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# A POST-HARVEST APPROACH FOR VALUE ADDITION TO JACKFRUIT THROUGH JAM PREPARATION

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**ABSTRACT**

The post-harvest technology is one of the most novel techniques to value addition for jam preparation in highly nutritious and demanding fruits like jackfruits in all the year round. The experiment consisted of two factors. Factor A: Sugar Concentrations per 500g fruit; $S_1$:200g sugar; $S_2$:250g sugar; $S_3$:300g sugar and Factor B: Preservatives per 500g fruit; $P_0$:no preservative; $P_1$:-sodium benzoate (1.4g); $P_2$:potassium metabisulphite (0.8g). All the samples were kept in pre-sterilizedglass bottles andstored at room temperature. Results obtained from statistical analysis showed that different sugar concentrations and preservation had significant effect on physico-chemical and organoleptic characteristics. After 90 days of storage, jam were found acceptable condition. Considering laboratory test, qualitative and organoleptic test, $S_2P_2$ was found the best. The quality parameters of $S_2P_2$ viz. moisture content (26.01%), pH (4.12), TSS (70%), TA (0.26%), vitamin C (1.68mg/100g). This suggested that 500g jackfruit pulp +250g sugar +0.8g potassium metabisulphite was the promising formulation for the preparation of good quality of jackfruit jam.

***Keywords:*** Jackfruit, Jam, Sodium benzoate, Potassium metabisulphite.

## INTRODUCTION

Jackfruit is a dicotyledonous compound fruit of the jack tree (*Artocarpus heterophyllus* L.) which belongs to the family Moraceae grows in many of the tropical countries of Southeast Asia but is particularly abundant in India and Bangladesh. Jackfruit is grown in all districts of Bangladesh but the leading growing areas are high land of greater Dhaka, Savar, Bhaluca, Madhupur hilly areas of greater Syihet districts, Rangamati and Khagrachhari. It ranks next to banana and mango inacreage and production (BBS, 2017, Hossain *et al*., 1979). In Bangladeshjackfruit cultivation area is about 14 thousand ha with the production of 1050 tons (BBS, 2017). The jackfruit significantly contributes to the nutrition of the people of this country as a source of vitamins, minerals and calories (Mondal *et al*., 2013).

Jackfruit cotyledons are fairly rich in starch and protein (Singh *et al*., 1991). Jackfruit contains vitamin A, vitamin C, calcium, potassium, sodium, thiamin, iron, zincand many other nutrients. The fruit is a rich source of potassium with 303 mg / 100 g of jackfruit (Swami *et al*., 2012; Mushumbusi 2015; Jackfruitnutrition facts). The fruit is rich in carotene, potassium and carbohydrates, moderately rich in ascorbic acid (Rahimand Quddus, 2000; Samaddar, 1985; Hossain *et al.,* 1979). Jackfruit is also a good source of vitamin C which is an antioxidant that protects the body against free radicals, strengthens the immune system, and keeps the gums healthy (Umesh *et al*., 2010). When compared with other tropical fruits jackfruit contains more protein, calcium, iron, and thiamin. Jackfruits have more protein, calcium, thiamine, riboflavin and carotene than banana but less nutrition than mango (Hossain *et al*., 1979).

In every year, a considerable amount of jackfruit, specially obtained in the glut season (June-July) goes waste due to lack of proper postharvest knowledge during harvesting, transporting and storing both in quality and quantity (Haque, 2010). Appropriate postharvest innovation for prolonging shelf life is fundamental. Also, exchange methods of utilizing jackfruits in no-seasons plays significant roles in lessening postharvest losses. Among them, processing is important one. It adds diversified and attractive food items in dietary menu as well as contributes to generation of income and employment (Singh *et al*., 1991).Very few studies have been reported on the desirable convenience foods (Hossain *et al*., 2011). There is have to expand use and lessen misfortunes through appropriate processing into a variety of convenientand relatively shelf-stable and satisfactory items like jam. Preparing jackfruit into jam will assist with making the nutrients that it gives accessible consistently. Jackfruit is likewise reach in pectin, subsequently making it good for handling into jam.

