Value Addition in Jackfruit Pickle for Physicochemical Properties and Sensory Evaluation

ABSTRACT

The present study was carried in Post-harvest Laboratory of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India. The current experiment was carried out to prepare the Jackfruit pickle added with Raw mango and Monkey jackfruit using different vinegar like apple vinegar, jamun vinegar, sugarcane vinegar with the objective to assess the physico-chemical and organoleptic properties of the pickle. The experiment was conducted in Completely Randomized Design (CRD), with ten treatments and three replications. Based on the statistical analysis, it has been observed that treatment T_5 (Jackfruit + Dried raw mango slices + Apple vinegar) was found best in terms of physico-chemical properties *viz.* pH, acidity (%), total soluble solids (^{o}Brix). Based on the statistical analysis, it has been observed that treatment T_6 (Jackfruit + Dried raw mango slices + Sugarcane vinegar) was found best in terms organoleptic properties *viz.* colour, taste, flavour, texture and overall acceptability.

Keywords: *Jackfruit, Organoleptic properties, Pickle, Physico-chemical properties, Vinegar*

INTRODUCTION

"Fruits and vegetables have historically held a place in dietary guidance because of their concentrations of vitamins, especially vitamin A and C; minerals, especially electrolytes; and more recently phytochemicals especially antioxidant. India is world's second largest fruit and vegetable producer, produced around 99.06 million

tons fruits and 191.76 million tons of vegetables which accounts for nearly 15.0% of country's share in the world production of vegetables in the year 2020. It ranked amongst the world's five largest producers of over 80% agricultural produce items, encounters a waste of close to 25% worth of produce" (NHB, 2020).

"Agricultural waste is the material obtained due to crop production or from plant growth. Agricultural based industries produce vast amount of residues every year. It is estimated that the food industry in Europe generates about 250 million tons per year by-products, waste and effluents and the 6% of them is represented by fruits and vegetable" **(Fuentes et al., 2004**). "Presently, in India, about 960 million tons of solid waste is being generated annually as by-products during industrial, mining, municipal, agricultural and other processes" **(Rais and Sheoran, 2015**). "These residues are released to the environment without proper disposal procedure and cause environmental pollution and harmful effect on human and animal health"[21-24]. "Most of the agro-industrial wastes are untreated and underutilized, therefore in maximum reports it disposed of either by burning, dumping or unplanned landfilling. These untreated wastes create different problems with climate change by increasing a number of greenhouse gases. As far as the composition of these agro-industrial residues are concerned, they have high nutritional prospective, therefore they are getting more consideration for quality control and also categorized as agro-industrial by-products" **(Graminha et al., 2008**). Fruits and vegetables are important constituents of the diet and provide significant quantities of nutrients, especially vitamins, sugars, minerals and fibres. Daily consumption of fruits and vegetables reduce the risk of cancer, heart disease, premature ageing, stress and fatigue primarily due to the integrated action of oxygen radical scavengers such as β- carotene and ascorbic acid plus calcium and dietary fibres. Most of the fruits and vegetables produced in India are still consumed fresh except for a very small quantity going into the manufacturing of pickles, fruit and vegetable drinks, tomato ketchup, fruit jelly, candy, juices and dried and fried fruits. Due to the perishable nature of the fruits and vegetables they require immediate processing to avoid post-harvest losses.

