

Effects of Dehydration Techniques for the Development of Ready to Cook Tender Jackfruit

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Abstract: Providing food for the subsistence of the ever growing population has always been a formidable challenge facing the global community. There is rise in demand for processed or preserved fruits and vegetables because of the increased requirements and urbanization trend. Jackfruit (*artocarpus heterophyllus*) is thought to be native of India. The raw materials selected for the present study was tender jackfruit. The selected raw materials were collected from the same tree and all having reached the same maturity. The different dehydration methods used were sun drying, drying by dehydrator, and drying by retort machine. The seven variations were as follows 1. Sundried sample of water blanched tender jackfruit with salt, lime juice and turmeric powder. 2. Sundried sample of water blanched jackfruit with salt and turmeric powder. 3. Sundried sample of steam blanched tender jackfruit with salt. 4. Dehydrated sample of water blanched tender jackfruit with salt, lime juice and turmeric powder. 5. Dehydrated sample of water blanched tender jackfruit with salt and turmeric powder. 6. Dehydrated sample of steam blanched tender jackfruit with salt. 7. Retort sample of steam blanched tender jackfruit with salt, lime juice and turmeric powder. The developed 7 variations were subjected to organoleptic evaluation. The mean rank scores obtained for each variation were statistically analysed to get the values for Kendall's Coefficient of Concordance. The overall acceptability of the developed products were evaluated using the "superscripts order of preference". Variation 6 got the highest overall acceptability rank followed by variations 5, 7, 4, 3, 2 and 1. Microbial analysis showed that in variation 7, toxic substances like specific pathogens and total plate count were completely absent. All other variations showed presence of total plate count. Among them variation 6 had the least presence, followed by variations 5, 3, 4, 2 and 1.

I. Introduction

Providing food for the subsistence of the ever growing population has always been a formidable challenge facing the global community. More discoveries regarding food and its processing and emerging on a global basis bringing the food for energy region closer to each other. In former days the preservation of food was performed out of the sheer necessity to bridge periods of scarcity and to store surpluses. Now a days preservation is used for a number of different reasons and several aspects needs to be considered. Availability of seasonal foods throughout the year also helps in stabilizing prices of such foods. Fruits and vegetables provide an abundant and inexpensive source of energy, body building nutrients, vitamins and minerals. Their nutritional value is highest when they are fresh, but it is not always possible to consume them immediately.

There is rise in demand for processed fruits and vegetables because of the increased defense requirements and urbanization trend. The increasing popularity of minimally processed fruits and vegetables has resulted in greater health benefits. Furthermore, the ongoing trend has been to eat out and to consume ready-to-eat foods. With this increasing demand for ready-to-eat, fresh, minimally processed foods, including processed fruits and vegetables by relatively mild techniques, new ecology routes for microbial growth have emerged (Fernandez and Tapia, 2003).

Jackfruit earned the well deserved name "poor man's food" owing to its numerous culinary uses and its availability in plenty at low price.

Tender jackfruit is a popular vegetable. Jack fruit (*Artocarpus heterophyllus*) is popularly known as the poor man's food in the eastern and southern parts of India. Most of the fruits and vegetables are seasonal. During the peak season they appear in the market and form glut to abundant supply at a time and the price comes down causing economic loss to the growers. All these factors discourage the growers from producing more. So reduction of postharvest losses and increases of their shelf life has become an urgent need in order to extend their availability round the year. Processing and preservation can play a vital role in reducing postharvest losses of fruits and vegetable and make them available during off-season.

A number of products have been developed from unripe as well as ripe fruits. In South East Asia, it is widely grown commercially and in the home garden. Since common vegetable are scarce and costly at that time of the year, jack fruit enjoys a high demand and premier price. Both tender and ripe fruits and seeds are rich in minerals and vitamins. Ripe fruits are rich in vitamins A which maintain good vision. Nutritive

value of tender jack fruit per 100 gm edible portion contains protein 2.6gm ,fiber 4.4 gm ,calcium 50.1mg phosphorous 97mg ,iron1.5mg , potassium 206mg and vitamin C 11mg (Hossain,2006).For human consumption, jackfruit is used as a vegetable, fruit as well as a substitute for staple food .Antioxidants regarded as compounds are able to delay retard or prevent oxidation process. The jack fruit also contains useful antioxidant compounds. The carotenoids composition of jack fruit was successfully determined and 14 of the 18 carotenoids werereported for the first time (Jagtap and Bapat, 2010).

