Journal of Postharvest Technology
2024, 12 (2): 106-113
https://doi.org/10.48165/jpht.2024.12.2.12
www.jpht.in

RESEARCH ARTICLE

Study on nutrient analysis of available varieties of mango kernel of Karnataka

Renuka Meti, Azma Inamdar

Department of Food Processing and Nutrition, Karnataka State Akkamahadevi Women's University, Vijayapura 586108, India

ARTICLE INFO

Received : 19.02.2024
Accepted : 25.04.2024

ABSTRACT

In the present study, the two most consumed mango varieties of Karnataka state, Alphonso and Totapuri, were subjected to analysis of selective nutrient contents in their kernels. The nutrients selected for analysis in this study are ash, moisture, total lipids, protein, carbohydrates, iron, calcium, zinc, vitamin A, vitamin E, and vitamin B12. The amount of nutrients present in these two varieties of mango kernel are as follows: the ash content was 2.00 g/100g and 1.0 g/100g, the moisture content was 5.97%/100g and 7.05%/100g, the total lipids content was 9.74g/100g and 11.45g/100g, the protein content was 7.58g/100g and 7.53g/100g, the carbohydrate content was 74.71g/100g and 69.77g/100g, the iron content was 11.39mg/kg and 12.40mg/kg, the calcium content was 54.71mg/kg and 170.00mg/kg, the zinc content was 12.27mg/kg and 5.60mg/kg, the vitamin A content was 0.00654mg/100g and 0.00522mg/100g, the vitamin E content was 1.91mg/100g and 1.59mg/100g, and the vitamin B12 content was 0.14mg/100g and 0.12mg/100g of Alphonso and Totapuri mango kernels, respectively.

Keywords: Alphonso, analysis, kernel, mango, nutrient, Totapuri.

Citation: Meti, R., & Inamdar, A. (2024). Study on nutrient analysis of available varieties of mango kernel of Karnataka. *Journal of Postharvest Technology*, **12**(2): 106-113.

INTRODUCTION

Scientific name of mango is *Mangifera indica* and it is a widely consumed fruit worldwide (Basma et al., 2015). Mango is tagged as the king of fruits because of its exotic flavor and brilliant color. In mango, mostly the pulp is consumed and the kernel is generated as waste. Not only is the mango pulp nutritious, but the kernels also contain nutrients in appreciable quantities (Reddy et al., 2021).

The nutrients present in the kernels are being wasted, so this paper aims to make the best out of waste by utilizing the nutrients present in the mango kernel. This can be achieved by analyzing the nutrients present in the kernels and making people aware of their nutrient content. Research on the nutrient analysis of mango kernels and how to incorporate them into our daily diet is necessary to achieve this goal.

* *For correspondence*: R. Meti (Email: renukabujurke1@gmail.com)

ISSN: 2348-4330

MATERIALS AND METHODS

The mango seeds are dehulled, and the kernels are taken out soon after removing the pulp. The kernels are then sundried in the shade for 3 days, which is equal to 36 hours. The temperature range during drying was between 30 to 33°C. Afterward, the dried kernels were ground using a grinder and sieved through a 60 mesh size. The resulting powder was used for further proximate analysis. Additionally, the sle is ground according to the specific requirements of each respective nutrient analysis method.

Estimation of ash content

Ash in the sle was estimated by the AOAC official method 2015. About 5 to 10 g of the sle was weighed accurately into a crucible (which was previously heated to about 6000 C and cooled). The crucible was placed on a clay pipe triangle and heated first over a low flame until all the material was completely charred, then heated in a muffle furnace for about 3 - 5 hours at about 6000 C. It was then cooled in a desiccator and weighed. To ensure the completion of ashing, the crucible was again heated in the muffle furnace for half an hour, cooled, and weighed. This was repeated until two consecutive weights were obtained and the ash was almost white or grayish white in color.

