

Original Research Article

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## Standardization of Protocols for Preparation of Star fruit (*Averrhoa carambola*), Muskmelon (*Cucumis melo*) and Mango (*Mangifera indica*) Blended Mixed Fruit Jam and their Shelf Life

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### ABSTRACT

#### Keywords

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An experiment was carried out during 2018-2019 at Post-Harvest Laboratory of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj; Uttar Pradesh, India. The experiment was designed with Completely Randomized Design (CRD), with ten treatments and each replicated thrice with the objective to evaluate the organoleptic acceptability and shelf life attributes. The treatments consisted T<sub>0</sub> (Control - 100% Carambola), T<sub>1</sub> (60% Carambola + 40% Mango), T<sub>2</sub> (60% Carambola + 40% Muskmelon), T<sub>3</sub> (50% Carambola + 50% Mango), T<sub>4</sub> (50% Carambola + 50% Muskmelon), T<sub>5</sub> (40% Carambola + 60% Mango), T<sub>6</sub> (40% Carambola + 60% Muskmelon), T<sub>7</sub> (60% Carambola + 20% Mango + 20% Muskmelon), T<sub>8</sub> (50% Carambola + 25% Mango + 25% Muskmelon), T<sub>9</sub> (40% Carambola + 30% Mango + 30% Muskmelon). The study shows that treatment T<sub>6</sub> (40% Carambola + 60% Muskmelon) was found to be the best and superior in organoleptic and shelf life attributes, whereas treatment T<sub>1</sub> (60% Carambola + 40% Mango) was found least acceptable in

### Introduction

Star fruit (*Averrhoa carambola*) has the highest antioxidant properties among the various Indian tropical fruits i.e. it is capable of fighting against free radicals as well as the damage caused due to free radicals (Amitabye *et al.*, 2003). This fruit has anti-inflammatory activity (Cabrin *et al.*, 2011), anti-ulcer activity (Ferreira *et al.*, 2008), hypoglycaemic activity as well as antimicrobial activity.

According to the USDA (United States Department of Agriculture) the nutrient content or nutrient database of 100g of star fruit (*Averrhoa carambola*) are as follows - Niacin (0.294-0.38 mg), Ascorbic Acid (26.0-53.1 mg), Calories (35.7 g cal), Moisture (89.0-91.0 %), Protein (0.38 g), Fat (0.08 g), Carbohydrates (9.38 g), Fibre (0.80-0.90 %), Ash (0.26-0.40 g), Calcium (4.4-6.0 mg), Phosphorus (15.5-21.0 mg), Iron (0.32-1.65 mg), Carotene (0.003-0.552 mg), Thiamine

(0.03-0.038 mg), Riboflavin (0.019-0.03 mg). Put in perspective, one Carambola weighs approximately 55 grams. Carambola is rich in antioxidants, potassium, and vitamin C and low in sugar and sodium.

Muskmelon (*Cucumis melo*) is popular for its nutritive and medicinal properties. They are naturally low in fat and sodium, have no cholesterol and provide many essential nutrients such as potassium, in addition to being a rich source of  $\beta$ -carotene and vitamin C. Muskmelon is rich in calories (100g fruit has 34 calories), Dietary fibre (2.25%), Beta-carotene, Folic Acid, Potassium, Iron (2.5%), Magnesium (2%), Vitamin A (112%), Vitamin C(61%), Vitamin B-16, Energy (1.5%), Carbohydrates (6.5%), Protein (1.5%), niacin (4.5%) and other Vital nutrients.

Mango (*Mangifera indica L.*) is the king among the tropical fruits and is greatly relished for its succulence, exotic flavour and delicious taste in most countries of the world (Bhatnagar and Subramanyam, 1973). Mangoes are high in Vitamins, Potassium, and Folate and also add Fibre to your diet. It contains Potassium (6%), Carbohydrates (19%), Dietary fibre (11%), Vitamin A (13%), Vitamin C(80%), Calcium (2%), Iron(1%), Protein(1g). Mangos are high in vitamin C.

Value addition plays an important role in preservation of fruits by increasing its shelf life in the form of Jam by Norman (1970). Star fruit, muskmelon and mango retain its nutritional property even after processing or value addition. In this era of modernisation consumers prefer to have a product with some additional nutritive value and flavour than that of a single one.

