

Standardisation, nutritional and sensory analysis of jackfruit *Halwa*

S. Jayashree and D.H. Jayasheela

The study aimed to develop Jackfruit *Halwa* and to evaluate sensory and nutritional parameters. Jackfruit *Halwa* were prepared with different variations (T_1 , T_2 , T_3 , and T_4) in sweetness. Statistical analysis was done to find the significant difference in sensory parameters in different treatments. The results show that there is significant difference ($P > 0.05$) between different jackfruit *Halwa* i.e. T_1 , T_2 , T_3 and T_4 for quality attributes of taste and over all acceptability, because the variation was made in the sweetness of the product. According to nutritional analysis TSS content varied from 52.7 ± 0.1 to 65.1 ± 0.1 . Titratable acidity of the products varied from 0.32 ± 0.01 to 0.48 ± 0.01 . The Ascorbic acid content was 5.18 ± 0.01 in T_1 and 8.17 ± 0.01 in T_2 product. Total sugar content of developed products varied from 20.67 ± 0.01 to 22.43 ± 0.01 . Non reducing sugars (%) content was highest in T_1 (20.1 ± 0.19) and lowest in T_4 (17.69). The results showed that the developed Jackfruit *Halwa* of different combinations with respect to sweetness is found to be acceptable by consumers with regard to taste and overall acceptability.

Key Words : Jackfruit *Halwa*, TSS, Sensory evaluation, Nutritional evaluation

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INTRODUCTION

India is one of the leading producers of fruits. But, most of the fruits do not reach the table of the consumers. There is a loss of around 40% per year. The reasons can be attributed to improper post harvest methods, and under utilization of fruits for value added products. Certain fruits like jackfruit, passion fruit, litchi etc. can be utilized to produce value added products (Sharma *et al.*, 2013).

Jackfruit is a dicotyledonous compound fruit of the jack tree (*Artocarpus heterophyllus* L.) which belongs to the family Moraceae grown in many of the tropical countries of Southeast Asia but is particularly abundant

in India and Bangladesh. Edible bulbs of ripe jackfruit (*Artocarpus heterophyllus* L.) are consumed for their fine taste and pleasant aroma.

In our country, the trees are found distributed in southern states like Kerala, Tamil Nadu, Karnataka, Goa, Coastal Maharashtra and other states like Assam, Bihar, Tripura, Uttar Pradesh and foothills of Himalayas. The name originated from its Malayalam name *Chakka*. It is also called *Kathhal* (hindi and urdu), *Pala* (Tamil), *Halasina hannu* (Kannada) *Panasa pandu* (Telugu) and *Phanos* (Marathi and Konkani). The fleshy carpel which is botanically the perianth is the edible portion. Apart from its use as a table fruit, jack is a popular fruit for preparation of pickles, chips, jack leather and *Papad*. The fruit has got good potential for value addition into several products like squash, jam, candy, *Halwa* etc. The ripe bulbs can be preserved for one year in sugar syrup or in the form of sweetened pulp. The unripe mature bulbs can be blanched and dehydrated for further use

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throughout the year. Seed is a rich source of starch and a delicacy during season. The timber is highly valued for its strength and sought for construction and furniture. The dried leaves are stitched to make disposable plates (Priya Devi *et al.*, 2014).

Jackfruit contain vitamin A, vitamin C, thiamin, riboflavin, calcium, potassium, iron, sodium, zinc, and niacin among many other nutrients. Jackfruit has a low caloric content where 100 g of jackfruit only contains 94 calories. The fruit is a rich source of potassium with 303 mg / 100 g of jackfruit. Studies show that food rich in potassium helps to lower blood pressure. 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). Jackfruit is rich in dietary fibre, which makes it a good bulk laxative. The fibre content helps to protect the colon mucous membrane by decreasing exposure time and as well as binding to cancer-causing chemicals in the colon. Fresh fruit has small amounts of vitamin-A, and flavonoid pigments such as carotene- β , xanthin, lutein and cryptoxanthin- β . Together, these compounds play vital roles in antioxidant and vision functions. The antioxidants like flavonoids, polyphenols, vitamins, carotenoids etc. are playing unique role in maintaining human health. They protect human body against damages by free radical induced oxidative stress. They also delay oxidation of food, metabolic disorders, degeneration and death of cells etc. (Gokhale *et al.*, 2014).

Halwa refers to many types of dense, sweet confection prepared in north India. It is a type of desert with the consistency of a very thick pudding, made from various kinds of fruits, vegetables, grains and lentils.