Weight of ash:

Ash content of the sle / 100 g = Weight of ash x 100

Weight of sle

Estimation moisture content

The stainless-steel boxes (weighed as W empty) were weighed by keeping them on a top-loading balance and their weights were recorded. Then the sle was transferred into the stainless-steel box using a stainless-steel spatula to avoid contamination. The stainless-steel boxes containing the sles were weighed on a top-loading balance and their weights were recorded as (weighed as W initial). With the help of tongs, the stainless-steel boxes were placed into a hot air oven whose temperature was set at 100°C for 16 hours. Then the sles were taken out from the hot oven using tongs and placed in a desiccator. After cooling the sle to room temperature, the weight of the steel box was recorded. The sles were then placed back into the hot oven for another 4 hours. After four hours, the sles were taken out from the hot oven and placed in a desiccator to cool. Then the weight of the steel box was recorded after cooling to room temperature (weighed as W final). The process of heating in the hot air oven, cooling in the desiccator, and weighing the stainless-steel box with the sle was repeated until a constant weight was obtained. (AOAC 2005)

Moisture (%) = (W initial - W final) x 100

Weight of the sle

Take the mean of the two observations for each sle and report the value.

Estimation of total lipid

Total lipid in the sle was estimated by acid hydrolysis. The sle was ground to pass through a 1 mm Wiley mill. 1 gram of ground sle was weighed into a 50 ml screw-top test tube. Then, the sle was wetted with 1 ml of ethanol to saturate it, and 5 ml of HCl was added. The sle was then placed in a preheated water bath at 75.5oC for 40 minutes, shaking occasionally. The sle was removed from the water bath and cooled to room temperature. 5 ml of ethanol was added and mixed. 12 ml of anhydrous ether was added and shaken orbitally for 1 minute. 12 ml of petroleum ether was added and shaken orbitally for 1 minute. Then, the ether and residue were allowed to separate. The top layer was pulled off into a dried and tared 150 ml beaker via a Pasteur pipette, pouring through a filter paper in a long stem funnel. Then, the ether adding steps were repeated with 8 ml portions of ether for three more times. Then, the sle underwent evaporation on a hot plate at low temperature for one hour to evaporate the ether and any water

contained in the beaker. The beaker was placed in a 135oC oven for 10 minutes. After that, the sle was transferred to a desiccator to cool to room temperature. The beaker plus fat was weighed to +/-0.01g.

% Fat = (Weight of beaker and fat – tared beaker weight) X 100 / (Sle weight)

Estimation of protein content

The crude protein content of the sle was estimated according to the Kjeldahl method AOAC (2000), which consists of three main steps: digestion, distillation, and titration. A sle of 500 mg was powdered and placed in a digestion tube. The digestion mixture (15 mg of potassium sulfate and 1.2 g of copper (II) sulfate pentahydrate) was added to the digestion tube for digestion for approximately 1 hour at 375 °C. In the distillation apparatus, 250 ml of water was added to completely dissolve the sulfates, along with 25 ml of sulfuric acid. Slowly, 100 ml of a 33% sodium hydroxide solution was poured into the digestion flask, and the flask was immediately connected to the distillation apparatus. The flask was heated in a way that approximately 150 ml of distillate was collected in 30 minutes. In the collecting flask, sulfuric acid was taken and titrated with a 0.1 mol/l or 0.25 mol/l sodium hydroxide solution, as appropriate, until the color changed from violet to green.

The crude protein content of the test sle was calculated using the following equation:

Wp = 6.25 x WN

Where:

Wp is the crude protein content, in grams per kilogram, of the test sle;

Wn is the nitrogen content, in grams per kilogram, of the test sle (either WN1 or WN2).

Estimation of total carbohydrates

Total carbohydrate content in the sle was estimated as per AOAC (2006). In a boiling tube, 100mg of the sle was taken and hydrolyzed by keeping it in a boiling water bath for 3 hours with 5mL of 2.5 N-HCl. The mixture was then cooled to room temperature and neutralized with solid sodium carbonate until the effervescence ceased. The volume was made up to 100mL and the mixture was centrifuged. The supernatant was collected and 0.5mL and 1mL aliquots were taken for analysis. Standards were prepared by taking 0, 0.2, 0.4, 0.6, 0.8, and 1mL of the working standard, with ‘0’ serving as the blank. The volume was made up to 1mL in all the tubes, including the sle tubes, by adding distilled water. Then 4mL of anthrone reagent was added. The mixture was heated for eight minutes in a boiling water bath, cooled rapidly, and the green to dark green color was read at 630nm. A standard graph was drawn by plotting the concentration of the standard on the X-axis versus the absorbance on the Y-axis. From the graph, the amount of carbohydrate present in the sle tube was calculated.

