.3.2 Potassium

5.3.2.1 Potassium Values of Mixed Fruit Jam

The potassium values of mixed fruit jam were studied (Fig. 5.3). The potassium value was recorded between 247.00 and 247.33 mg/100g of sample. After irradiation of jam it was found to be 247.10, 247.30, 247.00, 247.20, 247.30 mg/100g of sample in control and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively. The potassium values of jam were not altered by radiation doses and storage. The values were 247.17, 247.28, 247.08, 247.18, 247.29 mg/100g of sample for 3rd month, 247.16, 247.27, 247.09, 247.17, 247.32 mg/100g of sample for 6th month, 247.16, 247.27, 247.06, 247.18, 247.33 mg/100g of sample for 9th month of storage. At the end of storage it was found to be 247.17, 247.24, 247.07, 247.15, 247.31 mg/100g of sample in control and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively.

5.3.2.2 Potassium Values of Mixed Fruit Jelly

Fig. 5.4 shows that the potassium values for electron beam irradiated mixed fruit jelly. The potassium values of jelly were recorded as 184.23, 184.20, 184.27, 184.29, 184.24 mg/100g of sample for non-irradiated and irradiated samples (2.5, 5, 7.5, 10 kGy), respectively. The potassium values were not changed throughout the storage period. After 3rd month of storage it was found to be 184.23, 184.23, 184.26, 184.27, 184.21 mg/100g of sample for non-irradiated and 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. In the 6th month of storage, 184.19, 184.27, 184.23, 184.31, 184.23 mg/100g of sample and in 9th month it was 184.17, 184.25, 184.23, 184.34, 184.25 mg/100g of sample. In the 12th month of storage it was recorded as 184.17, 184.21, 184.20, 184.31, 184.21 mg/100g of sample for non-irradiated, 2.5, 5, 7.5, 10 kGy, respectively.
Fig. 5.3 Effect of electron beam irradiation on the potassium values of mixed fruit jam

![Graph showing the effect of electron beam irradiation on the potassium values of mixed fruit jam.]

Fig. 5.4 Effect of electron beam irradiation on the potassium values of mixed fruit jelly

![Graph showing the effect of electron beam irradiation on the potassium values of mixed fruit jelly.]

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5.3.3 Sodium

5.3.3.1 Sodium Values of Mixed Fruit Jam

The sodium values of mixed fruit jam were tested and sodium values are given in Fig. 5.5. The values were recorded after irradiation was 17.41, 17.22, 17.15, 17.28, 17.37 mg/100g of sample in non-irradiated and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively. The sodium values of jam were not altered by radiation doses and storage. It was recorded as 17.41, 17.21, 17.11, 17.27, 17.34 mg/100g of sample in 3\textsuperscript{rd} month and 17.43, 17.25, 17.15, 17.26, 17.34 mg/100g of sample in 6\textsuperscript{th} month of storage for non-irradiated and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively. In 9\textsuperscript{th} month and 12\textsuperscript{th} month of storage the sodium values were recorded as 17.38, 17.24, 17.15, 17.26, 17.38 mg/100g of sample and 17.38, 17.21, 17.14, 17.26, 17.36 mg/100g of sample for non-irradiated and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively.

5.3.3.2 Sodium Values of Mixed Fruit Jelly

Fig. 5.6 showed sodium values of mixed fruit jelly. The sodium values were recorded after irradiation and the storage period. After irradiation the values were found to be 12.76, 12.68, 12.85, 12.42, 12.27 mg/100g of sample in non-irradiated and irradiated samples 2.5, 5, 7.5, 10 kGy, respectively. After irradiation, the sodium values were slightly decreased with increasing radiation doses. It was maintained for further storage period. The values after 3 months of storage were 12.75, 12.69, 12.83, 12.45, 12.33 mg/100g of sample. The values after 6\textsuperscript{th} and 9\textsuperscript{th} month of storage was 12.77, 12.71, 12.81, 12.44, 12.31 mg/100g of sample and 12.73, 12.69, 12.77, 12.43, 12.33 mg/100g of sample. After 12 months of storage it was found to be 12.71, 12.65, 12.72, 12.43, 12.31 mg/100g of sample for non-irradiated and 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively.
Fig. 5.5 Effect of electron beam irradiation on the sodium values of mixed fruit jam

![Graph showing the effect of electron beam irradiation on the sodium values of mixed fruit jam.](image)

Fig. 5.6 Effect of electron beam irradiation on the sodium values of mixed fruit jelly

