

## Development of Innovative Mango Bar

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| ARTICLE INFO  | ABSTRACT  |
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| <b>Original Research article</b><br>Received on March 18, 2017<br>Accepted on May 02, 2017<br><br><b>Article Authors</b><br>Minerva Potsangbam,<br>A. K. Chaurasiya<br><b>Corresponding Author Email</b><br><a href="mailto:phthort@gmail.com">phthort@gmail.com</a>  | Mango ( <i>Mangifera indica</i> L.) is one of the most important tropical fruits in the world and currently ranked 5th in total world production among the major fruit crops. As mango is a seasonal fruit, about 20% of fruits are processed for products such as puree, nectar, leather, pickles, canned slices, and chutney. Mango fruit bar, an important product of commerce, is an excellent source of vitamin A and C, potassium fibre and $\beta$ -carotene. They are very famous mainly because of it tastes like a mango which come handy and is available off season. Mango bars are generally prepared by drying mango pulp with proper amount of sugar and acid. Thus, to standardize the recipe for preparation of good quality mango bar from mango pulp along with cassava and flour. |
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Mango (*Mangifera indica* L.) is known as King due to its exotic flavor, delicious taste and several other desirable characters. Mango, the national fruit of India is the most popular tropical fruit crop belongs to Anacardiaceae family originated from South Asia, the Indo-Burma region. It has intimate association with cultural, religious, aesthetic and economic life of Indians since time immemorial (Chattopadhyay, 1976). India is the largest producer of mango accounting for about 54 per cent of the world production, followed by Mexico, Pakistan and Indonesia. In India, mango occupies an area of 2516 million hectares with the production of 18931 MT and productivity 7.3 M/ha. (NHB, 2015) but as per Indian Council of Agriculture Research (ICAR-2012), the maximum loss in fruits and vegetables ranges between 12.4 to 18% (post-harvest) rendered unfit for consumption due to spoilage after harvesting, virtually negligent attitude towards post-harvest losses, and absence of food processing and unavailability of modern cold storages. The post-harvest losses touch an alarming amount of Rs. 2.13 lac crore in 2011-12 and may cross Rs.2.50 lac crore in 2013-2014 according to ASSOCHAM study. Mango fruits have been utilized for long time as fresh as well as its products like chutney, pickle, amchoor, pectin, jam, preserve, toffees, am papad, mango powder and many other preparations having Mango flavour green Mango beverage when it raw while ripe ones are used in making pulp, juice, nectar, squash, leather, slices, etc. All parts of the Mango plant from the seeds and flowers

to the leaves and gum are used in traditional South Asian medicine, but the fruits are most important. Unani physicians hold Mangos in very high esteem because of their many medicinal virtues. They are used for strengthening the nervous and blood systems, ridding the body of toxins and treating anemia. In Ayurveda, dried Mango flowers are used to cure dysentery, diarrhea and inflammation of the urinary tract. In South Asian folk medicine, rheumatism and diphtheria is treated using the astringent bark of the Mango tree. Cracked skin on the soles of feet and scabies is cured by applying the gum, which oozes from trunk of the tree. Powdered seeds are used to stem bleeding. Fruits are eaten as a kidney tonic and to cure headaches. Leaf, bark, stem and green unripe and half ripe fruits inhibit growth of bacteria, particularly *Escherichia coli*. Ripe mangoes contain anti-fungal properties, juice from the seeds give relief from diarrhea and young leaves prevent sickness. Mango fruit bar, an important product of commerce, is an excellent source of vitamin A and C, potassium, fibre and  $\beta$ -carotene. Mango bar are very famous mainly because of it taste like a mango which come handy and is available off season. Mango bars are generally prepared by drying mango pulp with proper amount of sugar and acid.

### MATERIALS AND METHOD

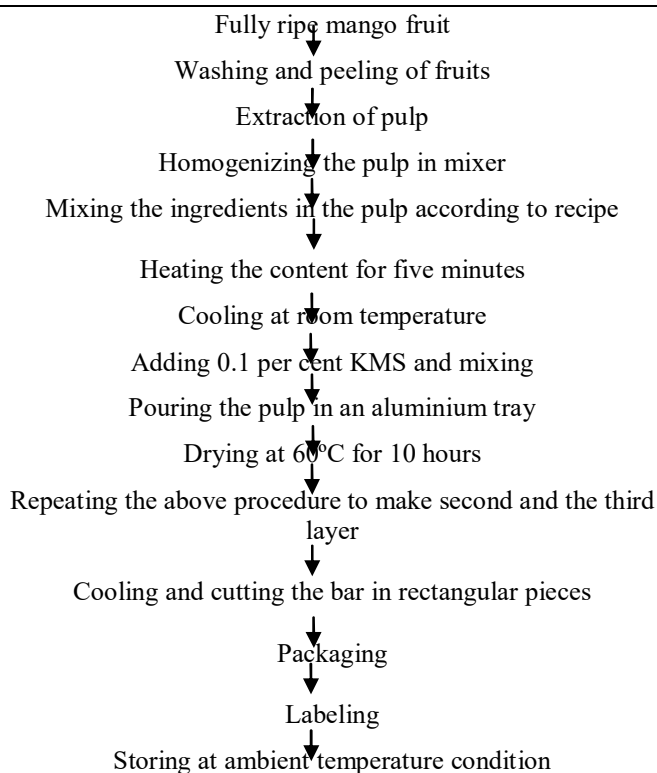
The experiment was carried out in the Laboratory of Horticulture, Department of

