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Study on value addition and products diversification of Mallero (*Elaeagnus latifolia*)

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Abstract
Mallero (*Elaeagnus latifolia*) is one of the indigenous underutilized fruit crops of the State of Sikkim. The study has been conducted at Postharvest Laboratory, Dept. of Horticulture, Sikkim University, Gangtok during 2014-2015 with an objective to standardize methods of preparation of jam as processed product of Mallero (*Elaeagnus latifolia*) upto commercial level. A total of four treatments with four replications were taken for the product. The standardized recipe for jam has been developed in the present study as well as multi-elements present have been determined. The prepared product is good in terms of commercial level consumer acceptability as per organoleptic test conducted. The other products produced in the present study were ketchup and pickle which are being reported in separate publication. Therefore, the present study is of considerable importance for commercialization and diversification of processed products of Mallero (*Elaeagnus latifolia*).

Keywords: Mallero, underutilized fruit crop, value addition

Introduction
The Eastern Himalayan Region has been rated as top 12th Global Biodiversity Hotspots by IUCN and one of the 200 significant eco-regions of the Globe. Some important wild edible fruits consumed by the people in this region are *Baccaurea sapida, Diploknema butyraceae, Eriolobus indica, Spondias axillaris, Machilus edulis and Elaeagnus latifolia* (Sundriyal and Sundriyal, 2001) [4]. *Elaeagnus latifolia* (Mallero) belonging to the family Eleagnaceae is one of the major wild edible fruits that is consumed by the tribal people in Sikkim The fruit of *Elaeagnus latifolia* (Mallero) is very rich in nutrition and it contains vitamins, minerals and specially essential fatty acids which is unusual for fruits. (Sundriyal and Sundriyal, 2003) [5]. As per study conducted in the Dept. of Horticulture, Sikkim University the T.S.S. of mallero fruit is 9.49^0 Brix, acidity 3.35%, crude fibre 7.22%, crude fat 0.55%, ash 4.41%, protein 7.19% and T.S.S. : Acid ratio 2.84 (Bhutia, 2015) [1].
By keeping in view the potential of the crop for product diversification, the present study was undertaken with the objective of preparing various processed products *i.e.* Mallero (*Elaeagnus latifolia*) jam of commercial grade.

Materials and methods
Preparation of jam
The fully ripened fruits of *Elaeagnus latifolia* (total 25Kg) were collected from Rumtek, Ranka, Pakyong, Mamring, Gangtok in East Sikkim. The instruments like ICPMS, water distillation unit, Hot air oven, flame photometer etc. were used for nutritional analysis.
For preparation of jam, fully ripened fruits were taken and they were washed under running tap water. The peeling and pulping of fruits was done manually with the help of knife. The grinding and cooking was done with 100 ml of water. The foam was removed and 1/4th sugar was added. Continuous stirring was done with the help of wooden laddle. The preservatives i.e. 3g KMS and remaining sugar were added. The essence was added and the end point was judged by drop or sheet test. The proper storage was done after proper bottling and capping. Four different treatments with varying concentrations of sugar, water, preservative, colour or essence were taken as represented in Table No.1.

Table 1: Details of treatments for jam preparation

Treatment No.	Ingredients for Jam Preparation (for 2 Kg fruits)			
	Sugar (g)	Preservative (g)	Water (ml)	Colour or Essence
T0	500	-	150	-
T1	600	-	150	-
T2	650	3	150	-
T3	700	3	150	rose

Plate 1: Mallero fruits and their processed products

Organoleptic test

The organoleptic test was conducted to check the quality and acceptability of the jam prepared from Mallero (*Elaeagnus latifolia*). The test was done with four different age groups- Group 1 (9-15yrs), Group 2 (15-20yrs), Group 3 (25-30yrs) and Group 4 (30-45yrs). Marking of the products was done for its taste, aroma, texture, colour and firmness for different treatments in the scale of 1 to 10. [10- excellent, 9- very good, 8- good, 7- little above satisfied, 6- satisfied, 5- average, 4- below average, 3- not so bad, 2- bad, 1- worst].