Blending of star fruit with muskmelon and mango can be attributed to their many beneficial properties as analgesic, antimicrobial, astringent, febrifuge, nervine and tonic substances. It also provides better

opportunity for import and export operations when there is no availability of proper means of transport of perishable fruits. It encourages innovative farmers to adopt skills, development and modern practices that aids in income generation to improve the economy. It ensures all year round availability of the fruit products even during off season. The present study was undertaken to standardize the proportions of Carambola, Muskmelon and Mango for making mixed fruit jam and also to study the shelf life of blended product.

### **Materials and Methods**

An experiment was conducted at Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (Allahabad) during 2018-2019. The experiment was designed with Completely Randomized Design (CRD) with total number of 10 treatments along with 3 replications. The allocation of these 10 treatments was done randomly. The treatment combinations was formulated from Carambola, Muskmelon and Mango Blend viz. T<sub>0</sub> (Control - 100% Carambola), T<sub>1</sub>(60% Carambola + 40% Mango), T<sub>2</sub> (60% Carambola + 40% Muskmelon), T<sub>3</sub>(50% Carambola + 50% Mango), T<sub>4</sub> (50% Carambola + 50% Muskmelon), T<sub>5</sub>(40% Carambola + 60% Mango), T<sub>6</sub> (40% Carambola + 60% Muskmelon), T<sub>7</sub> (60% Carambola + 20% Mango + 20% Muskmelon), T<sub>8</sub> (50% Carambola + 25% Mango + 25% Muskmelon), T<sub>9</sub>(40% Carambola + 30% Mango + 30% Muskmelon). The data were recorded on over all acceptability and shelf life of the blended produce (mixed fruit jam) attributes. The mean data of each character was subjected to statistical analysis of variance and test the significance of each character as per the procedure of Panse and Sukhatme (1967).

## Results and Discussion

The analysis of variance revealed significant differences among different treatment combinations. A wide range of variations among the different combination of fruit pulp blend to form mixed fruit jam of Carambola, Muskmelon and Mango in respect to find out the Standardization Proportion of fruit pulp, blend quality of fruits to form good quality mixed fruit jam, storage period, shelf life, overall acceptability, flavour, taste, colour, texture and appearance were recorded they have. The maximum score of colour (9.870, 9.326, 9.006 and 8.906) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon). Whereas minimum score of colour (5.840, 5.623, 5.296 and 5.096) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). Patil *et al.*, (2013) reported the increase in colour of different types of jams might be due to solubilisation of pulp consistent during hydrolysis of polysaccharides. In terms of appearance the highest score (9.354, 9.338, 9.210 and 9.355) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) whereas the lowest score (5.142, 5.160, 5.054 and 5.109) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). Similarly result founded Patil *et al.*, (2013) reported the increase in colour of different types of jams. In case of flavour the highest score (9.916, 9.356, 9.046 and 8.650) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) whereas the lowest score (5.880, 5.643, 5.216 and 5.093) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). The increase in flavour of jam during storage might be due to conversion of

polysaccharides into soluble sugars as reported by Patil *et al.*, (2013). The highest score in the case of taste (9.916, 9.326, 9.006 and 8.650) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) whereas the lowest score (5.880, 5.623, 5.296 and 5.093) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). Similar result was found by Patil *et al.*, (2013) who reported the increase in taste of jam might be due to solubilisation of pulp constituent during hydrolysis of polysaccharides. The maximum score of texture (9.893, 9.356, 9.046 and 8.906) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) whereas the minimum score (5.920, 5.643, 5.216 and 5.096) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). As the period of storage increased, the texture values of jam increased significantly up to 90 days of storage. According to overall acceptability the highest score (9.850, 9.893, 9.006 and 8.650) at Initial, 30, 60 and 90 days of Star fruit, Muskmelon and Mango mixed fruit jam was recorded with treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) whereas the lowest score (5.950, 5.920, 5.296 and 5.093) at Initial, 30, 60 and 90 days was observed in treatment T<sub>1</sub> (60% Star fruit + 40% Mango). As the period of storage increased, the overall acceptability values of jam increased significantly up to 90 days of storage. The maximum shelf life (125.66) was observed in treatment T<sub>6</sub> (40% Star fruit + 60% Muskmelon) and minimum shelf life was observed in treatment T<sub>1</sub> (100% Star fruit) during storage. The Shelf life of Star fruit, Muskmelon and Mango mixed fruit jam was showed increasing trend during storage this may possibly be due to increase in time interval, temperature and action of enzymes (Fig. 1–7 and Table 1–3).