At present, there is a growing consumer demand for wholesome, healthy, and convenient food items. In this manner, in recent years, there is a growing market for processed fruits. There are only a few recent studies that have focused on the extending shelf life and value addition of jackfruit. Introduction of high yielding jackfruit varieties, adhering to proper harvesting and postharvest practices for example appropriate handling, transportation and storage, development of novel processing technologies, and lookingfor new applications to minimize postharvest and production losses as well as conversion of jackfruit

waste into valueadded products would be better options for popularizing the jackfruit cultivation and consumption (Ranasinghe *et al*., 2019). The objectives of this work to produce jam using jackfruit, study the effect of different levels of sugar and preservatives on jam, investigate physico-chemical qualities and examine consumer acceptability of the prepared jam.

## MATERIALS AND METHODS

### Experimental Site and Materials

The experiment was conducted at postharvest laboratory of Sher-e-Bangla Agricultural University during March 2019 to November 2019 to develop value added jackfruit products (jam) using preservatives like KMS, sodium benzoate and measure the storage study of these products during 90 days of storage. Fully matured and disease free jackfruits (*Artocarpus heterophyllus Lam*) were collected from Horticulture Research field, SAU, Dhaka. Formulations and other ingredients are listed in Table 1.

**Table 1.** Formulations of preparation

| Ingredients | Jam |
|---|---|
| Jackfruit bulb (g) | 500 |
| Sugar (g) | $S_1$-200, $S_2$ -250, $S_3$-300 |
| Citric acid (g) | 2 |
| Pectin (g) | 5 |
| KMS (g) | 0.8 |
| Lemon (piece) | Half |
| Water (cup) | 1 |
| Sodium benzoate (g) | 1.4 |

### Experimental design and method of analysis

The two factorial experiments were laid out in the Completely Randomized Design *(*CRD*)* with tworeplications. The postharvest treatments were assigned randomly in each replication. The collected data on various parameters were statistically analyzed using MSTAT statistical software.

### Treatments

The experiment consisted of two factors. Factor A: Sugar Concentrations per 500g fruit; $S_1$:200g sugar; $S_2$:250g sugar; $S_3$:300g sugar and Factor B: Preservatives per 500g fruit; $P_0$:no preservative; $P_1$:sodium benzoate (1.4g); $P_2$:potassium metabisulphite (0.8g).There were 9 (3x3) treatment combinations, such as $S_1P_0$, $S_1P_1$, $S_1P_2$, $S_2P_0$, $S_2P_1$, $S_2P_2$, $S_3P_0$, $S_3P_1$, $S_3P_2$.These treatments were replicated three times in this study. Formulations of sugar and preservatives are listed in Table 1

### Preparation of Jam

Fresh ripened jackfruits were washed thoroughly with tap water to remove all the dirts. Then they were cut diagonally and fresh bulbs were separated from seeds and other fruit parts. The bulbs were blended with fruit grinder (prestige super blender, model no: MXT-17, China) and then sieved with a 2 mm mesh sieve. Then sieved pulp was boiled for about 10 minutes to soften the mixture for easy homogenization. After boiling pulp was weighed to 500g for each sample. Then different combination of sugars like, 200g, 250g and 300g and lemon juice (half piece) were added together to the pulp. Pulp mixture was boiled for approx. 35 min and stopped when it become relatively thicker in nature which may denotes jam (Mondal *et al*., 2013).

### Determination of moisture content

Experimental samples were subjected to moisture content analysis as described in AOAC (2004). Here, 10 gm fruit was taken in crucible and placed in an oven, the moisture content was determined by measuring weight loss of measured sample in a moisture box by desiccation in an oven maintained at 80°C for 72 hours untilconstant weight attained. The dry matter content was estimated as the difference of sample weight and moisture content.

$$\text{Moisture content (\%)} = \frac{(\text{Initial weight} - \text{Final weight}) \times 100}{\text{Initial weight}}$$

### Determination of pH

The pH was determined using a phs-25 pH meter as described in AOAC (2007). An electrolytic cell composed of two electrodes (calomel electrode and glass electrode) was standardized with buffer solution of pH 4. Buffer solution of any known pH may be used. Then the electrodes were dipped into the test sample (jam). A voltage corresponding to the pH of the solution was indicated by the instrument.