Jackfruit (Artocarpus heterophyllus) belong to the family Moraceae, is the largest edible fruit in the world and is the national fruit of Bangladesh. The domesticated jackfruit tree is important in tropical and sub-tropical regions, particularly in South and Southeast Asia. The tree is a major component of subsistence and small farmers' farming systems and the fruit often assumes the role of a secondary staple food as well as contributing to the livelihoods of the poor. It is commonly grown in Burma and Malasiya and to a considerable extent in Brazil. Jackfruit has been in cultivation in India from ancient times. It was probably taken by Arab traders to the East African coast, and now it has spread throughout the tropics. Jackfruit pickle is a popular condiment in many South Asian countries, particularly in India, Bangladesh, and Sri Lanka. It is made by marinating raw or ripe jackfruit pieces in a blend of spices and oil, and then storing it in an airtight container for several days to allow the flavors to develop. Jackfruit tree is well suited to tropical lowlands and is widely cultivated throughout tropical regions of the world including India, Bangladesh, Sri Lanka, and the rainforests of the Philippines, Indonesia, Malaysia and Australia. Jackfruit is Scientifically known as "Artocarpus heterophyllus". It belongs to same plant family as figs and mulberries i.e Moraceae. It bears the largest fruit of all tree (55kg in

weight, 90cm in length, and 50cm in diameter). The ripe fruit is sweet and is commonly used in desserts. Canned green jackfruit has a mild taste and meat like texture that lends itself to being called “vegetable meat”. Both ripe and unripe fruits are consumed. Jackfruit is also called as “Poor man’s fruit”. Jackfruit contains some fiber for healthy digestion and very little fat. Jackfruit also contains vitamins, minerals, and phytochemicals that have health benefits.

“Nutritional value: Jackfruit is a good source of dietary fiber, vitamin C, and potassium. It also contains antioxidants and phytonutrients that may have health benefits. Pickling jackfruit can help to preserve these nutrients, although some may be lost during the cooking and marinating process. Flavor profile: Jackfruit pickle has a unique combination of sweet, sour, and spicy flavors. The sweetness comes from the natural sugars in the fruit, while the sourness is derived from the vinegar or lemon juice used in the marinade. The spiciness comes from a variety of spices, such as cumin, mustard, and chili powder. 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.

Preservation : Pickling is a traditional method of preserving food, and jackfruit pickle can last for several weeks or even months if stored properly. This makes it a convenient and practical condiment for households that want to have a ready supply of flavorful and nutritious food. Culinary uses: Jackfruit pickle can be used as a side dish or a condiment to enhance the flavor of many dishes, such as rice, curry, and sandwiches. It can also be added to salads or eaten as a snack on its own. Health benefits: Although there is limited research on the specific health benefits of jackfruit pickle, some studies have suggested that consuming pickled fruits and vegetables can have positive effects on digestion, immunity, and overall health. Additionally, the presence of spices in jackfruit pickle may have antimicrobial and anti-inflammatory properties.

Overall, jackfruit pickle is a tasty and nutritious condiment that has been enjoyed in South Asian cuisine for centuries. Its unique flavor profile and versatility make it a popular addition to many dishes, while its preservation properties make it a practical and convenient food item for households.

MATERIALS AND METHODS

The experiment was conducted in the Post-harvest Technology Laboratory Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2022-2024. The experiment was laid out in Completely Randomized Design (CRD) having 10 treatments with three replications. The treatments were T_0 (Control), T_1(Jackfruit(100gm) + Jamun Vinegar(10ml)), T_2 (Jackfruit(100gm) +Apple vinegar(10ml)) , T_3 (Jackfruit(100gm) + Sugarcane vinegar(10ml)), T_4(Jackfruit(750gm) +Raw mango slices(250gm) + Jamun vinegar(10ml)) , T_5 (Jackfruit(750gm) + Raw mango slices(250gm) + Apple vinegar(10ml)) , T_6 (Jackfruit(750gm) + Raw mango slices(250gm) + Sugarcane vinegar(10ml)), T_7 (Jackfruit(750gm) + Monkey jack(250gm) + Jamun vinegar(10ml)), T_8 (Jackfruit(750gm) + Monkey jack(250gm) + Apple vinegar(10ml)) and T_9 (Jackfruit(750gm) + Monkey jack(250gm) + Sugarcane vinegar(10ml)) .