![Graph showing the effect of electron beam irradiation on the sodium values of mixed fruit jelly.](image)
5.3.4 Calcium

5.3.4.1 Calcium Values of Mixed Fruit Jam

The effect of electron beam irradiation on calcium values of mixed fruit jam was studied and it was illustrated in Fig. 5.7. In jam, the calcium values were found in the range of 11.16 to 11.25 mg/100g of sample. It was found to be 11.23, 11.24, 11.22, 11.23, 11.23 mg/100g of sample after irradiation in control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. The calcium values of jam were not affected by irradiation doses and storage period. In 3rd month of storage it was found to be 11.22, 11.23, 11.22, 11.21, 11.21 mg/100g of sample and in 6th month 11.22, 11.21, 11.22, 11.24, 11.20 mg/100g of sample in non-irradiated and irradiated samples, respectively. In 9th and 12th month of storage the values were 11.21, 11.16, 11.17, 11.21, 11.23 mg/100g of sample and 11.19, 11.17, 11.19, 11.19, 11.21 mg/100g of sample for non-irradiated and irradiated samples, respectively.

6.3.4.2 Calcium Values of Mixed Fruit Jelly

The calcium values were examined in irradiated and non-irradiated mixed fruit jelly (Fig. 5.8). The calcium values of jelly were found in the range of 12.08 to 12.15 mg/100g of sample. It was found to be 12.14, 12.14, 12.13, 12.15, 12.14 mg/100g after irradiation in control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. After irradiation and on further storage, no significant changes were observed in the calcium values of jelly. In 3rd month of storage it was recorded as 12.13, 12.13, 12.15, 12.13, 12.13 mg/100g of sample and in 6th month of storage 12.13, 12.12, 12.14, 12.13, 12.11 mg/100g of sample. Calcium values in 9th and 12th month of storage were recorded as 12.11, 12.14, 12.15, 12.15, 12.11 mg/100g of sample and 12.11, 12.11, 12.11, 12.13, 12.08, 12.11 mg/100g of sample for control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively.
Fig. 5.7 Effect of electron beam irradiation on the calcium values of mixed fruit jam

Fig. 5.8 Effect of electron beam irradiation on the calcium values of mixed fruit jelly
5.3.5 Iron

5.3.5.1 Iron Values of Mixed Fruit Jam

Fig. 5.9 showed that the iron values of mixed fruit jam. In jam, the iron values were found in the range of 2.11 to 2.19 mg/100g of sample. It was found to be 2.13, 2.17, 2.17, 2.17, 2.17 mg/100g of sample after irradiation in control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. After irradiation, the iron values of jam were not altered. Also, it was not altered during storage period. In 3rd month of storage it was found to be 2.12, 2.14, 2.15, 2.14 mg/100g of sample and in 6th month 2.14, 2.14, 2.16, 2.15, 2.17 mg/100g of sample in non-irradiated and irradiated samples, respectively. In 9th and 12th month of storage the values were 2.13, 2.16, 2.19, 2.15, 2.15 mg/100g of sample and 2.14, 2.17, 2.17, 2.17, 2.17 mg/100g of sample for non-irradiated and irradiated samples, respectively.

5.3.5.2 Iron Values of Mixed Fruit Jelly

Fig. 5.10 showed that the iron values of mixed fruit jelly. The iron values of jelly were found in the range of 1.81 to 1.87 mg/100g of sample. It was found to be 1.84, 1.82, 1.85, 1.82, 1.85 mg/100g of sample after irradiation in control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively. The iron values of jelly were not altered by irradiation and storage. In 3rd month of storage it was recorded as 1.85, 1.85, 1.84, 1.84, 1.85 mg/100g of sample and in 6th month of storage 1.86, 1.84, 1.85, 1.85, 1.85 mg/100g of sample. Iron values in 9th and 12th month of storage were recorded as 1.86, 1.83, 1.85, 1.82 mg/100g of sample and 1.85, 1.82, 1.84, 1.84, 1.81 mg/100g of sample for control, 2.5, 5, 7.5, 10 kGy of irradiated samples, respectively.
Fig. 5.9 Effect of electron beam irradiation on the iron values of mixed fruit jam

![Graph showing the effect of electron beam irradiation on the iron values of mixed fruit jam]

Fig. 5.10 Effect of electron beam irradiation on the iron values of mixed fruit jelly

![Graph showing the effect of electron beam irradiation on the iron values of mixed fruit jelly]
5.4 DISCUSSION