### Determination of TSS

Juice extracted from 100 g sample of jam of each treatment was used to determine the TSS. Total soluble solids (TSS) were determined by hand refractometer (ERMA made Japan) of 58-92 % range, at room temperature (Ranganna, 2010). The same quality attributes were evaluated for day 1(dayat which minimal processing was performed) and during the storage atperiodic intervals (Islam *et al*., 2019).

### Determination of Titrable acidity

The titrable acidity of jackfruit bulb samples was determined bythe visual titration method (Ranganna, 1986).

### Preparation of sample

A 10 g sample of pulp was taken in a 100 ml beaker and a littlequantity of distilled water was added to it. The mixture was then gently boiled in a water bath for 1 hour with occasional stirring and frequentlyreplacing water which was lost due to evaporation. After cooling, themixture was transferred to 100 ml volumetric flask and the volume madeup with distilled water. This was then filtered through Whatman No. 4 filter paper and the filtrate was used for analysis. (Islam *et al*., 2019)

**Procedure**

A 10 ml of filtrate was taken in a conical flask and titrated against 0.1N NaOH solution in a burette using 1 or 2 drops of phenolphthaleinindicator. Formation of pink colour was reckoned at the end point oftitration. The titration was repeated till consistent titre values wereobtained. (Islam *et al*., 2019)

**Calculation**

Titrable acidity, % =

$$\frac{\text{Titre value x N of NaOH (0.1M)x Volume made up(50 ml) x Equivalent weight of citric acid (64g) x 100}}{\text{Aliquot taken for titration (10ml)x weight of sample(10g)} \times 1000}$$

**Determination of Vitamin C (Ascorbic Acid) content**

The ascorbic acid content ofjackfruit was determined by 2,6-dichlorophenol indophenol visual titration method (Ranganna, 1986) as detailed hereunder.

**Preparation of 4 percent oxalic acid**

A 4 g of oxalic acid was placed in a beaker and dissolved in 100 mlof distilled water.

**Preparation of 2, 6-dichlorophenol indophenol dye solution**

In a beaker, 52 mg of 2, 6-dichlorophenol indophenol dye and 42mg NaHCO3 weredissolvedand the volume made up to 200 ml using hotdistilled water.

**Preparation of stock standard solution**

A 100 mg of ascorbic acid was dissolved in 100 ml of 4 percentoxalic acid.

**Standard ascorbic acid**

A 10 ml of stock standard solution was diluted to 100 ml using theacid (4 percent oxalicacid) mixture. Therefore, the standard ascorbic acidcontained 0.1 mg of ascorbic acid per ml solution.

**Determination of vitamin C equivalent of 10 ml dye**

A 1 ml of vitamin C solution containing 1 mg of vitamin C wasadded to 5 ml of 4 percent oxalic acid and titrated against dye solutiontaken in the burette. The titre value was noted down and the titrationrepeated till identical values were obtained.

**Calculation of Dye factor**

Dye factor = $\frac{\mathbf{X}}{\mathbf{Titre\ (ml)}}$ Here, X= 0.5

**Preparation of sample**

A 10g ofprocessed pulp of jackfruit bulbs wastaken in a 100 mlvolumetric flask and thoroughly mixed with 50 ml of 4percent oxalic acid. The mixture was filtered through a thin cloth, andthe filtrate volume made up to 100 ml using 4 percent oxalic acid. 10 mlof this was pipetted out and titrated against 2, 6 dichlorophenolindophenol dye solution.

**Procedure**

A 10 ml of filtered sample and 5 ml of 4 % oxalic acid were taken in a conical flask andtitrated against the 2, 6 dichlorophenol indophenoldye solution in a burette. The endpoint was light pink colour thatpersisted for 5-10 seconds.

**Calculation**

Ascorbic acid, mg/100g =

$$\frac{\text{Value titre(ml)} \times \text{Dye factor (0.081)} \times \text{Volume made up (100ml)} \times 100}{\text{Volume taken for titration (10ml)} \times \text{Weight of pulp sample(10g)}}$$

**Sensory evaluation**

Sensory evaluation of the jam samples were conducted as described by Iwe (2002) using 10-members panel randomly selected from the university community. The samples were packaged in a glass bottles and presented in a coded manner. The sensory quality attributes of the samples were color, appearance, sweetness, stickiness, flavor and acceptability. In the questionnaire presented to the panelists, they were requested to observe and taste each sample as coded with bread provided and grade them based on a 1-7 point hedonic scale showing dislike extremely to like extremely in all attributes. They were also provided with potable water to rinse their mouth after evaluating each sample to check taste interference (Paul *et al*., 2007).

