

Quality evaluation and storage stability of exotic fruit Jam blended with Pomelo and Grape fruits

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Abstract

The products like mixed/blended fruit jams associate with the characteristics nature of two or more fruits that allowed to develop exotic product rather than a simple jam blended with multiple nutritional factors along with characteristic/unique sensory properties. The present study was carried out to standardize appropriate combination of Pomelo-black grape blends for the development of exotic jam, and its storage quality evaluation. Total three combinations of pomelo+black grape concentration includes S1 (60%+40%), S2 (50%+50%), S3 (40%+60%) have been formulated and trial products were developed accordingly. Developed formulations were subjected to the quality evaluation in terms of sensorial and physicochemical properties and the final formulation accepted by majority of the panel members along with good quality patterns have been considered as the standardized final product. Prepared experimental products were stored in pre-sterilized glass jars at room temperature by following good hygienic practices and tested for their shelf life maxima. Physico-chemical, nutritional, organoleptic and microbiological parameters were undertaken at a regular interval of 15 days. The resulted data shown that, experimental samples were well acceptable for 45 days stored at room temperature during the storage and statistical analysis revealed that storage intervals have significant ($p \leq 0.05$) different in terms of moisture, reducing sugars, total sugar, and Vitamin C among the three experimental trials. Findings from sensory comparisons and physicochemical properties of blended jams revealed that blended jams have more acceptable rate than single fruit jams. Also,

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findings of the study gives a good scope for the future developments in the development of exotic fruits jams with characteristic nutritional and functional; properties.

Key words : Exotic fruit jam, Fruit blends, Pomelo, Black Grapes, Nutrients, Antioxidant, Shelf life.

In early days, excess fruits used to be converted to products like jams and fruit preserves to make the fruits available for consumption even during the off-season as well as preservation for long time to reach the consumers throughout the world. When manufacturing jams, the quantity of fruit pulp and sugar added in similar proportions into a container or vessel where the product is mixed thoroughly and cooked to the required consistency, the practice also results improved shelf life of the final product. Mixed/exotic fruit jams are said to be the blend of two or more fruits at required appropriate proportions to meet the consumer likes and dislikes in terms of nutritional, sensorial and acceptance point of view. The fruit pulp proportions at least 50% of the first-named fruit is added necessarily to the total fruit content and along with the not less than 68% of the total sugar content⁵. Mixed/exotic fruit jams are considered the more attractive products among the jams because of its multiple fruit blends representing various nutritional/functional benefits among the consumers. Because, Jams and jellies are the fruit based products consumed more frequently, especially among the children and younger populations due to delicacy of wide variety fruit flavours.

Pomelo (*Citrus grandis*) is one of the economically important fruit tree in India belongs to category of citrus fruit that packed important nutrients and antioxidants with characteristic sour taste. Same way, grapes

(black) are considered as a hub of so many nutrients like antioxidants, vitamins, minerals, flavonoids and pigments which are key functional food components supports the proper maintenance of human body. Pomelo is also called as Chinese grapefruit, shaddock, pumelo and pompelous belongs to the family Rutaceae. About 60 to 80 species of vining plants in the family Vitaceae, native to the North Temperate Zone including varieties that may be eaten as table fruit, raisins, juice or wine. Among them black grape (*Vitis vinifera*) is one of the finest and the healthiest fruits which are rich source of vitamins, minerals and pigments contribute to a balanced healthy life. However, the research on post-harvest technology and utilization of pomelo fruit to prepare value added products are very scanty. Therefore, in order to find out the potential possibilities of pomelo fruit processing into a value added nutritive product, attempts were made to standardize the recipes for developing highly acceptable products. Mixed fruit jam is one of the concepts for the blending of pomelo in to a product and could be a potential proposition to utilize pomelo fruit in a progressive way. Therefore, blending was also done to improve and supplement the appearance, nutrition and flavor to the jam along with other fruit combinations. Also, value addition can be achieved with the addition of pomelo to the new product development which has distinctly musky aroma and flavour.