In Srilanka one of the foods believed to increase breast milk production in nursing mothers is tender jackfruit. Like so many other tropical fruits, jackfruit is also rich in dietary minerals like calcium, potassium and iron. In fact, it is said to contain more calcium and magnesium than the banana. The jackfruit is also an excellent source of complex carbohydrate and dietary fiber, making it a great energy food. A single jackfruit can be as it often is a meal for an entire family. And that is the reason why in Srilanka, it is popularly called“the rice tree” (Railab, 2010). Jackfruits are eaten unripe at 25-50% full size as vegetables or ripe as a fruit.

The tender jackfruit is used for salads, curries, pickles, and juices. Ripe fruits are also standard and used for jam, jellies, juice and canned products (Janick and Paul, 2008).In traditional healing practices, jackfruit fresh and seeds are a cooling and nutritious food. A remedy of the juice of the tender jackfruit with coconut milk and jaggery is prescribed as an antidote for drug poisoning (Sanmugam,2007). Un ripe jackfruit bulbs are used for making chips and papads. Jackfruit could be very useful in the treatment of dreaded disease like AIDS. „Jacaline“, an extract of jackfruit inhibited growth of HIV infection in vitro. Also it has significant role in cancer treatment (Rajan, 2007).

In Kerala „Chakka varatti“ a Jam like preparation which can be presented for long periods is made from ripe jackfruit (Chadha, 2003).Jackfruit is universally very well appreciated for its unique taste and nutrition. During glut season, delicious curries and pickles are prepared from immature fruit while jams, jellies, marmalades etc, are made from fully ripe fruit. Usually seeds are eaten after roasting or steam-cooking. Sometimes sundried seeds are poured and used in making soups.

The seasonal nature of the fruit with short storage life, even under low temperature conditions, necessitates processing of the ripe and tender jackfruit. A number of products have been developed from unripe as well as ripe fruits. In South East Asia, it is widely grown commercially and in the home garden. Since common vegetable are scare and costly at that time of the year, jack fruit enjoys a high demand and premier price.

So the present study entitled “**Effects of dehydration techniques for the development of ready to cook tender jackfruit**” is done under the following

Objectives

1. To apply different types of preservation methods for tender jackfruit.
2. To compare quality of different preservation methods.
3. To conduct shelf life studies
4. To compare the microbial content in different preservation methods.

II. Methodology

2.1 Selection of raw material

The selected raw materials was collected from the same tree and all having reached the same maturity.

2.2 Pre-treatment of tender jackfruit

In the present study, the pre-treatments involved are steam blanching with salt and turmeric powder; water blanching with salt, turmeric powder and lime juice and water blanching with salt, and turmeric powder.

2.3 Preservation of tender jackfruit using different dehydration methods.

Dehydration is an operation in which the moisture content of food is substantially lowered under controlled conditions of temperature, relative humidity, and airflow in a chamber. Under these conditions, high-quality products are obtained that retains their natural characteristics upon reconstitution. Drying should be done in such a way that the food value, natural flavor and characteristic cooking quality of fresh material are retained after drying. Vegetables are considered to be dry when they become brittle and the residual moisture should not be more than 6-8 percent. Sun drying, drying by dehydrator and drying by retort machine were the different dehydration methods used in this present study.

2.3.1 Sun drying

This method is perhaps the oldest known method of food preservation. It is the evaporation of water

from products by solar or sun heat, assisted by movements of surrounding air. Sun drying requires considerable care. The products must be protected from insects with screen or netting, and must be carried into a shelter when dust blows or rain falls and before the dew falls in the evening. The pre-treated samples were mashed and sundried separately with time duration from 11 am to 3 pm daily. This process was continued for a week.

2.3.2 Drying by dehydrator

The pre-treated samples were mashed and dried using dehydrator at 80 °c for 2 hour.

2.3.3 Drying by retort machine

The retort pouch is a rectangular, flexible, laminated, plastic, four-side hermetically sealed pouch in which food is thermally processed. It is a light weight, high quality, durable, convenient and shelf stable packs. They were originally developed in the 1950s and 1960s in American through research and encouragement from the US Army. The materials from which retort pouches are made are aluminum foil bearing /plastic laminates or foil-free plastic laminate films.

The sample that was water blanched with salt, turmeric powder and lime juice was passed through the retort machine at 121 °c for 5 minutes.

24 Acceptability of developed product

2.4.1 Selection of judges

The selected panel members who were aware about nutrition, between the age group of 20-30, free of cold, chew no gum immediately before testing, have not ingested any other food for at least one hour before testing, nonsmokers, not colour blind and have no strong likes or dislikes for the food to be tested (Brown, 2000).