**Table 1. Combination of ingredient for processing of fruit bar recipe**

| Treatment | Name of ingredients            | Amount | Proportion of ingredients (gm) |
|-----------|--------------------------------|--------|--------------------------------|
| 1.        | Mango pulp (100%)              | 1000gm | 1000                           |
| 2.        | Mango pulp (90%) + sugar (10%) | 1000gm | 900 + 100                      |
| 3.        | Mango pulp (80%) + sugar (20%) | 1000gm | 800 + 200                      |
| 4.        | Mango pulp (70%) + sugar (30%) | 1000gm | 700 + 300                      |
| 5.        | Mango pulp (60%) + sugar (40%) | 1000gm | 600 + 400                      |
| 6.        | Mango pulp (50%) + sugar (50%) | 1000gm | 500 + 500                      |

Horticulture, North-Eastern Hill University, Tura Campus, Chasengre, West Garo Hills, Meghalaya during 2015-2017 with a view to analyze the physico-chemical characteristics and sensory attributes of mango bar and to standardize the recipe of fruit bar along with the evaluation of nutritional values of processed products.

### Preparation of Mango Bar



**Fig. 1. Flow chart for preparation of mango bar by Parab *et al.* (2014)**

### Standardization of Mango Bar Recipe

#### Preservatives

KMS @ 350ppm/kg (Potassium metabisulphite), acid content @ 0.5% and Cassava flour was added 20 % in each treatment.

#### Packaging of Processed Product

Prepared fruit bar was wrapped with butter paper and packed air tightly in pp packets and given treatment numbers as per the treatment and allowed to store in cool and dry places.

#### Physio-chemical Parameters

The physiochemical characteristics of fresh fruit and mango bar were analysed by standard method like total soluble solid (TSS) by hand refractometer, estimation of sugars by Lane and Eynon (1923), acidity by AOAC, 1984, Ascorbic acid by 2, 6 dichlorophenol indophenols solution as described by Ranganna (1997), Protein by Lowry's method (1951), carbohydrates by Hedge and Hofreiter (1962), starch by Moorthy and Maini, (2000) and  $\beta$ - carotene content of mango and its products were analysed spectrophotometrically (Ranganna, 1997) after extraction with acetone and in petroleum ether base.

#### Organoleptic Quality

Initially and periodically the samples were distributed to a team of taste panelist (10) for overall acceptability that actually include the points like color, flavor, texture of the freshly prepared mango bar on a 5 Point Hedonic Scale (Amerine *et al.*, 1965). The panel was selected only post graduate students and above. Samples receiving acceptability score of 3 and above were considered for acceptable of product.

**Table 2. Physical Parameters of Mango**

| S. N. | Parameters        | Value  |
|-------|-------------------|--------|
| i     | Fruit weight      | 240 gm |
| ii    | Pulp colour       | Yellow |
| iii   | Pulp              | 77.24% |
| iv    | Pulp: peel ratio  | 5.78   |
| v     | Pulp : seed ratio | 8.10   |

**Table 3. Biochemical Parameters of Mango**

| S. N. | Parameters    | Nutritional value |
|-------|---------------|-------------------|
| i     | TSS           | 14.20° Brix       |
| ii    | TS            | 6.45%             |
| iii   | RS            | 4.76%             |
| iv    | NRS           | 1.60%             |
| v     | Acidity       | 0.36%             |
| vi    | Ascorbic acid | 16.10 mg/100g     |
| vii   | Protein       | 10.16%            |
| viii  | Starch        | 7.96%             |
| ix    | β-carotene    | 4598.48 IU        |
| x     | Carbohydrates | 3.01%             |

### Statistical Analysis

Statistical analysis and test of significance were done following the method described by (Panse and Sukhatme 1967) while the method described by (Mahalanobis 1932) was followed for Completely Randomized Block Design. The analysis of variance (ANOVA) of the data was carried out by the techniques as suggested by (Raghuramula *et al.* 1983).

### Estimation of Benefit: Cost Ratio of Mango Bar

The benefit cost ratio was calculated after estimation of the cost involved including the operational and as well as 10% overhead charges incurred during the preparation of mango bar. The benefit: cost ratio was computed by the formula as given below.

$$\text{Benefit: cost ratio} = \frac{\text{Net income}}{\text{Total cost of production}}$$

The gross income was estimated by average market price of similar product and total cost of production was estimated by addition of the fixed cost and variable cost with 10% overhead charges of fixed inputs.