In the present study, mixed fruit jam was developed by processing of pomelo and black grapes to get fine pulp itself rich in pectin. The mixed pulp was successfully used for the preparation of jam and helps to attain exotic flavour and colour by blending different fruit pulp proportions⁹. The exotic mixed jam was developed and standardized from the unconventional fruit like pomelo with conventional fruit like black-grape with aim to develop a value added product. The final product was studied for its shelf life and keeping quality in terms of sensorial and physicochemical properties that required to understand the acceptance rate of the jam during the storage period.

Procurement of raw materials :

The materials and ingredients required for the development of mixed fruit jam are pomelo, black grapes and sugar were purchased from the local fruit market in the Tirupati city.

Preparation procedure of pomelo and black grape blended jam :

Approximately uniform ripened fruits have been selected for the experiment and procured without any damages and infestation by ensuring the quality measures of the whole fruits. Fruits were washed under running tap water followed by washing with 150 ppm of chlorinated water to remove surface born microorganisms and other foreign adhesives. The skin was peeled off carefully and pits and stems were removed. Then, fruits were cut into small chunks for the pulping process. Accordingly, Pomelo saps and black grapes are blended in a mixer into pulp individually

and filter to remove seeds and core part. Appropriate ratio of two different fruit pulp was mixed together and adds sugar into the homogenized mixer. Mixed pulp was heated upto 105°C until to dissolves and reach required TSS (Total Soluble Solids). The final product was then filled into clean and pre-sterilized glass bottles. After cooling to room temperature, the bottles were sealed with air tight cork caps and kept for the shelf life studies at ambient storage conditions. The detailed preparations procedure of pomelo-blended grape jam was shown in the Figure 1.

Shelf life studies :

Shelf life studies have been conducted to enumerate the keeping quality and changes in physicochemical properties of experimental jam samples during the different storage periods (initial day, 15, 30 and 45 days) with an interval of 15 days. The developed product was taken and the required physical, chemical, nutritional, sensorial, and microbial analysis was carried out accordingly.

Physicochemical properties :

Physicochemical properties of a product reveal its qualitative and quantitative changes during the preservation and storage with respect to the time and atmospheric conditions. So, different types of physicochemical properties of pomelo-grape fruit exotic jam was evaluated to understand the final product quality stature required for the optimal commercialization.

Moisture content :

Moisture content of the experimental

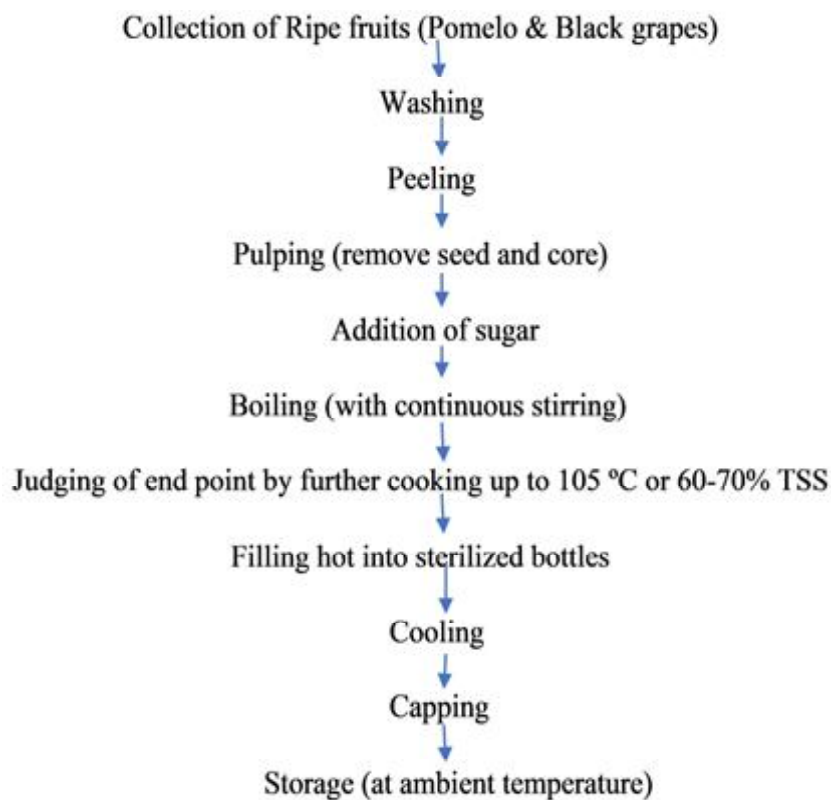


Figure 1. Flow chart for processing of pomelo blended exotic grape jam

samples was determined by the method Thiex (2009) with little modifications¹⁵.