Amount of carbohydrate present in 100mg of the sle = (mg of glucose ÷ Volume of test sle) X 100

Estimation of minerals (Iron, Calcium and Zinc)

The mineral estimation in the mango kernel powder is done by using a closed system mineralization. For this process, 0.5 g of the sle was taken in a digestion vessel. Then, 5 mL of deionized water and 5 mL of nitric acid (68%) were added to the digestion vessel. The vessel was kept under a fume hood for open digestion for 10 minutes and properly closed. The microwave digestion time duration was 1 hour. After that, the digestion flask was installed on the rotor, and the appropriate digestion program was applied. The closed microwave digestion time duration was also 1 hour. A gradual increase between selected phases was done

to avoid pressure spikes inside the vessel. To reduce the temperature and pressure inside the digestion vessel, a cooling phase was included at the end of the program. The final state of digestion of the sle depends on the digestion temperature. In general, the higher the temperature, the less residual carbon is left in the solution, resulting in better quality of the mineral deposit. The measurement was done with Atomic Absorption Spectrometry.

Metal Content (Mc) = (Cs – Cb) x (25 x f) / (m x 1000)

where, Cs = Sle concentration (mg/L), Cb = Blank concentration (mg/L), 25 = Final make up Volume (mL), f = possible dilution factor, m = test portion mass (g), and 1000 = Conversion factor from µg to mg.

Estimation of vitamin- A

Vitamin A was determined using the HPLC method. The retinol solution was prepared in 2-propanol. For every 1000 IU of vitamin A/ kg of sle, a retinol concentration of 2.5 IU/ml was extracted. An aliquot volume of solution 1 was evaporated to dryness at ambient temperature with a stream of inert gas. The residue was dissolved in the appropriate volume of 2-propanol to obtain the required retinol concentration and mixed. The standard solution was filtered through a membrane filter. For calibration purposes, a standard solution of vitamin A (retinol) in 2-propanol was prepared by diluting a stock standard solution of all-trans-retinol, which was made by dissolving an appropriate quantity of all-trans-retinol standard substance directly in 2-propanol. In this case, the vitamin A standard was checked by measuring the absorbance of the standard solution in quartz cells at wavelengths of 300 nm, 325 nm, 350 nm, and 370 nm against 2-propanol as a reference. The A/A325 ratio at each of the wavelengths for all-trans-retinol was determined.

wA = 20,000 xc / m

where wA = the numerical value of the vitamin A content of the test sle, in IU/kg. c = the numerical value of the retinol concentration of the extract, in IU/ml. m = the numerical value of the mass of the test sle, in grams.

Estimation of vitamin- E

The estimation of vitamin E in the given sle was done by the liquid chromatography-mass spectrometry method, which included three major steps: saponification, extraction, and washing. First, the sle was saponified by LC-MS. Approximately 5 g of the sle was homogenized into a 500 mL amber-colored iodine flask along with 10 mL of warm water. Then, the sle was subjected to the extraction step, where extraction was done using 50 mL of diethyl ether. Next, the ether layer from the extracted sle was washed with about 100 mL of distilled water. The washing step was repeated three times until the organic layer became neutral, as checked for alkali with 2-3 drops of phenolphthalein indicator. Then, the lower aqueous phase was removed, and the extracted sle was subjected to calculation using software.

Fat-Soluble Vitamins (ng/g or µg/kg) = Csmp x solvent X ng x mL

Wt. of the sle mL x g

Where:

Wt (g) = sle material taken for analysis

Solvent (mL) = solvent taken for extraction

Csmp (ng/mL) = concentration of fat-soluble vitamins calculated from linear solution. Calculation is done by the software.