Ascorbic acid estimation

Ascorbic acid content was estimated for the processed product of *Elaeagnus latifolia* i.e. jam. Usually, the fruits of *Elaeagnus latifolia* are rich source of ascorbic acid. So, it becomes essential to check and compare the content of ascorbic acid in raw fruit and the processed products of the same fruit (Ranganna, 2012) [3].

Ascorbic acid content was estimated by using 2, 6-Dichioropherol-Indophenol Visual Titration Method. The colour of the dye changes from blue (in alkaline solution) and red (in acid solution) to colourless due to the ascorbic acid. This technique is practically specific for ascorbic acid in the solution in the pH range of 1-3.5.

Reagents

The following reagents were prepared in the lab for ascorbic acid estimation.

1. 3% Metaphosphoric acid (HPO_3) which was prepared by dissolving pellets or sticks of HPO_3 in distilled water.
2. Ascorbic acid standard: 100mg of L-ascorbic acid was taken and 100ml of the solution was made with 3% HPO_3. 10ml to 100ml was diluted with 3% HPO_3 (1ml=0.1mg of ascorbic acid)
3. Dye solution was prepared by dissolving 50mg of sodium salt of 2, 6-Dichlorophenol-indophenol in 150ml (approx) of hot distilled water containing 42mg of sodium bicarbonate. The solution was then cooled and diluted with glass distilled water to 200 ml.

Standardization of dye

5ml of standard ascorbic acid solution was taken and 5ml of HPO_3 was added and was filled in a microburette. Titration was done with the dye solution and the dye factor was calculated using the following formula:

$$\text{dye factor} = \frac{0.5}{\text{titre}}$$

Preparation of the sample

Fruit juices: 10ml-20ml of the sample was taken and was made up to 100ml with 3% HPO_3.

Assay of extract: An aliquot (2-10ml) of HPO_3 extract of the sample was taken and titration with standard dye to a pink end point was done. The titration was done rapidly and preliminary determination of titre was done. For the next determination of the titre most of the dye required was added and then titration was done accurately.

Calculation

Ascorbic acid content of the sample was calculated using the following formula:

$$\text{mg of ascorbic acid per 100gm or ml} = \frac{\text{titre} * \text{dye factor} * \text{volume made up} * 100}{\text{aliquot of extract taken for estimation} * \text{wt or volume of sample taken for estimation}}$$

Determination of various elements using ICPMS

The Multi-wave digestion system (Anton Par microwave 3000) was used for sample digestion as per the following steps.

- 0.2 g ground samples were taken.
- 8 ml of 69% nitric acid was added into the digestion tube.
- The Ramp was maintained at 20, Hold 20, I.R 190^{0}C, Rate 0.3bar/sec and Power 1200 watt. The total time taken was 43 minutes for digestion.
- The digested samples were transferred to 50ml volumetric flask when the temperature of the samples was reduced and the distilled water was added for making the final volume of 50ml.
- The liquid samples were transferred into the narrow mouth bottle container before the minerals were

determined by ICP-MS.

- ICP-MS (Inductively Coupled Plasma Mass Spectrophotometry) Perkin Elmer Nex ION 300X was used for nutrient estimation. Digested samples were analyzed for the ionic constitution using multi elements standards solution1, 3 and 5 solution containing analysis were used as a standards such as Ca, K, Mg, P, S, Fe, B, Zn, I

Results and discussion

Organoleptic test

The treatment T3 (700g sugar+ 3g preservative+150 ml water + rose essence) showed the best results as per organoleptic test conducted for jam (Table No.2).