Determination of pH, total soluble solids, titratable acidity, and ascorbic acid :

Estimation of pH, total soluble solids (TSS), and titratable acidity (TA) were measured by ⁴method with slight modifications. 5g of jam was homogenized in 25 ml of distilled water and then the mixture was properly filtered using muslin cloth. An aliquot sample was used to measure pH with a pH meter (Eutech instruments, prod- ECPH70042SEU, Singapore). TSS was measured using a hand refractometer (Erma

Inc. Tokyo, Japan) and expressed as °brix. The titratable acidity was determined with 0.1 N NaOH using phenolphthalein as indicator. Pomelo and grape blended jam (3g) was homogenized using a mortar and pestle (grinder) and then centrifuged at 3500 rpm (Remi centrifuge, CE model, India) for 10 minutes, the supernatant was collected and used to determine ascorbic acid content by 2,6-dichlorophenolindophenol titration².

Total sugars :

Total sugars of experimental samples have been estimated according to the standard

procedure and the values were expressed as percentage on weight basis¹⁰.

$$\text{Total sugars (\%)} = \frac{\text{Factor (0.05)} \times \text{Volume made up} \times \text{Dilution} \times 100}{\text{Titrate value} \times \text{Weight of the sample taken}}$$

Reducing sugars :

Reducing sugars present in the fresh fruit and mixed fruit jam were estimated with the method used by Lane and Eynon with slight modifications⁷. The amount of reducing sugars present in the experimental samples was quantified and the values were expressed as percentage on weight basis.

$$\text{Reducing sugars (\%)} = \frac{\text{Factor (0.05)} \times \text{Volume made up} \times \text{Dilution} \times 100}{\text{Titrate value} \times \text{Weight of the sample taken}}$$

Nutrient analysis :

The nutrient analysis of the experimental sample was done by following standard procedures and methods^{1,11,13}.

Microbial growth rate :

Microbial growth as total plate count (TPC) and yeast & molds (Y&M) were determined by pour plate method during the storage period with standardised intervals. Microbial count was expressed as log CFU/g³.

Sensory evaluation :

Laboratory developed Pomelo-black grape blended jam was evaluated for sensory characteristics like appearance, colour, taste, flavour and overall acceptability by 20 panellists which in terms represents and gives

an overall idea of product acceptability ratio. Each sensory characteristic was evaluated by 'five-point hedonic scale' method and scoring was given accordingly¹³.

Statistical Analysis :

All the experiments were carried out in triplicates, the data was subjected to one-way analysis of variance (ANOVA) followed by Duncan's multiple range test for the average value parameter among the four different storage intervals. Tukey's HSD test is used to compare the mean values between pair of storage days. Differences were calculated to compare significant effects $p \leq 0.05$ levels with the IBM SPSS statistic 20 software tool¹².

The present product development investigation was undertaken to develop effective processing technology for extraction of pulp from pomelo fruit as well as black grapes and the same was used for the development and standardization of exotic mixed fruit jam.

Standardization of ingredients :

Three experimental trials were performed with different concentrations of pomelo, black grape pulp extract and sugar. All the variations were subjected to sensory evaluation through 5-point hedonic scale method. Based on the sensory scores, trial II with high sensory score considered the final formulation as the optimized and standardized product (Table-1).