A panel of ten judges including staff and students were selected as the sensory panel for evaluating the formulated products students were selected as the sensory panel for evaluating the developed products

2.4.2 Organoleptic evaluations

Acceptability of the developed product with colour flavor, appearance, taste, texture was estimated using numerical score test. Organoleptic evaluation is done to every product. Organoleptic evaluation of the tender jackfruit samples which were cooked using a standard recipe initially. Quality attributes like appearance, colour, flavor, texture, taste and acceptability were evaluated. Each of the mentioned quality attributes were assessed by a five point hedonic rating scale.

2.4.3 Microbial analysis

Foods are natural organic materials and as a consequence are rarely sterile. They carry a mixed population of organisms derived from the natural micro flora of the plant or animal from which they originate and from microorganisms as that contaminate the food during harvesting, slaughter, processing, storage and distribution (Wensun *et al*, 2012).

Table 1. Microbial tests of the samples

Toxic substance	Test	Referance
Mould & yeast	spread plate method	(Downes and Ito, 2001).
Total plate counts	pour plate method	(Meekin, 2000).

2.5 Statitital analysis

The scores of the organoleptic evaluation by ten judges for six parameters appearance, color, flavor, texture, taste, acceptibility of the prepared products of different packaging for different storage days were statistically analyzed using Kendall's Coefficient of Concordance test statistics and the mean rank scores were worked out.

III. Results And Discussion

The present study entitled" *Effects of dehydration techniques for the development of ready to cook tender jackfruit*" were analyzed and the results are presented under the following headings.

3.1 Organoleptic evaluation of the variations

3.2 Shelf life of the preserved variations

3.3. Microbial evaluation of the preserved variations

3.1 Organoleptic evaluation of the variations

Based on the above method of evaluation, the developed products are presented to panel

members of ten judges. The panel List evaluated each sample on a specific five point hedonic scale for a particular characteristic indicating the rating of the samples.

Organoleptic evaluations of the developed products were studied separately. The evaluation was based on the fine quality attributes namely appearance, Colour, Flavor, Texture and taste. Mean rank scores of each variation based on the attributes was done and was statistically analysed using Kendall's Coefficient of Concordance. For calculating overall acceptability of the developed products, „superscripts orders of preference“ ranks were given to the mean rank score. The seven preserved tender jackfruit variations were as follows

1. Sundried sample of water blanched tender jackfruit with salt, lime juice and turmeric powder 2. Sundried sample of water blanched jackfruit with salt, and turmeric Powder. 3. Sundried sample of steam blanched tender jackfruit with salt. 4. Dehydrated sample of water blanched tender jackfruit with salt, lime juice and turmeric powder. 5. Dehydrated sample of water blanched tender jackfruit with salt and turmeric powder. 6. Dehydrated sample of steam blanched tender jackfruit with salt 7. Retort sample of steam blanched tender jackfruit with salt, lime juice and turmeric powder.

3.1.1 Overall acceptability of the developed products

The overall acceptability was evaluated using five parameters appearance, colour, flavor, taste, and texture obtained through organoleptic evaluation (Prasad *et al.*, 2007)

The individual rank scores of the judges are pooled for each product so as to arrive at the summary rank scores.

Table 2. Orders of preference score

Variations	Appearance	Colour	Flavour	Taste	Texture	Totalrank
1	26	27	25.5	26	26	130.5
2	26	25	26.5	26	26	129.5
3	20	20	20	19	20	99
4	10.5	11	15.5	10.5	16	63.5
5	8.5	9	10	9.5	9.5	46.5
6	5	4	6	4	9	28
7	17	16	8.5	16	5.5	63

The above table indicates the sum of the „superscripts order of preference“. From these results it is evident that the overall acceptability of developed products was categorized under seven variations.

In the case of appearance, variation 6 (Dehydrated sample of steam blanched tender jackfruit with salt) got the highest superscripts order of preference and variation 1 and 2 got the least. In the case of colour variation 6 was found to be the most acceptable one followed by the same in the appearance. The mean rank scores of texture showed a gradual decrease in the values from variation 7 to variation 3. Variation 1 and 2 showed the same lowest mean rank score. The mean rank scores obtained for the taste based on Kendall's Coefficient of Concordance, the highest acceptability was for variation 6 followed by variations 5,4,3,2and 1.In the case of flavor, variation 6 showed the highest followed by the variations 7,5,4,3,1 and 2.