Estimation of vitamin-B12

About 10 g of sle were homogenized and then transferred into a 50 mL volumetric flask. To the flask, 50 mg of alpha-amylase and 20 mL of 0.25 M sodium acetate buffer were added. The mixture was vortexed for 5 minutes. The solution was then sonicated for 20 minutes and the volume was adjusted to 50 mL using 0.25 M sodium acetate buffer. The solution was sonicated again for 20 minutes. Next, the sle solution was transferred into a 50 mL centrifuge tube and vigorously shaken for 2 minutes using a vortex. The sle solution was centrifuged at 6000 rpm for 5 minutes at 4°C. The supernatant layer of the sle solution was collected and filtered using a 0.45 µm filter paper. A C18 solid phase extraction cartridge weighing 900 mg was attached to the stopcock of the vacuum manifold. A disposable syringe barrel with a volume of 10 mL was attached to the top of the cartridge. The cartridge was conditioned with 20 mL of methanol, allowing the methanol to gravity filter through the cartridge, and then rinsed with 10 mL of water. 20 mL of the filtered sle solution was transferred into the cartridge and passed through it. The cartridge was then rinsed with 5 mL of water and the eluent was discarded. The cartridge was air dried by pulling a vacuum until no more effluent was observed. Each stopcock was closed and 4 mL of diluent was added to the cartridge. The solution was eluted into a vial and transferred to the vial containing the collected sle solution. This solution was used for injection into the LC-MS.

The formula for calculating the concentration of water-soluble vitamins (in ng/g or µg/kg) is as follows:

Concentration of Water-Soluble Vitamins (ng/g or µg/kg) = (Csmp x solvent) x (X ng x mL)

---------.

Wt. of the sle x mL x g

Where:

- Wt (gm) represents the weight of the sle material taken for analysis

- Solvent (mL) represents the volume of solvent taken for extraction

- Csmp (ng/mL) represents the concentration of water-soluble vitamins calculated from a linear solution. The calculation is done by the software.

RESULTS AND DISCUSSION

According to the above-mentioned methodology, the selected mango kernels were analyzed for the selective macronutrient estimation of Alphonso and Totapuri mango kernels. Table-1 shows the results of parameters such as ash, moisture, total lipid, protein, and carbohydrate content. The ash content of Alphonso mango kernels was 2.00 g/100g and of Totapuri mango kernels was 1.0 g/100g. The ash content ranged from 1.78 to 2.87% (Mutua et al., 2016). The difference in the content of ash between these two mango kernel varieties is 1 g/100g. The moisture content of Alphonso mango kernels is 5.97%/100g and of Totapuri mango kernels is 7.05 %/100g. The moisture content ranged between 9.2-9.6% (Masud et al., 2020). The difference in the content of moisture between these two mango kernel varieties is 1.08 %/100g. The total lipid content of Alphonso mango kernels is 9.74g/100g and of Totapuri mango kernels is 11.45g/100g. The lipid content in the mango kernel was 16% (Rojas et al., 2016). The difference in the content of total lipids between these two mango kernel varieties is 1.71 g/100g. The protein content of Alphonso mango kernels is 7.58g/100g and of Totapuri mango kernels is 7.53g/100g. Mango seed kernel powder contains on average 6.74–9.20% protein content (Mutua et al., 2016). The difference in the content of total lipids between these two mango kernel varieties is 0.05 g/100g. The carbohydrate content of Alphonso mango kernels is 74.71g/100g and of Totapuri mango

kernels is 69.77g/100g. The carbohydrate content in mango kernels was 18.2% (Reddy et al., 2021). The difference in the content of carbohydrate between these two mango kernel varieties is 4.94 g/100g.