Table-1. Composition of product ingredients for the pomelo and black grape jam (100g)

S.No	Ingredients	Trial 1	Trial 2	Trial 3
1	Pomelo pulp (ml)	60	50	40
2	Black grapes pulp (ml)	40	50	60
3	Sugar (g)	100	100	100

Physicochemical analysis :

Physicochemical characteristics are the important markers chiefly considered while analysing the quality standards of the new product during the shelf life studies/storage period. So, moisture content was analysed throughout the storage period with different time intervals as it influences the shelf life and product quality. During the storage, there is a significant difference ($p \leq 0.05$) was observed between the 0 day, 15, 30 and 45th day of storage. Chemical analysis shows the changes in the quality and structure of the food. According to the data present in Table-2, the mean scores for the pH, total soluble solid (TSS) of the product have been shown no significance difference ($p \geq 0.05$) at different storage periods (initial day, 15, 30 and 45th day). Findings indicated that pH and TSS doesn't effected at any cost during the storage is a good asset for the new product. Besides, acid composition is also considered as reserve source of energy available to the fruits and would therefore be expected to decline during

the greater metabolic activity that occurs on ripening process due to their utilization as respiratory substrates. According to the experimental data, it is observed that no significant fall in titratable acidity was noted during the storage period but, a short fall from 0.75 to 0.38% is considered as common phenomenon with new products on storage. However, total sugars and reducing sugars in a final product was important for the product quality. Total sugars are mono and disaccharides present in food, derived from any source. Experimental data shown that there was a significant decrease in total sugar content followed with increasing storage period. Other side, reducing sugars are capable of acting as a reducing agent because it has a free aldehyde group or a free ketone group which gradually increased from 52 to 57% during the storage. These results were similar with the study conducted by Khan *et al.*,⁶ that showed an increase in glucose and fructose content in strawberry fruits and pulp during the storage.

Table-2. Mean scores of different physicochemical properties of Pomelo blended grape jam at different storage periods

Physicochemical analysis	Storage period			
	0 th day	15 th day	30 th day	45 th day

Mean values± standard deviation. Means followed by the same letters in the row are not significant ($p > 0.05$)

Table-3. Mean scores of various nutrient analysis of Pomelo blended grape jam at different storage periods

Moisture Content	28.10±0.30 ^a	26.00±0.30 ^{bA}	24.20±0.30 ^{cBA}	22.00±0.30 ^{dCB}
pH	3.35±0.17 ^a	3.60±0.17 ^a	3.72±0.17 ^a	3.83±0.17 ^a
TSS (°Brix)	71.50±0.17 ^a	71.52±0.17 ^a	73.54±0.17 ^a	73.58±0.17 ^a
Titrateable acidity (%)	0.75±0.17 ^a	0.69±0.17 ^a	0.40±0.17 ^a	0.38±0.17 ^a
Total Sugar	55.08±0.17 ^a	52.60±0.17 ^{bA}	56.86±0.17 ^{cBA}	58.00±0.17 ^{dCA}
Reducing Sugar (%)	52.00±0.17 ^a	53.00±0.17 ^{bA}	54.40±0.17 ^{cBA}	57.00±0.17 ^{dCB}

Nutrient Analysis	Period of storage days			
	0th day	15th day	30th day	45th day
Energy (k.cal)	280.55±5.85 ^a	295.00±0.17 ^{bA}	302.00±0.17 ^{cAA}	311.00±0.17 ^{dBA}
Carbohydrates (g)	70.68±0.17 ^a	72.92±0.17 ^{bA}	74.89±0.17 ^{cBA}	77.42±0.17 ^{dCA}
Protein (g)	0.53±0.17 ^a	0.53±0.17 ^a	0.29±0.17 ^a	0.29±0.17 ^a
Fat (g)	0.20±0.26 ^a	0.26±0.19 ^a	0.25±0.17 ^a	0.25±0.17 ^a
Vitamin C (µg)	14.70±0.30 ^a	13.50±0.30 ^{bA}	12.60±0.30 ^{cBA}	11.75±0.30 ^{dCB}

Mean values± standard deviation. Means followed by the same letters in the row are not significant ($p>0.05$)

Nutritional calculation was the most vital requirement to study the shelf life of any product as the subjective evaluation mainly depends on the human acceptability towards the various nutrient attributes. The fat content of the blended grape jam was 0.20 to 0.25g. The vitamin 'C' content is a major factor for determining the shelf life as it fruit based product. Vitamin -C (ascorbic acid) which is a water soluble vitamin with acidic nature. Significant difference ($p\leq 0.05$) was observed in between 0th & 15th day, 30th & 45th day of storage period. Here, vitamin C content in mixed grape Jam is much more than the other commercial products that support the adequate vitamin C intake in the children and teenagers