Preparation and Storage of Jackfruit Pickle

The Jackfruit was washed thoroughly and peeled. Then, it was cut into slices and boiled until they became soft. The boiled pieces were left to sun dry to remove moisture. After drying, the slices were placed into a container, and oil and spices were added. The mixture was stirred well with a spoon to ensure the spices were thoroughly mixed with the slices. Vinegar and sodium benzoate were then added to the mixture. The pickle was filled into sterilized plastic bottles and stored at ambient room temperature.

Evaluation of Physico-chemical Properties of Jackfruit Pickle

The value added Jackfruit pickles were evaluated for various physico-chemical properties like pH, acidity, TSS, moisture. The pH content was analyzed by digital pH meter. The acidity content was analyzed by titration method. The TSS content was analyzed by hand refractometer. The moisture content was analyzed by oven dry method. The recorded data of all samples for different parameters were tabulated and statistically analyzed to find out the most suitable treatment combination in terms of physico-chemical properties.

- **Total soluble solid (TSS)**

The total soluble solids in beetroot leathers were determined by weighing the ground sample and mixing in 20 ml distilled water and kept for 1 hour. After standing it was centrifuged at 5000 rpm for 5 min (by using research centrifuge R-24). The

supernatant was taken in petri dish and evaporated to solid form with constant weight. Weight of total soluble solids was recorded in grams and expressed as gram per 100 g sample.

- **Total acidity (%)**

Acidity was determined by Rangana (1978) method by putting the sample in a blender. Added water to the sample and hot for one hour and allowed to evaporate. Then cooled and transferred to a value volumetric flask to make up volume. It was diluted and aliquot of sample with recently boiled distilled water and titrated with 0.1 N NaOH using a few drops of 1% phenolphthalein Solution as an indicator and titrate value are noted.

$$\% \text{ total acid} = \frac{\text{Titrate x normality of alkali x volume x equivalent wt. of acid x 100}}{\text{Vol. of sample taken x wt. of sample}}$$

- **Moisture content**

The initial moisture content of pickles was determined by standard oven method (**Ranganna, 1986**). The sample was dried in oven at 55 °C temperature until the material became completely dry. Then sample were removed from oven and cooled in desiccators for 10 min. Then the weight of the dry sample was taken. The per cent moisture content was calculated by using equation.

$$M = \frac{W1 - W2}{W1} \times 100$$

- **pH**

The electrode assembly of the pH meter was dipped into the standard buffer solution of pH 7 taken in a clean and dry beaker. The temperature correction knob was set to 280C and the fine adjustment was made by asymmetry potential knob to pH 7. After washing with distilled water the electrode assembly was dipped into a solution of standard pH 4 and adjusted to the required pH by fine asymmetry potential knob. The electrode assembly was raised, washed twice with distilled water, and then rinsed with jackfruit juice and finally it was dipped into the juice of jackfruit and pH was recorded from the meter

Evaluation of Organoleptic Properties of Jackfruit Pickle

The value added Jackfruit pickles were evaluated by a panel of five judges to determine colour, taste, flavour, texture and overall acceptability. Each sample was evaluated and given a score by the panelists on the scale of 1-9 using hedonic rating method. The mean scores of all samples of all the five members were tabulated and statistically analyzed to find out which treatment combination is most acceptable in terms of sensory acceptability.

RESULTS AND DISCUSSION

Physico-chemical Propertiesof Jackfruit Pickle

The nutritional value of Jackfruit pickle was evaluated by analyzing its physico-chemical properties like pH, acidity, TSS, moisture. The data recorded on physico-chemical properties of Jackfruit pickle have been presented in Table 1.

Effect of different treatments on pH of Jackfruit Pickle

Statistical analysis revealed that pH content differed significantly across all treatments. The mean values of pH content ranged from 4.29 to 4.75%. The minimum pH content 4.29 was recorded in T_8 (Jackfruit + Monkey jackfruit + Apple vinegar), while the maximum pH content 4.75 was recorded in T_6 (Jackfruit + Dried raw mango slices + Sugarcane vinegar). Similar result were reported by Mondal *et al.* (2013) in jackfruit pickle; Pal *et al.* (2018) in wood apple pickle; Kokani and Mohape (2021) in carrot pickle; Sultana *et al.* (2021) in carrot, green chilli and brinjal pickle.