The overall acceptability of the developed products were evaluated using the “superscripts order of preference” of five parameters such as appearance, colour, texture, taste and flavor obtained through organoleptic evaluation. Sum total of the superscripts order of preference showed the overall acceptability ranks of the each variation. Variation 6 (Dehydrated sample of steam blanched tender jackfruit with salt) got the highest overall acceptability rank (28) among all other variations followed by variations

5(46.5),7(63),4(63.5), 3(99), 2(129.5) and 1(130.5). Shelf life study of the developed variations revealed that the variations 6,5, 7 had maximum acceptability during the evaluating period

3.2 Shelf life of the preserved samples

Table 3 Microbial analysis of the preserved samples

Variations	Toxic Substances	Initial CFU/G	1 st Month CFU/G	2 nd Month CFU/G	3 rd Month CFU/G
V1	Yeast & Mould	10	10	2	3
	Total Plate Count	3500	100	100	83
V2	Yeast & Mould	Absent	Absent	Absent	Absent
	Total Plate Count	5200	200	200	200
V3	Yeast & Mould	Absent	Absent	Absent	Absent
	Total Plate Count	2300	200	76	100
V4	Yeast & Mould	Absent	Absent	Absent	Absent
	Total Plate Count	600	600	520	540
V5	Yeast & Mould	Absent	Absent	Absent	3
	Total Plate Count	200	100	33	66
V6	Yeast & Mould	Absent	Absent	Absent	Absent
	Total Plate Count	170	63	10	10
V7	Yeast & Mould	Absent	Absent	Absent	Absent
	Total Plate Count	No growth	No growth	No growth	No Growth

Microbial analysis of the different variations showed that variation 7(Retorted sample of water blanched tender jackfruit with salt limejuice and turmeric powder) toxic substances like specific pathogens and total plate count were completely absent. Except variation 7, all other variations showed presence of total plate count. Among them variation 6 had the least presence, followed by variations 5, 3, 4, 2 and 1.

IV. Summary And Conclusion

The present study entitled “*Effects of dehydration techniques for the development of ready to cook tender jackfruit*” was done with an aim to develop ready to cook tender jackfruit thoran using seven different variations. Overall acceptability and microbial analysis of different variations were done. Several studies on different dehydration techniques are being carried out these days. Through different methods taste, appearance, quantity may change and become easily acceptable.

There are huge market opportunities for food manufacturers to develop product offerings that assist families and individuals in simplifying their lives and enhancing their quality of life. Fully-prepared and partially-prepared meal solutions that address decision making, time, energy and skill shortages of today's consumers will find a home in the marketplace.

Products targeting the convenience trend can also be bundled with other attributes appealing to consumers interests in technology, health, and ethical concerns. This will assist companies differentiate their products from the competitor. In addition companies can capitalize on the convenience trend by building consumers' confidence in the kitchen and serving as a trusted helper, as well as by targeting the differing comfort needs of consumers and their preferences for traditional /home cooked dishes.

Many consumers are feeling overwhelmed by their lifestyle obligations. Time-pressured consumers express strong preferences for quick, efficiency-driven products that allow them to feel more in control of their time. This consumer group will multi-task in order to compress more activities into less time, leading to wide behavioral implications.

For instance, time scarcity is a common reason for consumers failing to maintain a healthy lifestyle, including, skipping meals, eating-on-the-go, cooking from scratch less often, and failing to exercise regularly. As a result, consumers are looking to simplify and reduce time in the kitchen. Product solutions are needed to restore balance in the consumers' life. From the study it can be concluded that how to use tender jack fruit in off season.

From this study in case of appearance, variation 6 (Dehydrated sample of steam blanched tender jackfruit with salt) got the highest superscripts order of preference and variation 1 and 2 got the least. In the case of colour variation 6 was found to be the most acceptable one followed by the same in the appearance. The mean rank scores of texture showed a gradual decrease in the values from variation 7 to variation 3. Variation 1 and 2 showed the same lowest mean rank score. The mean rank scores obtained for the taste based on Kendall's Coefficient of Concordance, the highest acceptability was for variation 6 followed by variations 5,4,3,2 and 1. In the case of flavor, variation 6 showed the highest followed by the variations 7,5,4,3,1 and 2.

The countdown for jackfruit development has begun in the country. Many civil society groups have

started organising jackfruit festivals. In the past decade, about 75 jackfruit festivals have been conducted in Kerala and Karnataka, two in Tamil Nadu and one each in Maharashtra, Mizoram. The jackfruit will definitely become the most sought after fruit in the coming years. Once the inferiority complex attached to jackfruit in South India gets removed, the wastage will start reducing drastically.

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