**Table.1** Change in colour and appearance of star fruit, muskmelon and mango blended mixed fruit jam

Treatments		Colour				Appearance			
		Initial	30 Days	60 Days	90 Days	Initial	30 Days	60 Days	90 Days
<b>T<sub>0</sub></b>	100% Carambola (Control)	8.843	8.440	8.116	7.693	8.703	8.662	8.495	8.586
<b>T<sub>1</sub></b>	60% Carambola+ 40% Mango	5.840	5.623	5.296	5.096	5.142	5.160	5.054	5.109
<b>T<sub>2</sub></b>	60% Carambola +40% Muskmelon	8.793	8.493	8.206	8.073	8.379	8.203	8.183	8.222
<b>T<sub>3</sub></b>	50% Carambola + 50% Mango	6.506	6.430	6.270	6.073	6.653	6.338	6.208	6.271
<b>T<sub>4</sub></b>	50% Carambola +50% Muskmelon	9.420	9.213	9.126	9.006	9.339	9.326	9.098	9.235
<b>T<sub>5</sub></b>	40% Carambola + 60% Mango	6.500	6.423	6.226	5.950	6.341	6.131	6.055	6.091
<b>T<sub>6</sub></b>	40% Carambola +60% Muskmelon	9.870	9.326	9.006	8.906	9.354	9.338	9.210	9.355
<b>T<sub>7</sub></b>	60% Carambola + 20% Mango + 20% Muskmelon	7.910	7.803	7.520	7.173	7.483	7.393	7.166	7.333
<b>T<sub>8</sub></b>	50% Carambola + 25% Mango + 25% Muskmelon	7.730	7.536	7.263	7.106	7.449	7.215	7.125	7.208
<b>T<sub>9</sub></b>	40% Carambola + 30% Mango + 30% Muskmelon	7.900	7.740	7.340	7.096	7.390	7.221	7.025	7.205
<b>F- test</b>		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>S.Ed (±)</b>		<b>0.10</b>	<b>0.09</b>	<b>0.10</b>	<b>0.12</b>	<b>0.16</b>	<b>0.18</b>	<b>0.20</b>	<b>0.23</b>
<b>C.D.at 5%</b>		<b>0.22</b>	<b>0.18</b>	<b>0.20</b>	<b>0.25</b>	<b>0.34</b>	<b>0.37</b>	<b>0.43</b>	<b>0.48</b>

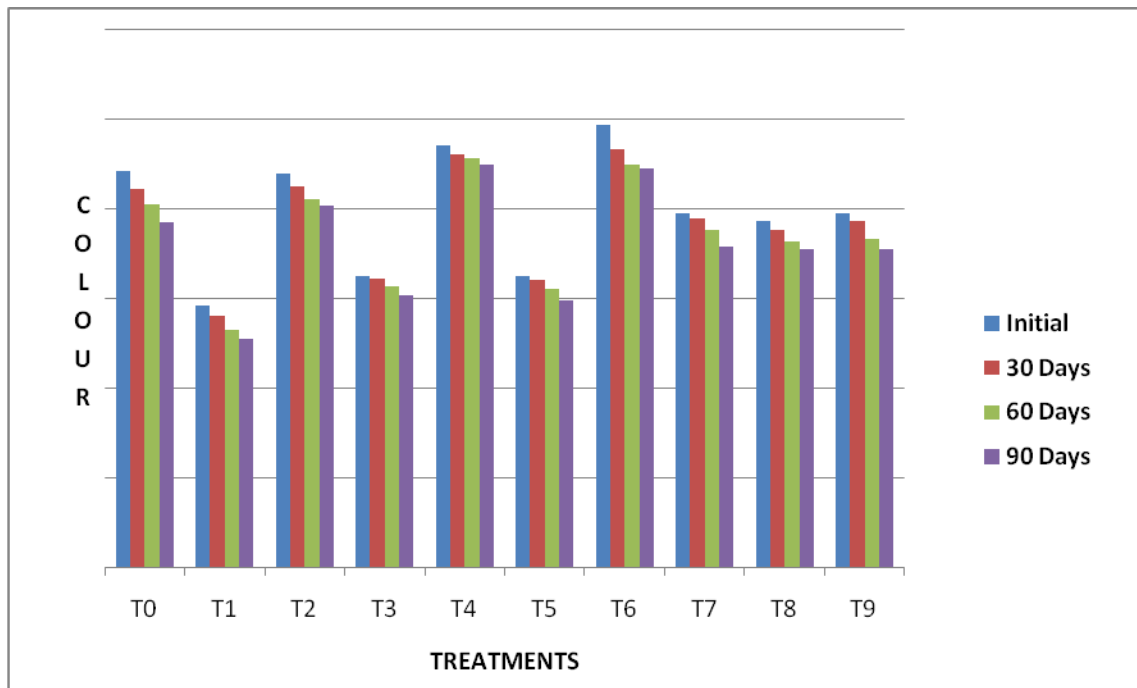
**Table.2** Change in flavour, taste and texture of star fruit, muskmelon and mango blended mixed fruit jam