In the present study, minerals such as phosphorus, potassium, sodium, calcium and iron were analysed for the evaluation of the effect of electron beam irradiation on mixed fruit jam and jelly products. Phosphorus is a primary bone-forming mineral and it is essential for multiple cellular functions, including glycolysis, gluconeogenesis, DNA synthesis, RNA synthesis, cellular protein phosphorylation, phospholipid synthesis and intracellular regulatory roles (DiMeglio et al., 2000). Potassium is the most abundant mineral element in fruits and vegetables. Potassium is act as important role in regulation of heartbeat, blood pressure, in muscle contraction and in conduction of nerve impulses. Sodium is important in electrolyte balance and essential for the regulation of blood pressure. Calcium is important in bone and tooth formation (Vicente et al., 2009). Iron is important and needed element in numerous essential proteins, such as the heme-containing proteins, electron transport chain and microsomal electron transport proteins and iron-sulfur proteins and enzymes such as ribonucleotide reductase, prolyl hydroxylase phenylalanine hydroxylase, tyrosine hydroxylase and aconitase (Arredondo and Nunez, 2005).

In electron beam irradiated mixed fruit jam products the minerals phosphorus, potassium, sodium, calcium and iron values were ranged from 47.28 to 49.05, 247.00 to 247.33, 17.11 to 17.44, 11.16 to 11.25 and 2.11 to 2.19 mg/100g of sample and for mixed fruit jelly product, it was found to be 48.42 to 48.99, 184.17 to 184.34, 12.27 to 12.85, 12.08 to 12.15, 1.81 to 1.87 mg/100g of sample, respectively. The mineral composition of electron beam irradiated mixed fruit jam and jelly products in this study are comparable to earlier reports on minerals composition of different jam and jelly products (Sharma et al., 2011; Wafaa and Nadir, 2012; Habiba and Mehaia, 2008). The daily recommended dietary allowance value for minerals is $380 – 1050$ mg for
phosphorus, 4000 – 4700 mg for potassium, 1000 – 1500 mg for sodium, 800 – 1100 mg for calcium, 8 – 22 mg for iron. The nutritional significance of food is related to their contribution to the daily recommended dietary allowance for a healthy nutrition (Joel et al., 2013).

The minerals composition of mixed fruit jam and jelly products were remain unchanged after electron beam irradiation. After irradiation, the slight variations were observed only in the phosphorus and sodium values of jelly with an increase in the radiation doses. It was maintained for throughout the storage period except phosphorus values of jam which are increased based on the increase in irradiation doses. These results are an agreement with the Bhat et al. (2008), the changes in the mineral composition of electron beam irradiated Mucuna seeds at this dose levels (2.5 to 10 kGy) are minimal and may not be hinder the nutritional quality of the product. In Mucuna seeds, electron beam irradiation did not affect the overall composition of minerals sodium, potassium, calcium and iron upto a dose of 15 kGy while the phosphorus value was increased at this dose level. But, all the minerals of Mucuna seeds were significantly decreased at 30 kGy. The differences in the mineral composition of food products after irradiation based on the doses delivered which might have increased the extractability of nutrients.

Gamma irradiation of extract of licorice powders at the dose of 10 kGy showed that increased the calcium, potassium and sodium values (Al-Bachir and Lahham, 2003; Al-Bachir and Zeinou, 2005; Al- Bachir et al., 2004). Bhat and Sridhar (2008) found that in lotus seeds minerals sodium, phosphorus, magnesium, iron, zinc, manganese, selenium were not altered by electron beam irradiation dose of upto 30 kGy. Potassium and calcium values of lotus seeds at 10 kGy onwards were significantly lowered. Application of gamma and electron beam irradiation in
chamomile powder extract at the doses of 10 kGy and 20 kGy showed that the minerals calcium, potassium and sodium values were not significantly affected by irradiation (Al-Bachir, 2014).

In general, after irradiation the macronutrients like protein, lipid and carbohydrates quality does not loss (WHO, 1999) and micronutrients like minerals also shown to remain stable (Diehl, 1995). Minerals are generally more stable than other components of foods to most of the processing conditions such as heat, air, oxygen, acid and alkaline conditions (Fennema, 1985). In commercially available different irradiated cats diets (25 - 50 kGy) showed no significant differences in the macronutrients, minerals, vitamins and fatty acids composition of the irradiated diet compared with non-irradiated diets (EFSA, 2011). The minerals studied in mixed fruit jam and jellies were not significantly altered by electron beam irradiation at the dose level of 2.5 to 10 kGy. Therefore, the present study reveals that the electron beam irradiation could be useful in preserving jam and jellies without affecting the quality of the product in terms of minerals after irradiation.