Effect of different treatments on Acidity of Jackfruit Pickle

Statistical analysis revealed that acidity content differed significantly across all treatments. The mean values of acidity content ranged from 0.45 to 0.55%. The minimum acidity content 0.45% was recorded in T_0(Jackfruit + Sugar cane Vinegar), while the maximum acidity content 0.55% was recorded in T_5 (Jackfruit + Dried raw mango slices + Apple Vinegar). Due to the addition of Vinegar, Acidity of the Picle increased. Similar results were reported by Mir *et al.* (2020) in carrot pickle; Kokani and Mohape (2021) in carrot pickle; Sultana *et al.* (2021) in carrot, green chilli and brinjal pickle; Rymbai and Chaurasiya (2022) in carrot, pea and ginger pickle.

Effect of different treatments on Total Soluble Solids of Jackfruit Pickle

Statistical analysis revealed that TSS content differed significantly across all treatments. The mean values of TSS content ranged from 14.61 to 16.99 ^{o}Brix. The minimum TSS content 14.61 oBrix was recorded in T_4 (Jackfruit + Dried raw mango slices + Jamun vinegar), while the maximum TSS content 16.99 ^{o}Brix was recorded in

T_2 (Jackfruit + Apple vinegar). Similar results were reported by Pal *et al.* (2018) in wood apple pickle; Verma *et al.* (2023) in wood apple pickle.

Effect of different treatments on Moisture of Jackfruit Pickle

Statistical analysis revealed that moisture content differed significantly across all treatments. The mean values of moisture content ranged from 14.42 to 14.89%. The minimum moisture content 14.42% was recorded inT_2 (Jackfruit + Apple Vinegar) , while the maximum moisture content 14.89% was recorded inT_3 (Jackfruit + Sugarcane vinegar). The decrease in moisture content is due to the dehydration phenomenon. Similar results were reported by Mondal *et al.* (2013) in jackfruit pickle; Ali *et al.* (2013) in brinjal pickle; Rymbai and Chaurasiya (2022) in carrot, pea and ginger pickle; Meena *et al.* (2023) in mango pickle.

Organoleptic Properties of Jackfruit Pickle

The sensory acceptability of Jackfruit pickle was evaluated by analyzing its organoleptic properties like colour, taste, flavour, texture and overall acceptability. The data recorded on organoleptic properties of Jackfruit pickle have been presented in Table 2.

Effect of different treatments on Jackfruit Pickle

Statistical analysis revealed that organoleptic score for colour differed significantly across all treatments. The mean values of organoleptic score for colour ranged from 5.0 to 8.3. The minimum organoleptic score 8.3 for colour was recorded in T_0 (Control), while the maximum organoleptic score 8.3 for colour was recorded in T_6 (Jackfruit + Dried raw mango slices + Sugar cane vinegar).

Effect of different treatments on Taste of Jackfruit Pickle

Statistical analysis revealed that organoleptic score for taste differed significantly across all treatments. The mean values of organoleptic score for taste ranged from 5.7 to 8.7. The minimum organoleptic score 5.7 for taste was recorded in T_0 (control) , while the maximum organoleptic score 8.7 for taste was recorded in T_6 (Jackfruit + Dried raw mango slices + Sugar cane vinegar)

Effect of different treatments on Flavour of Jackfruit Pickle

Statistical analysis revealed that organoleptic score for flavour differed significantly across all treatments. The mean values of organoleptic score for flavour ranged from 5.3 to 8.3. The minimum organoleptic score 5.3 for flavour was recorded inT_5 (Jackfruit + Jamun Vinegar) , while the maximum organoleptic score 8.3 for flavour was recorded in T_6 (Jackfruit + Dried raw mango slices + Sugar cane vinegar)

Effect of different treatments on Texture of Jackfruit Pickle

Statistical analysis revealed that organoleptic score for texture differed significantly across all treatments. The mean values of organoleptic score for texture ranged from 5.0 to 8.0. The minimum organoleptic score 5.0 for texture was recorded in T_0 (Control), while the maximum organoleptic score 8.0 for texture was recorded in T_6 (Jackfruit + Dried raw mango slices + Sugar cane vinegar).