Treatments		Flavour				Taste				Texture			
		Initial	30 Days	60 Days	90 Days	Initial	30 Days	60 Days	90 Days	Initial	30 Days	60 Days	90 Days
<b>T<sub>0</sub></b>	100% Carambola (Control)	8.873	8.456	8.123	7.913	8.873	8.440	8.116	7.913	8.926	8.456	8.123	7.693
<b>T<sub>1</sub></b>	60% Carambola+ 40% Mango	5.880	5.643	5.216	5.093	5.880	5.623	5.296	5.093	5.920	5.643	5.216	5.096
<b>T<sub>2</sub></b>	60% Carambola +40% Muskmelon	8.840	8.526	8.190	7.913	8.840	8.493	8.206	7.913	8.826	8.526	8.190	8.073
<b>T<sub>3</sub></b>	50% Carambola + 50% Mango	6.563	6.433	6.250	6.046	6.563	6.430	6.270	6.046	6.740	6.433	6.250	6.073
<b>T<sub>4</sub></b>	50% Carambola +50% Muskmelon	9.466	9.233	9.016	8.913	9.466	9.213	9.126	8.913	9.640	9.233	9.016	9.006
<b>T<sub>5</sub></b>	40% Carambola + 60% Mango	6.566	6.443	6.190	5.780	6.566	6.423	6.226	5.780	6.693	6.443	6.190	5.950
<b>T<sub>6</sub></b>	40% Carambola +60% Muskmelon	9.916	9.356	9.046	8.650	9.916	9.326	9.006	8.650	9.893	9.356	9.046	8.906
<b>T<sub>7</sub></b>	60% Carambola + 20% Mango + 20% Muskmelon	7.946	7.826	7.500	7.200	7.946	7.803	7.520	7.200	7.896	7.826	7.500	7.173
<b>T<sub>8</sub></b>	50% Carambola + 25% Mango + 25% Muskmelon	7.776	7.586	7.250	7.093	7.776	7.536	7.263	7.093	7.750	7.586	7.250	7.106
<b>T<sub>9</sub></b>	40% Carambola + 30% Mango + 30% Muskmelon	7.946	7.776	7.340	7.106	7.946	7.740	7.340	7.106	7.906	7.776	7.340	7.096
<b>F- test</b>		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>S.Ed (±)</b>		<b>0.08</b>	<b>0.09</b>	<b>0.10</b>	<b>0.10</b>	<b>0.08</b>	<b>0.09</b>	<b>0.10</b>	<b>0.10</b>	<b>0.06</b>	<b>0.09</b>	<b>0.10</b>	<b>0.12</b>
<b>C.D.at 5%</b>		<b>0.17</b>	<b>0.20</b>	<b>0.22</b>	<b>0.22</b>	<b>0.17</b>	<b>0.18</b>	<b>0.20</b>	<b>0.22</b>	<b>0.13</b>	<b>0.20</b>	<b>0.22</b>	<b>0.25</b>