Preparation of *Halwa* is not very easy as the raw material specification, their proportion, sequence of adding and processing steps are very specific. Apart from this, *Halwa* contains a high amount of fat and sugar. In the present work, an attempt has been made to develop jackfruit *Halwa* and analyze the nutritional and sensory qualities of Jackfruit *Halwa*.

METHODOLOGY

Collection of fruits :

Well matured, ripened and sound fruits were used during this study. The fruits were procured from the local market of APMC, Shivamogga.

Methodology of preparing *Halwa* :

Steps followed for preparing *Halwa* is given in Fig. A.

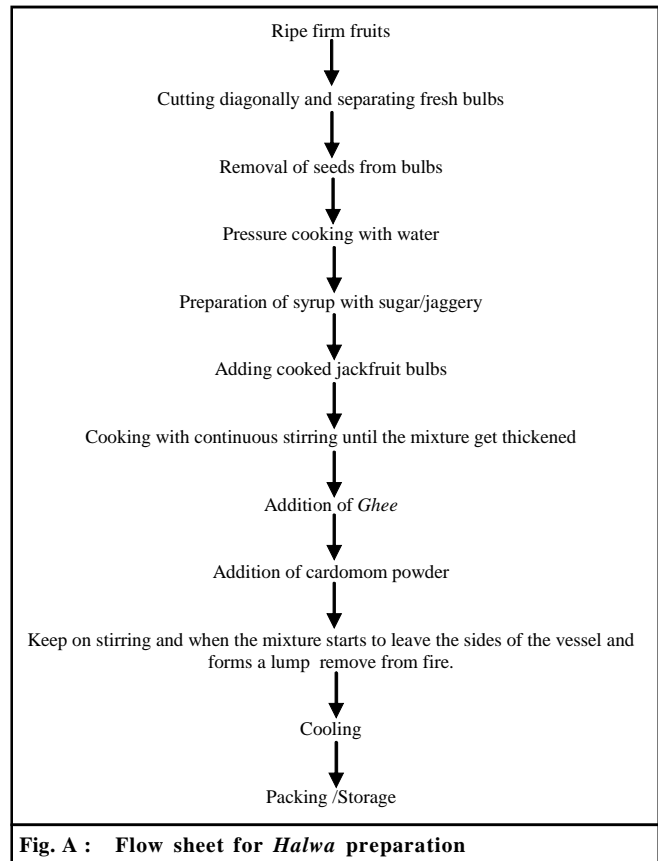


Table A : Details of treatments employed during the development of jackfruit *Halwa*

Sr. No.	Ingredients	T ₁	T ₂	T ₃	T ₄
1.	Jack fruit (g)	500	500	500	500
2.	Sugar(g)	150	125	-	-
3.	Jaggery(g)	-	-	150	125
4.	Ghee(g)	50	50	50	50
5.	Cardamom powder(g)	5	5	5	5

Nutritional evaluation :

Total soluble solids (TSS) :

The TSS of jackfruit *Halwa* of different combinations were measured using Digital pocket Atago Hand Refractrometer (Model:PAL 3) and expressed as degree Brix (°B).

Titration acidity :

Titration acidity of Jackfruit *Halwa* samples were

determined by visual titration method (Ranganna, 1995). solution.

Preparation of sample :

Ten gram of sample was taken in a 100 ml beaker and a little quantity of distilled water was added to it. The pulp was boiled for 1 hour frequently replacing the water which was lost due to evaporation. The pulp was filtered using Whatman No. 4 filter paper and the filtrate was used for analysis.

Procedure :

Ten ml of filtrate was taken in a conical flask and titrated against 0.1N NaOH solution using 1 or 2 drops of phenolphthalein indicator. Formation of pink colour was recorded as the end point of filtration. Then, the acidity expressed as the percentage of anhydrous citric acid was calculated as follows:

Calculation:

$$\text{Titrateable acidity \%} = \frac{\text{Titre value} \times \text{N of NaOH} \times \text{volume} \times \text{equivalent}}{\text{Weight made up of citric acid} \times \text{Aliquot taken for titration} \times \text{weight of sample}} \times 100$$

Ascorbic acid :

Ascorbic acid of jackfruit *Halwa* was determined by 2, 6-dichlorophenol indophenols visual titration method (Ranganna, 1995).