Table. 1: Macro nutrients

Parameters		Mango variety	
		Alphonso	Totapuri
Ash	(g/100g)	2.00	1.0
Moisture	(%/100g)	5.97	7.05
Total lipids	(g/100g)	9.74	11.45
Protein	(g/100g)	7.58	7.53
Carbohydrates	(g/100g)	74.71	69.77

The Table-2 shows the results of selective mineral content such as iron, calcium, and zinc. The iron content of Alphonso mango kernel is 11.39 mg/kg, and the iron content of Totapuri mango kernel is 12.40 mg/kg. The difference in iron content between these two mango kernel varieties is 1.01 mg/kg. The calcium content of Alphonso mango kernel is 54.71 mg/kg, and the calcium content of Totapuri mango kernel is 170.00 mg/kg. The difference in calcium content between these two mango kernel varieties is 115.29 mg/kg. The zinc content of Alphonso mango kernel is 12.27 mg/kg, and the zinc content of Totapuri mango kernel is 5.60 mg/kg. The difference in zinc content between these two mango kernel varieties is 6.67 mg/kg. The iron, calcium, and zinc content in mango kernel was 450, 11.9, and 1.1 mg respectively (Lebaka et al., 2021).

Table. 2: Minerals

Parameters		Mango variety	
		Alphonso	Totapuri
Iron	(mg/kg)	11.39	12.40
Calcium	(mg/kg)	54.71	170.00
Zinc	(mg/kg)	12.27	5.60

The Table-3 shows the results of selective vitamin content, such as vitamin A, vitamin E, and vitamin B12. The vitamin A content of Alphonso mango kernel is 0.00654 mg/100g, and of Totapuri mango kernel is 0.00522 mg/100g. The vitamin A content in the mango kernel was 80 µg (Mahuwaa et al., 2022). The difference in the content of vitamin A between these two mango kernel varieties is 0.00114 mg/100g. The vitamin E content of Alphonso mango kernel is 1.91 mg/100g, and of Totapuri mango kernel is 1.59 mg/100g. The vitamin E content in the selected varieties ranged between 131.1-142.0 mg/100g (Masud et al., 2020). The difference in the content of vitamin E between these two mango kernel varieties is 0.32 mg/100g. The vitamin B12 content of Alphonso mango kernel is 0.14 mg/100g, and of Totapuri mango kernel is 0.12 mg/100g. The vitamin B12 content was 0.12 mcg (Lahutiya et al., 2023). The difference in the content of vitamin B12 between these two mango kernel varieties is 0.02 mg/100g.

Table. 3: Vitamins

Parameters		Mango variety	
		Alphonso	Totapuri
Vitamin- A	(mg/100g)	0.00654	0.00522
Vitamin- E	(mg/100g)	1.91	1.59
Vitamin- B_{12}	(mg/100g)	0.14	0.12

CONCLUSION

In this study, the difference in the nutrient content of two mostly consumed mango kernel varieties of Karnataka was analyzed to compare the nutrient content of these two mango varieties in order to incorporate them in product development the nutrient analyzed in this study were ash, moisture, carbohydrates, protein, total lipid, iron, calcium, zinc, Vitamin A, Vitamin E, and Vitamin B12. In terms of ash content, the Alphonso mango kernel was higher at 2.00g/100g compared to the Totapuri mango kernel at 1.0g/100g. In terms of moisture content, the Totapuri mango kernel was higher at 7.05%/100g compared to the Alphonso mango kernel at 5.97%/100g. In the total lipid content, the Totapuri mango kernel was higher 11.45g/100g than that of Alphonso mango kernel at 9.74g/100g. There was not much difference in protein content between both mango varieties, with the Alphonso mango kernel at 7.58g/100g and the Totapuri mango kernel at 7.53g/100g. In terms of carbohydrate content, the Alphonso mango kernel was higher at 74.71g/100g compared to the Totapuri mango kernel at 69.77g/100g. There was not much difference in iron content between both mango varieties, with the Alphonso mango kernel at 11.39mg/kg and the Totapuri mango kernel at 12.40mg/kg. The Totapuri mango kernel had a higher calcium content at 170.00mg/kg compared to the Alphonso mango kernel at 54.71mg/kg. The Alphonso mango kernel was higher 12.27g/100g than that of Totapuri mango kernel at 5.60g/100g. When we focus on vitamin content, the selected vitamins are Vitamin A, Vitamin E, and Vitamin B12. There is a very slight difference between the two selected mango kernel varieties in all three vitamins. The values are as follows: Vitamin A of Alphonso mango kernel is 0.00654mg/100g and of Totapuri is 0.00522mg/100g, Vitamin E of Alphonso mango kernel is 1.91mg/100g and of Totapuri is 1.59mg/100g, and Vitamin B12 of Alphonso mango kernel is 0.14mg/100g and of Totapuri is 0.12mg/100g.