(Major consuming groups of Jams). This is especially due to the reason that the product was developed with two variety fruit (pomelo & black grape) which are itself rich in vitamin C and other nutrients imparts to the product and made it as nutritionally sound. In general, fruit jams are judged by their soft and uniform consistency. *etc.*⁸

The major sensory characteristics like appearance, colour, taste, texture, flavour and overall acceptability were evaluated for the standardized pomelo blended mixed-grape jam (Fig. 2). The product maintained the overall acceptability throughout the storage period. There is no significant difference ($p>0.05$) in

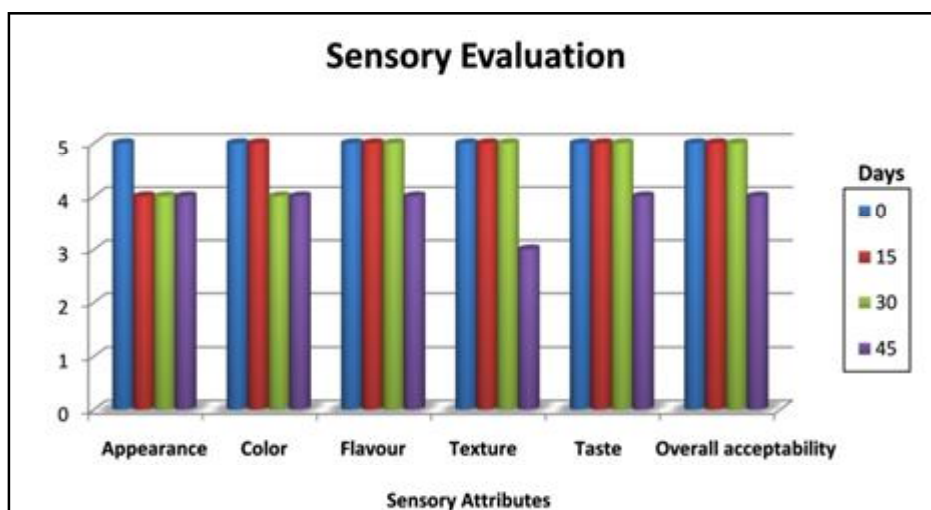


Figure 2. Score for the organoleptic attributes of pomelo blended grape jam at different storage periods.

quality characteristics was shown during the storage intervals. Finally, it was noted that the mixed-black grape jam which contain pomelo extract was successfully remain acceptable for 45 days.



Figure 3. A product of exotic pomelo blended black grape jam

Aside, microbial quality assessment of food product is important that may provide

information concerning the shelf life and safety quality of the product. Mixed fruit jam samples were analysed for their total plate count (TPC) and yeast & molds (Y&M) count. Always microbial load is inversely proportional to the shelf life of the food product. The total plate count was almost nil at initial storage period and there was no significance difference ($p > 0.05$) in TPC during storage period. Another side, yeast and mould count was also nil at initial storage period and corresponding results of shelf life studies showed that product does not have microbial contamination. The count did not exceed the levels throughout the storage period and it is considered acceptable during shelf life period.

These results are however based on laboratory studies, blended jam was prepared from pomelo and black grapes (Fig. 3) pulp was evaluated for physicochemical and sensory characteristics for 0, 15, 30, 45 days of storage

respectively. The storage has great effect on the quality and stability of pomelo blended grape jam (Taste, colour & flavour). However, it was concluded that the best quality of pomelo blended grape jam can be prepared by 50% fruit pulp (Pomelo-25% & black grape-25%) which shares 1:1 ratio of fruit pulp and 50% sugar (1:1 ratio of mixed pulp and sugar) and the final product samples were stored at room temperature. Preparation of pomelo blended grape jam attains as value-added product and helps in improving adequate nutrient profile that help to meet daily nutritional requirements of children and teenagers who are occupied major portion of jam consumers.

Conflicts of Interest :

Authors declare that there is no conflict of interests.

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