Preparation of 2, 6-dichlorophenol indophenols dye solution :

In a beaker, 52 mg of 2, 6-dichlorophenol indophenols dye and 42 mg of sodium bicarbonate were dissolved using 150 ml hot distilled water. Then, the volume was made upto 200 ml with distilled water.

Preparation of 4 per cent oxalic acid:

Forty gram of oxalic acid was dissolved in 900 ml distilled water. Then, the volume was made upto 100 ml with distilled water.

Standard ascorbic acid :

Fifty mg of L-ascorbic acid was dissolved in a small quantity of 4 per cent oxalic acid in a 50 ml volumetric flask and the volume is made upto 50 ml with 4 per cent oxalic acid. 10 ml of this stock solution was diluted to 100 ml using 4per cent oxalic acid. Therefore, the standard ascorbic acid contained 0.1 mg of ascorbic per ml of

Standardization of dye :

One ml of standard ascorbic acid solution and 5 ml of 4 per cent oxalic acid were taken in a conical flask and titrated against the dye solution. The end point was light pink colour which persisted for atleast 5-10 seconds. The dye factor was then calculated as:

$$\text{Dye factor} = 0.1 / \text{Titre value}$$

Preparation of sample :

Ten gram of sample was taken in a 100 ml volumetric flask and 50 ml of 4 per cent oxalic acid was added. The sample was thoroughly mixed and the volume was made upto the mark using 4 per cent oxalic acid. The solution was filtered using Whatman No. 4 filter paper and the filtrate was used for analysis.

Procedure :

Ten ml of ascorbic acid extract was taken in a conical flask and titrated against the standard dye solution. The end point was light pink colour that persisted for 5-10 seconds.

Calculation :

$$\text{Ascorbic acid, mg/100 g} = \frac{\text{Titre value} \times \text{Dye factor} \times \text{Volume made up}}{\text{Volume taken for titration} \times \text{Weight of the sample}} \times 100$$

Sugars :

Sugars present in jackfruit *Halwa* was estimated by following the method outlined by Lane and Eymon (1923).

Preparation of sample :

Ten gram of sample was blended with 80 ml distilled water in a 100 ml volumetric flask and the sample was neutralized with 1N NaOH using phenolphthalein indicators. This solution was boiled gently for 1 hour with occasional stirring. Boiling water was added to maintain the original level. It was cooled and transferred to 100 ml volumetric flask, volume was made up using distilled water and was also filtered through Whatman No.4 filter paper. From this solution, 50 ml was pipetted out in to a 250 ml volumetric flask, 100 ml water and 2 ml lead acetate was added and was allowed to stand for 10 minutes. Then the excess lead was precipitated by adding 1.8 ml potassium oxalate solution. It was made upto mark with

distilled water and filtered through Whatman No. 4 filter paper and the filtrate was used for analysis.

Procedure :

Ten ml of Fehling's solution (Fehling's No. 1 (25 ml) + Fehling's No. 2 (25 ml) with 25 to 50 ml of distilled water was taken in a conical flask, heated to boil and titrated against the filtrate sample using methylene blue as an indicator. The end point of titration was brick red colour. The reducing sugar was calculated using equation.

Calculation :

$$\text{Reducing sugar (\%)} = \frac{0.05 \times \text{Volume made up}}{\text{Titre value} \times \text{weight of sample}} \times 100$$

Total sugars :

Fifty ml of the filtrate (prepared for reducing sugar estimation) was hydrolyzed with 10 ml of 6 N HCl at room temperature for 24 hours in 250 ml volumetric flask. Add 4 drops of phenolphthalein indicator to hydrolyzed sample and was neutralized with 10 per cent NaOH and the volume was made upto 250 ml with distilled water. Since all the sugars present in the sample were now converted to reducing sugars, estimation of reducing sugars in the aliquot as explained in the previous section gave the total sugar present.

Calculation :

$$\text{Total sugar (\%)} = \frac{0.05 \times \text{Volume made up} \times 100}{\text{Titre value} \times 25 \times \text{weight of sample}} \times 100$$

Non-reducing sugars :

The non-reducing sugar contents of the Jackfruit *Halwa* samples were determined by method of difference

as:

$$\text{Non-reducing sugars} = \text{Total sugars} - \text{Reducing sugars}$$

Sensory evaluation of jackfruit *Halwa* :

Prepared Jackfruit *Halwa* of different combinations (4 products using different sugar concentration) were evaluated by a panel of 10 judges for sensory attributes such as colour/appearance, texture, taste (aroma and sweetness) and overall acceptability in order to identify best one sample. Numerical scoring method with maximum 9 point hedonic scale (Lim, 2011) was adopted for evaluating the products and the samples were ranked for quality parameters from higher to lower in descending order of acceptability.