**Storage Study**

All the prepared samples were stored at room temperature (28-32 °C) for a period of 3 months. The stored samples were examined monthly. During storage the changes in moisture content, pH, TSS, titrable acidity and vitamin-Cwere observed. The analyses of the parameters were done according to standard analytical methods summarized by (AOAC, 2004) and (Rangana, 2010). Quality parameters like colour, taste, flavor, texture and overall acceptability were examined during the storage period for about 3 months.

**Statistical Analysis**

The data collected from storage materilas wasstatistically analyzed. The mean valuesfor all the treatments was calculated and the analysis of variance for most of the characters was accomplised by F variance test. The significance of difference between pair of means was tested by Duncan's Multiple Range Test (DMRT) test at 1% probability (Gomez and Come, 1984).

## RESULTS AND DISCUSSION

### Moisture content (%)

### Effect of different sugar concentrations and preservatives on moisture content of jackfruit jam

Sugar concentrationshadsignificant influence on moisture content of jackfruit jam (Table 2). During 90 days of storage, moisture content was decreased gradually. The highest moisture content was found in $S_3$ and it was (31.35%), the lowest in $S_1$ (27.71%) and $S_2$ had also lower (28.01%). In all storage condition, $S_2$ had the lower moisture content.Low moisture content indicates that the jams have a long shelf life,the highest moisture is more susceptible to spoilage than the other samples by microbial invasion especially fungi and mould (Ihekoronye and Ngoddy, 1985).

**Table 2.** Effect of different sugar concentrations and preservatives on moisture content of jackfruit jam

| Treatment | Moisture content at different days after storage | | | |
|---|---|---|---|---|
| | 0 day | 30 days | 60 days | 90 days |
| **Effect of sugar concentrations** | | | | |
| $S_1$ | 29.98b | 29.35c | 28.69c | 27.71c |
| $S_2$ | 29.14b | 30.16b | 29.17b | 28.01b |
| $S_3$ | 33.75a | 33.33a | 32.50a | 31.35a |
| **Effect of preservatives** | | | | |
| $P_0$ | 32.15a | 32.67a | 32.01a | 30.70a |
| $P_1$ | 31.08b | 30.84b | 30.01b | 29.02b |
| $P_2$ | 29.65c | 29.34c | 28.34c | 27.35c |
| **Combined effect of different sugar concentrations and preservatives** | | | | |
| $S_1P_0$ | 31.03g | 30.01h | 30.05f | 29.06e |
| $S_1P_1$ | 29.02 j | 29.02j | 28.03i | 27.05g |
| $S_1P_2$ | 29.91j | 29.03j | 28.01ii | 27.03eg |
| $S_2P_0$ | 29.92ij | 33.00d | 32.00d | 31.01c |
| $S_2P_1$ | 29.52k | 29.51i | 28.51h | 27.03gg |
| $S_2P_2$ | 28.00i | 28.00k | 27.01j | 26.01h |
| $S_3P_0$ | 35.51a | 35.00a | 34.00a | 32.04b |
| $S_3P_1$ | 34.70c | 34.01c | 33.50b | 33.00a |
| $S_3P_2$ | 31.04g | 31.00f | 30.01 f | 29.01e |
| Level of Significance | * | * | * | * |
| CV (%) | 0.06 | 0.06 | 0.03 | 0.05 |
| LSD at 1% | 0.09102 | 0.09102 | 0.09102 | 0.09102 |

In a column, means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability.

Different preservatives hadsignificant influence on moisture content of jackfruit jam (Table 2). During 90 days of storage, moisture content was decreased gradually. The highest moisture content was found in $P_0$ and it was (30.70%), and the lowest in $P_2$ (27.35%). In all storage condition, $P_2$ had the lower moisture content. Results from Muhammad *et al*., (2008) revealed that moisture content of diet apple jam was decreased during 90 days storage.