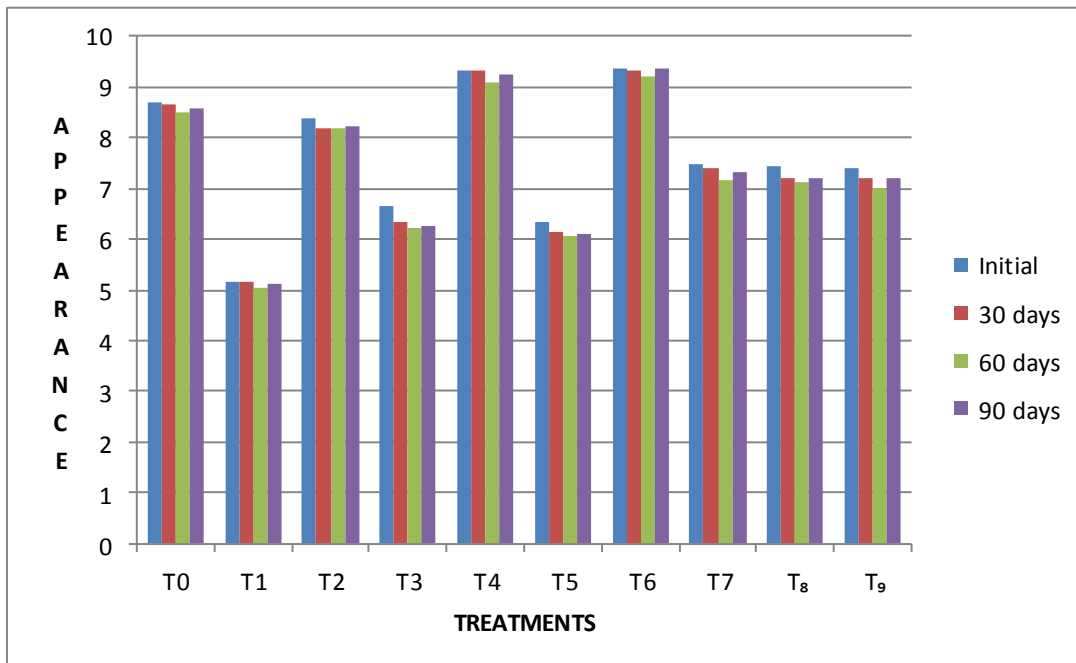
**Table.3** Overall acceptability and shelf life of star fruit, muskmelon and mango blended mixed fruit jam

Treatments		Overall Acceptability				Shelf life
		Initial	30 Days	60 Days	90 Days	Days
T <sub>0</sub>	100% Carambola (Control)	8.953	8.926	8.116	7.913	110
T <sub>1</sub>	60% Carambola+ 40% Mango	5.950	5.920	5.296	5.093	94.33
T <sub>2</sub>	60% Carambola +40% Muskmelon	8.916	8.826	8.206	7.913	102.33
T <sub>3</sub>	50% Carambola + 50% Mango	6.850	6.740	6.270	6.046	99.33
T <sub>4</sub>	50% Carambola +50% Muskmelon	9.716	9.640	9.126	8.913	120
T <sub>5</sub>	40% Carambola + 60% Mango	6.863	6.693	6.226	5.780	102.66
T <sub>6</sub>	40% Carambola +60% Muskmelon	9.850	9.893	9.006	8.650	125.66
T <sub>7</sub>	60% Carambola + 20% Mango + 20% Muskmelon	7.870	7.896	7.520	7.200	104.33
T <sub>8</sub>	50% Carambola + 25% Mango + 25% Muskmelon	7.803	7.750	7.263	7.093	107.66
T <sub>9</sub>	40% Carambola + 30% Mango + 30% Muskmelon	7.803	7.906	7.340	7.106	107.66
<b>F- test</b>		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>S.Ed (±)</b>		<b>0.05</b>	<b>0.06</b>	<b>0.10</b>	<b>0.10</b>	<b>3.05</b>
<b>C.D.at 5%</b>		<b>0.10</b>	<b>0.13</b>	<b>0.20</b>	<b>0.22</b>	<b>6.41</b>