Effect of different treatments on Overall acceptability of Jackfruit Pickle

Statistical analysis revealed that organoleptic score for overall acceptability differed significantly across all treatments. The mean values of organoleptic score for overall acceptability ranged from 5.3 to 8.3. The minimum organoleptic score for overall acceptability 5.3 was recorded in T_0 (Control), while the maximum organoleptic score for overall acceptability 8.3 was recorded in T_6 ((Jackfruit + Dried raw mango slices + Sugar cane vinegar).

Table 1: Effect of different treatments on Physico-chemical properties of Jackfruit Pickle

Treatment	pH	Acidity(%)	TSS (^{o}Brix)	Moisture (%)
T_0	4.62	0.56	15.63	14.54
T_1	4.46	0.54	14.89	14.76
T_2	4.43	0.51	16.99	14.42
T_3	4.54	0.45	16.62	14.89
T_4	4.64	0.46	14.61	14.74
T_5	4.34	0.55	15.20	14.78
T_6	4.75	0.52	15.63	14.61
T_7	4.46	0.49	16.05	14.66
T_8	4.29	0.49	15.14	15.42
T_9	4.53	0.51	14.70	15.19
C.V.	0.29	3.55	3.86	1.40
F' Test	**S**	**S**	**S**	**S**
S.E. (d)	**0.01**	**0.01**	**0.49**	**0.17**
C.D. at 5%	**0.02**	**0.03**	**1.02**	**0.36**

Table 2: Effect of different treatments on Organoleptic properties of Jackfruit Pickle

Treatment	Colour	Taste	Flavour	Texture	Overall Acceptability
T_0	5.0	5.7	5.7	5.0	5.3
T_1	5.7	5.3	6.7	5.3	6.0
T_2	6.0	6.0	6.0	6.0	6.7
T_3	6.7	6.3	6.3	6.3	6.3
T_4	7.7	7.3	8.0	7.7	7.7
T_5	8.0	8.0	8.3	7.0	8.0
T_6	8.3	8.3	8.7	8.0	8.3
T_7	6.0	6.7	6.3	6.7	7.0
T_8	6.3	5.7	6.0	7.3	6.7
T_9	6.0	6.0	6.3	6.3	7.3
C.V.	**12.36**	**12.29**	**12.05**	**11.98**	**8.19**
F' Test	**S**	**S**	**S**	**S**	**S**

S.E. (d)	**0.66**	**0.66**	**0.67**	**0.64**	**0.46**
C.D. at 5%	**1.39**	**1.38**	**1.41**	**1.38**	**0.97**

CONCLUSION

Based on the statistical analysis, it has been observed that treatment T_5 (Jackfruit + Dried raw mango slices + Apple vinegar) was found best in terms of physico-chemical properties *viz.* pH (4.75), acidity (0.56%), Moisture (15.42%), Total soluble solids (16.99 ^{0}Brix). Based on the statistical analysis, it has been observed that treatment T_6 (Jackfruit + Dried raw mango slices + Sugarcane Vinegar) was found best in terms organoleptic properties *viz.* colour (8.3), taste (8.3), flavour (8.7), texture (8.0) and overall acceptability (8.3).

This research sheds light on the untapped potential of Jackfruit, demonstrating its versatility and value beyond traditional uses. By promoting the production and consumption of Jackfruit pickle, we contribute to minimizing agricultural losses, fostering awareness about this nutritious vegetable, and enriching culinary experiences.

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