### Combined effect of different sugar concentrations and preservatives on moisture content of jackfruit jam

The moisture content of jackfruit jam at different treatments varied significantly (Tab. 3). After 90 days of storage, the lowest moisture content was found in $S_2P_2$ (26.01%). Similar results were also found by Hakeem *et al*., (2017) revealed that the moisture content of of all the treatments of apricot jam was decreased during 80 days of storage periods.

**Table 3.** Effect of different sugar concentrations and preservatives on pH of jackfruit jam

| Treatment | pH content at different days after storage | | | |
|---|---|---|---|---|
| | 0 day | 30 days | 60 days | 90 days |
| **Effect of sugar concentrations** | | | | |
| $S_1$ | 3.84c | 3.78c | 3.74c | 3.64c |
| $S_2$ | 4.31a | 4.08a | 3.98a | 3.82a |
| $S_3$ | 4.23b | 4.15b | 4.07b | 3.95b |
| **Effect of preservatives** | | | | |
| $P_0$ | 4.00c | 3.80c | 3.80c | 3.65c |
| $P_1$ | 4.16a | 4.06b | 3.91b | 3.77b |
| $P_2$ | 4.22a | 4.14a | 4.08a | 3.99a |
| **Combined effect of different sugar concentrations and preservatives** | | | | |
| $S_1P_0$ | 3.41g | 3.36j | 3.34gh | 3.31i |
| $S_1P_1$ | 3.85f | 3.78i | 3.74h | 3.58h |
| $S_1P_2$ | 4.26ab | 4.20bc | 4.16cde | 4.05ab |
| $S_2P_0$ | 4.27ab | 3.80hi | 3.90fgh | 3.65gh |
| $S_2P_1$ | 4.30ab | 4.12cd | 3.80b | 3.70g |
| $S_2P_2$ | 4.36a | 4.34a | 4.25a | 4.12a |
| $S_3P_0$ | 4.32ab | 4.25ab | 4.16bc | 4.00bc |
| $S_3P_1$ | 4.34ab | 4.30ab | 4.20bc | 4.05ab |
| $S_3P_2$ | 4.05cd | 3.90fg | 3.85e | 3.80f |
| Level of Significance | * | * | * | * |
| CV (%) | 0.26 | 0.22 | 0.28 | 0.28 |
| LSD at 1% | 0.09102 | 0.09102 | 0.09102 | 0.09102 |

In a column, means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability.

### pH value

### Effect of different sugar concentrations and preservatives on pH of jackfruit jam

Sugar concentrationshadsignificant influence on pH of jackfruit jam (Table 3). The pH was decreased gradually during storage. After 90 days of storage, the highest pH was in $S_3$ (3.95), $S_2$ had also higher (3.82) and the lowest in $S_1$ (3.64). The pH of $S_3$ and $S_2$ was almost similar but $S_1$ had very lower pH.

Different preservatives hadsignificant influence on pH of jackfruit jam (Table 3). During 90 days of storage, pH was decreased gradually. The highest pH was in $P_2$ (3.99), and the lowest in $P_0$ (3.65). In all storage condition, $P_2$ had the higher pH. During storage intervals pH decreases due to increase in acidity during storage. Mudasir, B. and Anju, B. (2018) found that there was a decrease trend of pH of pumpkin guava belnded jam during 6 months of storage.Muhammad *et al*., (2008) also observed a decrease in pH of diet apple jam from 4.34 to 3.01 during 90 days storage.

**Combined effect of different sugar concentrations and preservatives on pH of jackfruit jam**

The pH of jackfruit jam at different treatments varied significantly (Table 3). After 90 days of storage, the highest pH was found in $S_2P_2$ (4.12). Hakeem *et al*., (2017) found that there was a regular decrease of pH value of all the treatments of apricot jam during 80 days of storage.

**Total soluble solids concentration**

**Effect of different sugar concentrations and preservatives on TSS of jackfruit jam**

Sugar concentrationshadsignificant influence on TSS of jackfruit jam (Table 4). The TSS was increased gradually during storage. After 90 days of storage, the highest TSS was found in $S_3$ (71.35%), and the lowest in $S_1$ (68.01%).