**Fig.1** Change in colour of star fruit, muskmelon and mango blended mixed fruit jam



**Fig.2** Change in appearance of star fruit, muskmelon and mango blended mixed fruit jam.



**Fig.3** Change in flavour of star fruit, muskmelon and mango blended mixed fruit jam

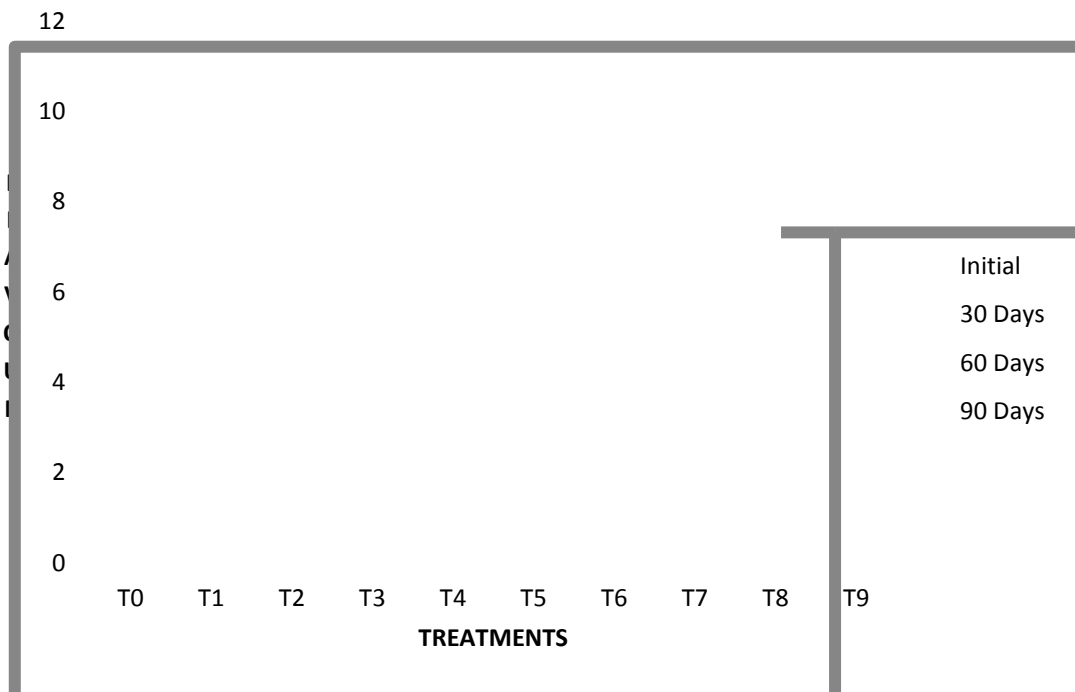


Fig.4 Change in taste of star fruit, muskmelon and mango blended mixed fruit jam

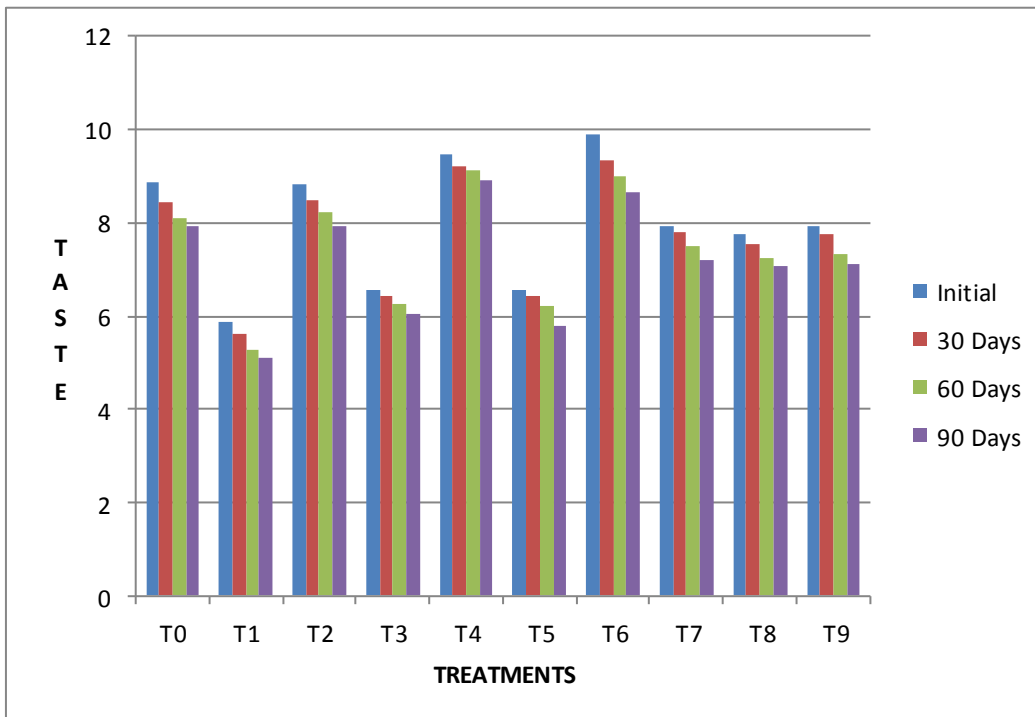
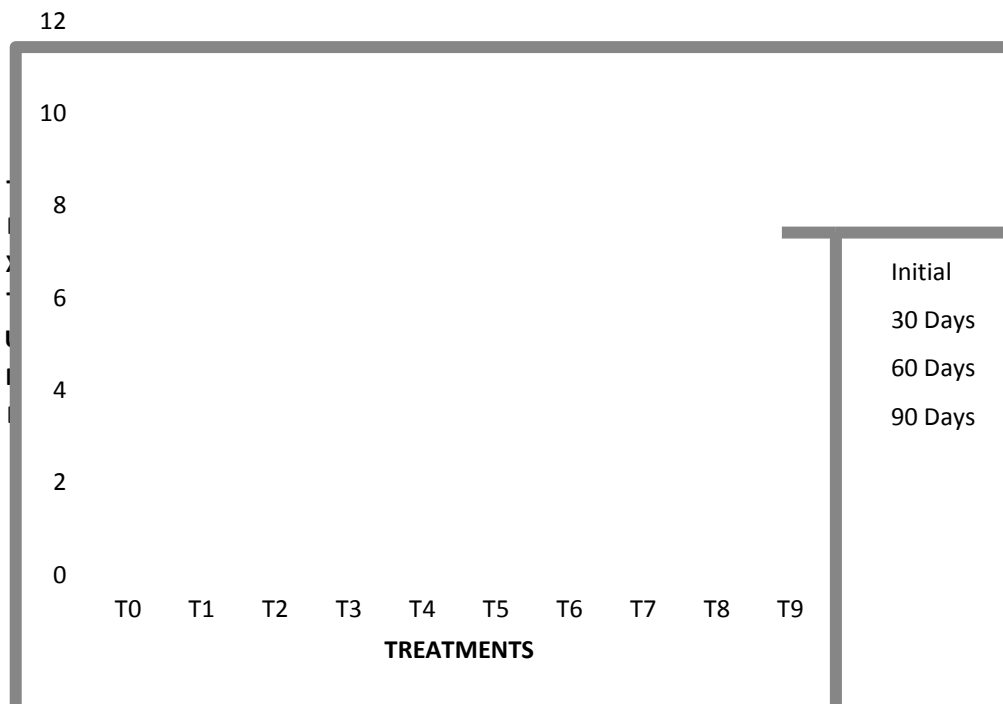
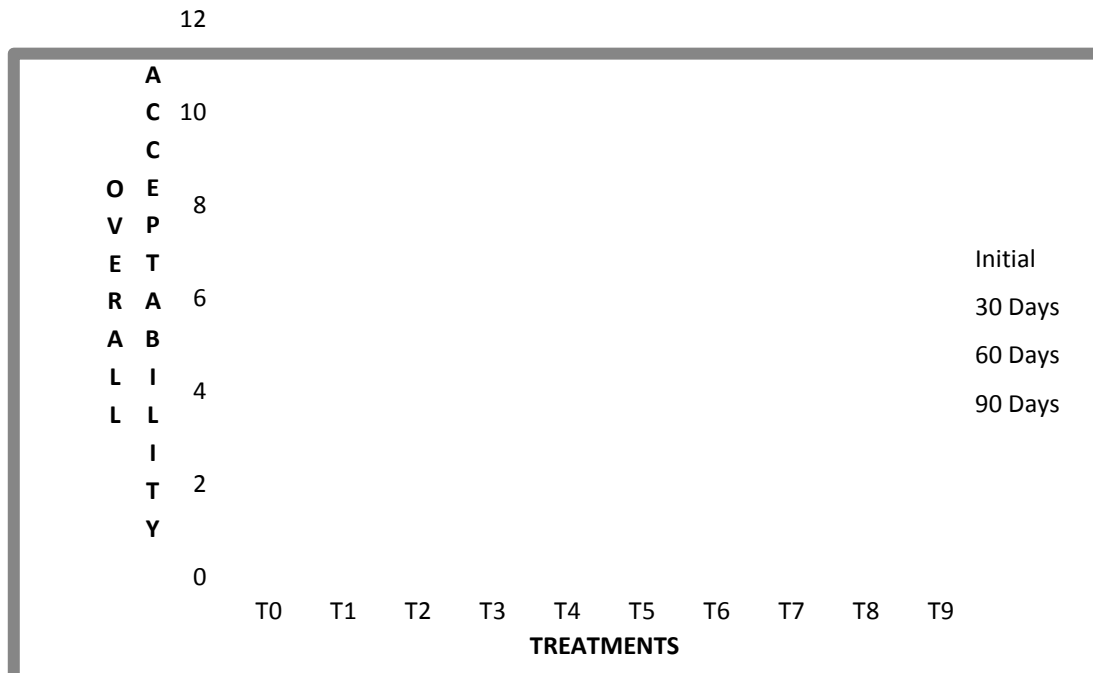