Statistical analysis :

The experimental data were analyzed as per the statistical design using the ARIS computer facility of College of Agriculture, Shivamogga to study the main treatment effects (Sundaraja *et al.*, 1972). The limit of probability fixed for the test of significance was $P = 0.05$.

OBSERVATIONS AND ASSESSMENT

Table 1 shows the average score obtained by the four Jackfruit *Halwa* products for colour/appearance, texture, taste and overall acceptability.

The product T₁ was found to be superior in all quality parameters that is colour/appearance, texture, taste and over all acceptability. However the overall acceptability score of developed products varied from 6.8 to 8.3. All the products were acceptable. T₁ was highly acceptable followed by T₃. The product T₁ had higher score for colour/appearance, texture, taste and overall acceptability as compared to other products.

Table 1 : Organoleptic scores of jackfruit *Halwa* for various sensory attributes

Treatments	Quality parameters			
	Colour	Texture	Taste	Overall acceptability
T ₁	7.8	8.1	8	8.3
T ₂	7.5	7.4	7.5	7.4
T ₃	7.8	7.1	7.6	7.6
T ₄	7	6.8	6.8	6.8
Mean	7.525	7.35	7.475	7.525
F value	1.777	2.436	1.776	2.726
C.D. (P=0.05)	0.89	1.01	1.06	1.06
P value	0.08	0.21	0.04	0.32
S.E.±	0.31	0.35	0.37	0.37

Table 2 : Nutritional qualities of jackfruit *Halwa*

Constituents	Treatments			
	T ₁	T ₂	T ₃	T ₄
TSS (°B)	65.1 ± 0.1	64 ± 0.10	52.7 ± 0.1	55.4 ± 0.10
Titration acidity (%)	0.32 ± 0.01	0.4 ± 0.1	0.48 ± 0.01	0.42 ± 0.005
Ascorbic acid (mg/100g)	5.18 ± 0.01	8.17 ± 0.01	7.22 ± 0.07	7.17 ± 0.02
Total sugar (%)	20.67 ± 0.01	21.36 ± 0.1	22.43 ± 0.01	20.67 ± 0.01
Reducing sugar (%)	3.4 ± 0.20	3.53 ± 0.15	3.5 ± 0.1	2.97 ± 0.01
Non reducing sugar (%)	20.1 ± 0.19	17.82 ± 0.11	18.93 ± 0.09	17.69 ± 0

Values are Mean ± SD.

The results also show that there is significant difference at ($P > 0.05$) between different Jackfruit *Halwa* i.e. T₁, T₂, T₃ and T₄ for quality attributes of taste and over all acceptability, because the variation was made in the sweetness of the product.

However, significant difference ($P > 0.05$) was found for taste and overall acceptability stating that there is a difference between the products for taste and overall acceptability.

Nutritional quality of developed products are presented in Table 2. The TSS content varied from 52.7 ± 0.1 to 65.1 ± 0.1. However, we don't have FSSAI specifications for *Halwa*. Further, the studies on fruit *Halwa* standardisation are not mentioned anywhere.

Titration acidity of the products varied from 0.32 ± 0.01 to 0.48 ± 0.01. The importance of high acidity in developed food products shows it can be stored for some time. The higher acidity in the study sample may be due to higher acidity of the fresh jackfruit used. However, the Ascorbic acid content was 5.18 ± 0.01 in T₁ and 8.17 ± 0.01 in T₂ product. Frequent consumption of jackfruit and its products will help the body develop resistance against infectious agents and scavenge harmful free radicals.

Total sugar content of developed samples varied from 20.67 ± 0.01 to 22.43 ± 0.01. Non reducing sugars (%) content was highest in T₁ (20.1 ± 0.19) and lowest in T₄ (17.69 ± 0).

Conclusion:

Jackfruit can be called a wonder fruit because of its great benefits. It has low calorie, high protein and antioxidants. The work was done as an attempt to provide a value addition to an underutilised fruit. The developed Jackfruit *Halwa* of different combination with respect to

sweetness is found to be accepted by consumers with regard to overall acceptability. The *Halwa* prepared by using jaggery has good health benefits than the *Halwa* prepared from sugar. All the treatments were acceptable and have the good nutritional value.

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