Different preservatives hadsignificant influence on TSS of jackfruit jam (Table 4). During 90 days of storage, TSS was increased gradually. The highest TSS was found in $P_2$ (70.67%) and the lowest in $P_0$ (68.35%). The TSS of $P_0$ and $P_1$ was almost similar but $P_2$ had higher TSS. Singh *et al*., (2005) revealed that during storage of the beal/blended beal jam, the total soluble solids (TSS) was increased up to three months.

**Combined effect of different sugar concentrations and preservatives on TSS of jackfruit jam**

The TSS of jackfruit jam at different treatments varied significantly (Table 4). After 90 days of storage, $S_2P_2$ gave the best value (70.00%). The TSS content of $S_2P_2$ was good and that was > 68.00%. According to FPO specifications, a jam should contain a minimum of 68% TSS in the final product and the fruit content in the final product should not be more than 45 % (w/w). The results of present study arein close conformity to the findings of Safdar *et al*., (2012) who found a gradual increase in total soluble solids content of mango jam throughout the storage period of 150 days.

**Table 4.**Effect of different sugarconcentrations and preservatives on TSS of jackfruit jam

| Treatment | Total soluble solids % at different days after storage | | | |
|---|---|---|---|---|
| | 0 day | 30 days | 60 days | 90 days |
| **Effect of sugar concentrations** | | | | |
| $S_1$ | 64.18c | 65.00c | 66.00c | 68.01c |
| $S_2$ | 66.00b | 67.34b | 68.17b | 69.00b |
| $S_3$ | 67.67a | 69.51a | 70.17a | 71.35a |
| **Effect of preservatives** | | | | |
| $P_0$ | 65.34b | 66.68b | 67.33b | 68.35c |
| $P_1$ | 64.68c | 66.50b | 67.67b | 69.35b |
| $P_2$ | 67.83a | 68.67a | 69.33a | 70.67a |
| **Combined effect of different sugar concentrations and preservatives** | | | | |
| $S_1P_0$ | 63.02i | 64.01i | 65.01i | 66.01h |
| $S_1P_1$ | 64.02h | 65.00h | 66.00h | 69.04e |
| $S_1P_2$ | 65.50g | 66.00g | 67.01e | 69.00e |
| $S_2P_0$ | 66.01f | 67.01f | 67.50j | 69.01e |
| $S_2P_1$ | 64.00h | 66.02g | 68.01h | 68.00f |
| $S_2P_2$ | 68.00d | 69.01c | 69.00b | 70.00d |
| $S_3P_0$ | 67.00e | 69.03c | 69.50d | 70.03d |
| $S_3P_1$ | 66.03f | 68.50d | 69.02e | 71.02c |
| $S_3P_2$ | 70.00a | 71.00a | 72.00a | 73.01a |
| Level of Significance | * | * | * | * |
| CV (%) | 0.03 | 0.02 | 0.02 | 0.03 |
| LSD at 1% | 0.09102 | 0.09102 | 0.09102 | 0.09102 |

In a column, means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability.

**Titrable acidity**

**Effect of different sugar concentrations and preservatives on titrable acidityof jackfruit jam**

Sugar concentrationshadsignificant influence on titrable acidity of jackfruit jam (Table 5). The titrable acidity was increased gradually during storage. After 90 days of storage, the highest titrable acidity wasfound in $S_3$ (0.21%), $S_2$ had also higher (0.18%) and the lowest in $S_1$ (0.15%).

Different preservatives hadsignificant influence on titrable acidity of jackfruit jam (Table 5). During 90 days of storage, titrable acidity was increased gradually. The highest titrable acidity wasfound in $P_2$ (0.21%) and the lowest in $P_0$ (0.16%). In all storage condition, The titrable acidity of $P_0$ and $P_1$ was almost similar and $P_2$ had slight higher titrable acidity. Mesquita *et al*., (2013) evaluated guava jam and found a sharp increase of acidity, of 1.2% to 1.9% during storage.

**Combined effect of different sugar concentrations and preservatives on titrable acidityof jackfruit jam**

The titrable acidity of jackfruit jam at different treatments varied significantly (Table 5). After 90 days of storage, the highest titrable acidity was found in $S_2P_2$ (0.26%). Shakir *et al*., (2008) found that the mean values of titratable acidity for different treatments of apple and pear mixed fruit jam increased significantly from 0.63 to 0.75 during storage interval of 90 days.