REFERENCES

Basma, R., Shakir, Al, Janabi., Suha, Mohmed, Ibrahim., Ahmed, Ibrahim, Jessim. (2015). Detection and determination of Butylated Hydroxyl Toluene (BHT) in imported milk for adults and infants at Baghdad city. *International Journal of Advanced Research, 3*(4), 1178-1185.

Christinawatay, S., & Damayanti, S. (2015). Simultaneous Determination Method of Butylhydroxyanisole, Butylhydroxytoluene, Propyl Gallate and tertiary Butyl hydroxqunione in Margarine Using High Performance Liquid Chromatography. *Asian Journal of Pharmaceutical and Clinical Research, 8*(4), ISSN – 0974 – 2441.

Schreier, C. J., & Greene, R. J. (2012). AOAC. Artificial Preservatives in Pet Food: BHT, BHA and Ethoxyquin Extraction by QuEChERS Methodology and Analysis by LC-MS/MS.

Latimer, G. W. (1996). AOAC Official Method. Ethoxyquin in Feeds Liquid Chromatographic Method.

Al Mentafii, H. N. (2005). AOAC official methods of analysis, 18th Edition, *1*(4).

El Karbane, M., Azougagh, M., Amood, M., Kamarany, L., Bouchafra, H., Cherrah, Y., & Bouklouze, A. (2014). Development and validation of a reversed-phase HPLC method for simultaneous analysis of butylhydroxyanisol, simvastatin and its impurities in tablet dosage forms. *Annales Pharmaceutiques Francasies, 72*(4), 244-255.

Hossain, M. S., Islam, M. S., Bhadra, S., & Rouf, A. S. (2016). Screening of caffeine, preservatives and antioxidants in dairy products available in Bangladesh using an RP-HPLC method. *International Journal of Food Contamination, 3*(11), 2-11.

Olafisoye, O. B., Fatoki, O. S., Oguntibeju, O. O., & Osibote, A. O. (2015). An Evaluation of the Level of Synthetic Phenolic Antioxidants in Virgin Palm Oil. *International Journal of Food Engineering, 1*(2), 121-126.

Dzomba, P. (2014). Reversed Phase HPLC-UV Quantitation of BHA, BHT and TBHQ in Food Items Sold in Bindura Supermarkets, Zimbabwe. *International Research Journal of Pure & Applied Chemistry, 4*(5), 578-584.

Paris, F. (1989). Standard Methods for the Analysis of Oils, Fats and Derivatives, 223-245.

Mutua, J. K., Imathiu, S., & Owino, W. (2017). Evaluation of the proximatecomposition, antioxidant potential, and antimicrobial activity of mango seed kernel extracts. *Food Science and Nutrition, 5*(2), 349–357.

Reddy, V., Jung, Y., Ye, W., & Korivi, M. (2021). Nutritional Composition and Bioactive Compounds in Three Different Parts of Mango Fruit. *Environmental Research and Public Health, 18*(2),741.

Masud, F., Rifai, A., & Sayuti, M. (2020). Mango seed kernel flour (Mangifera indica): nutrient composition and potential as food. *Malaysian Journal of Nutrition, 26*(1), 101-106.

Chaudhary, M., & Chhabra, S. (2022). Potential significance of mango seed kernel in boosting the immune system. *International Journal of Home Science, 8*(1), 01-03.

Lahutiya, V., Singh Yadav, S. P. (2023). Systematic Analysis Of Nutritional Contents In Mango Seed Kernel (Msk) After Application Of Different Processing Techniques. *Malaysian Journal of Halal Research, 6*(1), 09-12.