Table 2: Organoleptic test conducted for aroma, taste, colour, texture, firmness for jam

Product Jam / Treatments	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	Avg
T0	8.8	9	6.8	8.4	5.8	5.4	5.2	6.6	5.6	5.4	5.6	5.2	4	5.3	3.2	6.02
T1	8.8	9	6.8	8	7	6.4	7.6	8.2	6.4	5.8	6.8	7	4.8	6	5	6.91
T2	7	9	5.6	5	5.4	6	6.2	6.4	5.8	6.2	6.4	6.4	5	6.4	4.8	6.11
T3	7	8.6	4.6	7.2	8	8.4	8.8	8.8	6.8	7	6.8	7.2	5.8	7.4	7	7.29

Estimation of ascorbic acid in jam

The raw fruits of *Elaeagnus latifolia* contain higher amount of Vitamin C (ascorbic acid). Treatment T3 for jam shows high concentration (0.08-0.09 mg/100gm) of ascorbic acid and treatment T2 for jam shows the lowest concentration (0.04-0.05 mg/100g) of ascorbic acid. The concentration of ascorbic acid was significantly different for all the treatments of jam with the highest for treatment T3 (0.088mg/100gm) followed by T1 (0.059mg/100gm), T0 (0.055mg/100gm) and T2 (0,048mg/100gm) (Table No. 3).

Table 3: Estimation of ascorbic acid content in jam

Treatments	JAM (mg/100g)
T0	0.055
T1	0.059
T2	0.048
T3	0.088
SEm	0.167
CD at 5%	0.544

Estimation of multi-elements in Jam

It is evident from Table No.4 that in jam Ca was highest in T3 which was at par with the treatments T2, T1 and T0. The element K was significantly superior in treatment T3 followed by T1 which was at par with T2 and T0. Treatment T3 was found to be significantly superior for Mg which was followed by T1 which was at par with T2 and T0. P was highest in T3 which was at par with T1, T0 and T2. Treatment T2 was found to contain highest amount of I which was at par with T0, T1 and T3. Fe was highest in T3 which was found to be at par with T0, T1 and T2. Treatment T0 for S was found to be highest and was at par with T2, T3 and T1. Zn was highest in treatment T3 which was at par with other treatments T0, T1 and T2 (Table 4). From Table no. 4, treatment T3 shows high concentration of elements such phosphorous (0.88 mgL^{-1}), potassium (2.7 mgL^{-1}), magnesium (0.77mgL^{-1}), calcium (0.4 mgL^{-1}) and iodine (0.22mgL^{-1}) and other elements are present in very small amounts. For other treatments the concentration of elements is found to be almost same.

The content of different elements in the jam prepared from jamun also shows the presence of various major and minor elements. The major elements in jam were Mg (0.0943mg/g), Ca (0.2523mg/g) and K (21.83mg/g) and minor elements were Fe (0.0109mg/g), Zn (0.0116mg/g) as reported by Nawaz *et al.* (2010) [2]. The result for jamun jam shows comparable values with that of mallero jam.

Table 4: Estimation of contents of various elements in Jam

JAM									
Treatment No.	Ca	K	Mg	P	S	Fe	B	Zn	I
T0	0.1	1.1	0.13	0.23	0.07	0.03	0.01	0.01	0.26
T1	0.13	1.38	0.19	0.26	0.05	0.02	0.01	0.01	0.26
T2	0.15	1.3	0.19	0.2	0.06	0.02	0.01	0.01	0.29
T3	0.4	2.74	0.73	0.88	0.06	0.06	0	0.05	0.25
SEm	0.292	0.128	0.129	0.231	0.137	0.645	-	0.288	0.194
CD at 5%	0.899	0.416	0.422	0.754	0.447	0.210	-	0.188	0.633

Conclusions

Based on organoleptic test conducted for the products treatment T3 for jam has been accepted more by the people. The fruit of mallero is rich source of ascorbic acid as well as various other major elements P, K, Mg, Ca and S and minor elements Fe, Zn, B, and Cu. The content of other major elements (P, K, Mg, Ca, S) and minor elements (Fe, Zn and B) were found to be higher and will lead to more consumer preference. The toxic elements like Pb, As, Al, Ti, Ni and Cr were also analyzed and found to be safe for human consumption. The commercialization of processed products of indigenous fruit Mallero (*Elaeagnus latifolia*) is very relevant and important in enhancement of economic potential of tribal farming community of Sikkim.

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