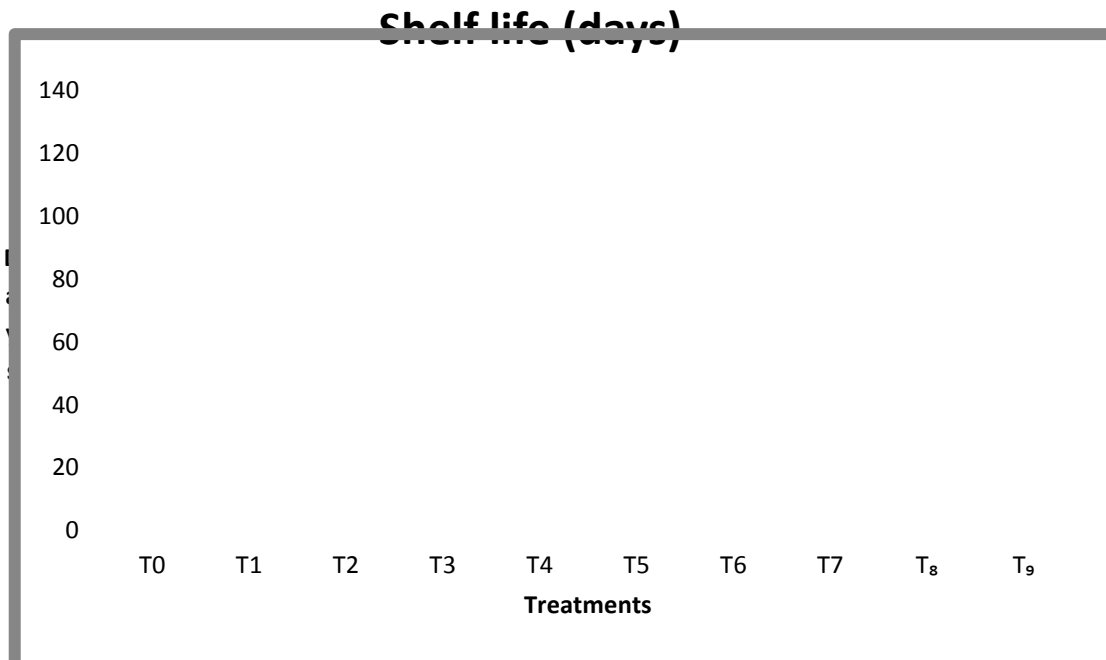
Fig.5 Change in texture of star fruit, muskmelon and mango blended mixed fruit jam



**Fig.6** Overall acceptability of star fruit, muskmelon and mango blended mixed fruit jam



**Fig.7** Shelf life of star fruit, muskmelon and mango blended mixed fruit jam



Similar results were reported by Shanker *et al.*, (1967) in case of guava juice Shabi *et al.*, (2018) in guava cheese.

The results were in conformity with the findings of Patil *et al.*, (2013), Shanker *et al.*, (1967) and Shabi *et al.*, (2018).



On the basis of research findings, it is concluded that the treatment T<sub>6</sub> (40 % Carambola + 60 % Muskmelon) was found best with storage period of 90 Days. It was also observed superior in terms of both organoleptic and shelf life attributes. Hence, it clearly shows that the fruits are suitable for the preparation of mixed fruit jam with good blend quality along with high nutritive value.

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