## RESULTS AND DISCUSSION

Mango (var. Lakhanbhog) was brought from the local market and used for the standardization of mango bar recipe for the mango bar. Mango bar was prepared with the combination of mango pulp, sugar and cassava flour. The experiments consist of 6 treatments. Experimented viz. T<sub>1</sub>- M (mango pulp), T<sub>2</sub>- M+S (mango pulp + sugar in proportion of 90+10%), T<sub>3</sub>- M+S (80+20%), T<sub>4</sub>- M+S (70+30%), T<sub>5</sub>- M+S (60+40%), T<sub>6</sub>- M+S (50+50%) and KMS @350ppm and cassava flour 20% were added in each treatment, and acid content was maintained @ 0.5% for each treatment. The data presented in tables.

### Physico-chemical Characteristics of Fresh Mango

Physico-biochemical parameters of fresh mango are shown in Table 2 and 3. The average fruit weight of mango was found 240 gm, pulp colour; yellow, pulp %; 77.24, pulp: peel ratio; 5.78 and pulp: seed ratio, 8.10. The biochemical parameters like TSS, TS, RS, NRS, acidity, ascorbic acid, protein, starch, β-carotene and carbohydrates, were found the value 14.20° Brix, 6.45%, 4.76%, 1.60%, 0.36%, 16.10 mg/100g, 10.16%, 7.96%, 4598.48 IU and 3.01% respectively. Similar results were also observed by (Ara *et al.* 2014) in nutritional evaluation of different mango varieties.

### Nutritional Quality of Freshly Prepared Mango Bar and Standardization of Recipe

The quality of freshly prepare mango bar is shown in (Table 4). The T<sub>2</sub> got the maximum value (4.56) by panelist followed by T<sub>3</sub> (4.30) and T<sub>5</sub> (3.50) among the six treatments. The T<sub>2</sub> was having good taste and aroma as well as soft texture and non sticky in nature during biting. Highest TSS was observed in T<sub>2</sub> followed by T<sub>3</sub> and T<sub>6</sub> while T<sub>5</sub> has the highest Total Sugar content (46.67%) and NRS and as well as highest RS was observed in T<sub>3</sub>

**Table 4. Quality of freshly prepared mango bar and sensory evaluation**

| Treatments     | TSS<br>(°Brix) | TS %  | RS %  | NRS%  | Acidity % | Ascorbic<br>acid<br>mg/100g | Protein % | Starch% | β- carotene IU | Carbohydrates<br>% | Moisture% | Sensory evalu-<br>ation |
|----------------|----------------|-------|-------|-------|-----------|-----------------------------|-----------|---------|----------------|--------------------|-----------|-------------------------|
| T <sub>1</sub> | 56.80          | 27.38 | 15.81 | 10.99 | 0.55      | 13.32                       | 10.49     | 11.52   | 3593.54        | 12.54              | 19.80     | 2.64                    |
| T <sub>2</sub> | 59.47          | 24.07 | 15.02 | 8.60  | 0.47      | 12.41                       | 8.54      | 12.20   | 3118.48        | 15.08              | 18.10     | 4.56                    |
| T <sub>3</sub> | 57.33          | 39.52 | 18.28 | 20.18 | 0.39      | 7.27                        | 4.48      | 12.72   | 2033.63        | 16.23              | 17.97     | 4.30                    |
| T <sub>4</sub> | 54.53          | 43.33 | 8.59  | 33.01 | 0.40      | 6.06                        | 5.41      | 13.23   | 1420.03        | 18.98              | 17.95     | 2.70                    |
| T <sub>5</sub> | 53.60          | 46.67 | 9.78  | 35.05 | 0.40      | 11.20                       | 3.84      | 13.84   | 1339.72        | 20.53              | 18.30     | 3.50                    |
| T <sub>6</sub> | 56.53          | 46.67 | 9.54  | 35.27 | 0.55      | 14.53                       | 3.60      | 15.16   | 992.42         | 21.83              | 19.63     | 3.27                    |

followed by T<sub>1</sub> and T<sub>2</sub>. It was observed that highest ascorbic acid, starch and carbohydrates in T<sub>6</sub> while T<sub>1</sub> has the highest content of protein, beta-carotene and moisture content.

#### Estimation of Benefit: Cost of Standardized Product

The benefit cost ratios of the three standardized products of mango bar are given below: The benefit cost ratio of T<sub>2</sub> [Mango + sugar (90+10)%] was found 1.18, T<sub>3</sub> [Mango+ sugar (80+20)%] was 1.34 and T<sub>5</sub> [Mango + sugar (60+40)%] was 0.93 whereas T<sub>2</sub> was rated by panelist with high score as per compared to the T<sub>3</sub> and T<sub>5</sub>. But as per b/c ratio was more in T<sub>3</sub> because, recovery was more. The overall sensory ratings and quality was found more in T<sub>2</sub>.

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