**Table 5.** Effect of different sugar concentrations and preservatives on titrable acidityof jackfruit jam

| Treatment | Titrable acidity % at different days after storage | | | |
|---|---|---|---|---|
| | 0 day | 30 days | 60 days | 90 days |
| Effect of sugar concentrations | | | | |
| $S_1$ | 0.12c | 0.13c | 0.14c | 0.15c |
| $S_2$ | 0.14b | 0.16b | 0.16b | 0.18b |
| $S_3$ | 0.15a | 0.17a | 0.18a | 0.21a |
| Effect of preservatives | | | | |
| $P_0$ | 0.13c | 0.13c | 0.14c | 0.16c |
| $P_1$ | 0.14a | 0.16b | 0.15b | 0.18b |
| $P_2$ | 0.14a | 0.17a | 0.19a | 0.21a |
| Combined effect of different sugar concentrations and preservatives | | | | |
| $S_1P_0$ | 0.12ef | 0.13d | 0.14g | 0.14f |
| $S_1P_1$ | 0.19bc | 0.18e | 0.17g | 0.20de |
| $S_1P_2$ | 0.06f | 0.09df | 0.11h | 0.13h |
| $S_2P_0$ | 0.14cd | 0.14d | 0.16f | 0.19e |
| $S_2P_1$ | 0.07ef | 0.11e | 0.08i | 0.11hi |
| $S_2P_2$ | 0.21a | 0.23a | 0.24a | 0.26a |
| $S_3P_0$ | 0.13d | 0.12d | 0.13hg | 0.17e |
| $S_3P_1$ | 0.18c | 0.19c | 0.21d | 0.23d |
| $S_3P_2$ | 0.16b | 0.21b | 0.22c | 0.24c |
| Level of Significance | * | * | * | * |
| CV (%) | 1.02 | 1.12 | 2.16 | 2.08 |
| LSD at 1% | 0.09102 | 0.09102 | 0.09102 | 0.09102 |

In a column, means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability.

**Vitamin C**

**Effect of different sugar concentrations and preservatives on vitamin C of jackfruit jam**

Sugar concentrationshadsignificant influence on vitamin C content of jackfruit jam (Table 6). The vitamin C was slightly decreased gradually during storage. After 90 days of storage, $S_3$ had the lowest vitamin C (1.20mg/100g) and $S_1$ and$S_2$ had almost similar higher value and it was (1.35mg/100g) and (1.32mg/100g). In all storage condition, $S_2$ had the higher vitamin C. Different preservatives hadsignificant influence on vitamin C of jackfruit jam (Table 6). During 90 days of storage, vitamin C was decreased gradually. The highest vitamin C was found in $P_2$ (1.49mg/100g) and the lowest in $P_0$ (1.11mg/100g). In all storage condition, $P_2$ had the higher vitamin C. Mazur *et al*., (2014) observed a significant decrease of ascorbic acid concentration during storage (6 months at 20 °C) of strawberry jam.

**Combined effect of different sugar concentrations and preservatives on vitamin C of jackfruit jam and jelly**

The vitamin C of jackfruit jam at different treatments varied significantly (Table 6). After 90 days of storage, the highest vitamin C was found in $S_2P_2$ (1.68mg/100g). These results are in accordance with the findings of Pavlova *et al*., (2013) who found thata significant reduction of ascorbic acid concentration in of peach and raspberry jams stored under room temperature during 90 days.

**Table 6.** Effect of different sugar concentrations and preservatives on vitamin C ofjackfruit jam

| Treatment | Vitamin C mg/100g at different days after storage | | | |
|---|---|---|---|---|
| | 0 day | 30 days | 60 days | 90 days |
| **Effect of sugar concentrations** | | | | |
| $S_1$ | 1.45b | 1.44b | 1.40b | 1.35b |
| $S_2$ | 1.44b | 1.41b | 1.35c | 1.32c |
| $S_3$ | 1.29a | 1.25a | 1.20a | 1.20a |
| **Effect of preservatives** | | | | |
| $P_0$ | 1.17c | 1.15c | 1.15c | 1.11c |
| $P_1$ | 1.37b | 1.35b | 1.29b | 1.28b |
| $P_2$ | 1.65a | 1.60a | 1.51a | 1.49a |
| **Combined effect of different sugar concentrations and preservatives** | | | | |
| $S_1P_0$ | 1.62b | 1.61b | 1.59b | 1.50b |
| $S_1P_1$ | 1.08d | 1.07d | 1.03d | 1.02d |
| $S_1P_2$ | 1.66b | 1.64b | 1.58b | 1.55b |
| $S_2P_0$ | 1.07d | 1.06d | 1.06d | 1.04d |
| $S_2P_1$ | 1.39c | 1.35c | 1.29c | 1.26c |
| $S_2P_2$ | 1.88a | 1.82a | 1.70a | 1.68a |
| $S_3P_0$ | 0.82e | 0.78e | 0.80e | 0.79e |
| $S_3P_1$ | 1.65b | 1.63b | 1.57b | 1.57b |
| $S_3P_2$ | 1.42c | 1.34c | 1.25c | 1.24c |
| Level of Significance | * | * | * | * |
| CV (%) | 1.77 | 2.03 | 1.18 | 1.10 |
| LSD at 1% | 0.09102 | 0.09102 | 0.09102 | 0.09102 |

* Significant at 1% level of probability, CV= Co-efficient of variation

**Sensory attributes**

A consumer acceptability sensory trial was coducted. The panelist comprised of 10 volunteers who were students of the university. The sensory quality attributes of the samples were color, appearance, sweetness, stickiness,

flavor and acceptability (Table 7). A 7-point hedonic scale was used. Therefore, the respondents answers were coded 1-7 with 7 being 'like extremely' and 1 being 'dislike extremely'.

**Table 7.** Mean score for color, appearance, sweetness, stickiness, flavor and acceptability point of jackfruit jam was

| Treatments and products | Color | Apperance | Stickiness | Sweetness | Flavour | Acceptability |
|---|---|---|---|---|---|---|
| $S_1P_0$ | 3.12 i | 3.21 i | 3.40 i | 3.23 i | 3.82 i | 3.72 i |
| $S_1P_1$ | 3.22 h | 3.31 h | 3.46 h | 3.33 h | 3.92 h | 3.82 h |
| $S_1P_2$ | 3.32 g | 3.51 g | 3.60 g | 3.73 g | 3.95 g | 3.92 g |
| $S_2P_0$ | 3.52 f | 3.63 f | 3.70 f | 3.83 f | 4.02 f | 3.72 f |
| $S_2P_1$ | 3.72 e | 3.72 e | 3.80 e | 3.92 e | 4.12 e | 4.22 a |
| $S_2P_2$ | 5.75 a | 5.72 a | 5.07 a | 5.42 a | 5.67 a | 5.52 a |
| $S_3P_0$ | 4.82 c | 4.27 c | 4.40 b | 4.50 b | 4.77 b | 4.80 b |
| $S_3P_1$ | 4.25 b | 4.35 b | 4.27 c | 4.32 c | 4.65 c | 4.72 c |
| $S_3P_2$ | 4.08d | 4.12 d | 4.17 d | 4.22d | 4.52d | 4.65d |
| LSD at 5% | 0.35 | 0.17 | 0.20 | 0.22 | 0.26 | 0.28 |
| LSD at 1% | 0.45 | 0.26 | 0.29 | 0.36 | 0.33 | 0.40 |
| CV (%) | 2.85 | 2.29 | 2.44 | 4.34 | 2.64 | 3.22 |

In a column, means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability.

The highest hedonic scale of color, appearance, sweetness, stickiness, flavor and acceptability point was recorded with $S_2P_2$. The results obtained for all the monitored sensory parameters are in agreement with findings of Muhammad *et al*., (2009).

## CONCLUSION

It can be concluded from the present findings that the better quality of jackfruit jam can be prepared by using (500g jackfruit pulp + 250g sugar + 0.8g potassium metabisulphite) with better organoleptic properties as well as chemical composition and good storage stability at ambient storage conditions up to 3 months storage period. Products were also found stable on storage at ambient temperature for 3 months as the physico-chemical, sensory parameters were not changed significantly. It indicates that the jackfruit can be utilized for the commercial production of standard quality products like jam.

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