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Changes in chemical composition of jackfruit seed flour during storage

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Abstract

In the experiment i.e. 'Changes in chemical composition of jackfruit seed flour', completely randomized design (CRD) was used with four treatments viz. T₁ ('0' month), T₂ (1 month), T₃ (2 months) and T₄ (3 months) were studied. The prepared jackfruit seed flour was analyzed for different chemical composition. During three months storage of jackfruit seed flour, protein, crude fibre, fat, calcium, magnesium, phosphorus and potassium were found to be decreased from T₁('0' month) to T₄ (3 months), whereas moisture and carbohydrate were found to be increased. Ash content was constant for two months, but then it decreased during the three months storage period.

Keywords: Jackfruit, seed, flour chemical composition

Introduction

The jackfruit (*Artocarpus heterophyllus* L.) belongs to the family of Moraceae. The jackfruit order is Rosales and has basic chromosome no. 2n = 56. This Moraceae family encloses about 1000 species in 67 genera, mostly tropical shrubs and trees, but also a few vines and herbs (Bailey 1948 and Merrill, 1912) [7, 15]. The phytonutrients such as lignin, saponin and isoflavones present in the seeds play a beneficial role in human health (Noor *et al.*, 2014) [18]. The presence of high fibre content (3.6/100 g) in the jackfruit improves the digestion system. The seeds are rich in dietary fibre content, they help lower risk of heart disease, prevent constipation and promote weight loss. Jackfruit seed also contains resistant starch which controls blood sugar and keeps the gut healthy. The seeds contain an important lectin known as 'jacalin' used as a tool to evaluate the immune system of an HIV infected person (Butool *et al.*, 2013) [8]. The seed contains an abundance of magnesium which plays a vital role in lowering the blood pressure and maintaining bone health. Since it aids in calcium absorption and hence helps to strengthen the bones. Seeds are rich in highly soluble protein resulting in the prevention and treatment of mental stress. Alves *et al.* (2020) [4] observed that the fruit contains lignin flavones and saponin which have the properties of anti-cancer, anti-ulcer, anti-hypertensive and anti-aging.

Objective and Hypothesis

Therefore, study was conducted with the objective to prepare seed flour from jackfruit. If such nutritive and medicinally rich product is prepared on commercial scale, it will be in great demand, as the consumer have become health conscious.

Materials and Methods

The present investigation was undertaken in the Fruit and Vegetable Processing Unit, College of Horticulture, Dapoli- 415712, Dist. Ratnagiri, Maharashtra State (India) during the year 2021-2022. Soft flesh jackfruits seeds were used for study and they were analysed for chemical composition. During the course of investigation jackfruit seed flour was prepared. and changes in chemical composition were studied during three months' storage at ambient temperature (27 to 30 °C).

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Experimental material

Crop	Jackfruit (<i>Artocarpus heterophyllus</i> L.)
Design	CRD
No. of treatments	5
No. of replications	4
No. of glass jars used per treatment per replication	2
Total glass jars used	40

Treatment details

Treatments	Month
T ₁	1
T ₂	2
T ₃	3
T ₄	4

The disease free, ripe soft flesh jackfruits were cutted and bulbs were removed. Then seeds and carpels were separated. Then seeds were washed 3-4 times with water to remove stickiness and inert material. The seeds were weighed on an electronic weighing balance and dried in a cabinet dryer for two days. The dried seeds were used for preparation of powder as per details given in Fig 1. And stored at room temperature for further studies.

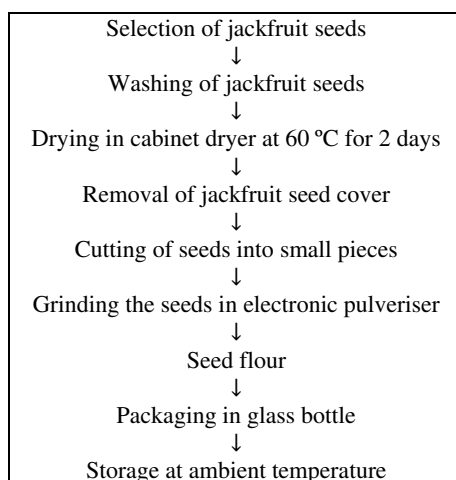


Fig 1: Preparation of jackfruit seed flour

Results and Discussion

Moisture (%)

The data regarding moisture content in jackfruit seed flour during four month storage presented in the table 1.

The moisture content in jackfruit seed flour on an average was 7.54 percent. The highest moisture content was obtained in T₄ (8.11 %). The minimum moisture content was observed in T₁ (6.41) i.e., at '0' month during storage. The minimum moisture content at T₁ was significantly superior over others.

The moisture content was found to be increased from T₁ ('0' month) to T₄ (3 months). The increase in moisture content might be due to absorption of moisture by seed flour from the surrounding environment during ambient storage.

Similar results were observed by Chowdary *et al.* (2012) [10] conducted a study on functional properties of raw and blended jackfruit seed flour (a non-conventional source) for food application. In this study the moisture percent was found 10.7 percent. Maibam *et al.* (2016) [14] who carried out a study on quality characteristics of jackfruit seed flour

The moisture content of the prepared sample was determined by a method described by A.O.A.C. (1990) [1] as follows. The nitrogen content of the prepared sample was estimated by using kjeldahl method pelican kelpus equipment. Protein was calculated by multiplying with a factor 6.25 (A.O.A.C. 1990) [1]. The carbohydrate content in the prepared sample was determined by difference i.e., by subtracting the sum of values for moisture (%), protein (%), fat (%), fibre (%) and ash (%) from 100, Rangana, (1997) [21].

The fat content of the jackfruit seed flour prepared sample was determined by using a method described in A.O.A.C. (1990) [1].

The ash content was calculated using the following formula.

$$\text{Ash content (\%)} = \frac{\text{weight of the ash}}{\text{weight of sample}} \times 100$$

Calcium was determined by using di – acid extract with the Ver senate method as described in A.O.A.C., 1980. potassium was determined .. Crude fibre content was analysed by method suggested [2] Phosphorus was determined by colorimetric method (vanadomolybdophosphoric yellow colour in nitric acid system). Magnesium content was analysed using method suggested [9].

and its suitability for the preparation of dumplings and reported that moisture content of jackfruit seed flour was increased from 6.3 to 7.5 during 120 days of storage period. Shehin *et al.* (2019) [24] reported that moisture content in jackfruit seed flour was 10.3 percent.

Table 1: Changes in moisture content (%) in jackfruit seed flour during storage.

Treatments	Moisture (%)
T ₁	6.41
T ₂	7.68
T ₃	7.96
T ₄	8.11
Mean	7.54
S.Em. ±	0.025
C.D. at 1%	0.10

Protein

It is evident from data presented in the Table 2. The Protein content in jackfruit seed flour on an average was 5.26

percent. The significantly highest protein content was obtained in '0' month i.e. (6.94%). The minimum protein content was observed in T₄ (3.85%) i.e. at 3 months during storage.

The protein content was found to be decreased from T₁ ('0' month) to T₄ (3 months). The decreased in protein content in jackfruit seed flour may be due to increase in moisture content during storage.

Similar results observed by Praveenasri *et al.* (2006) [20] studied on incorporation of jackfruit seed flour on extruded products the protein content of jack fruit seed flour was found 6.69 percent. Sharon and Usha (2006) [23] studied the effect of storage on nutritional and sensory qualities of breadfruit flour. It was observed that the protein content in breadfruit flour present only 4.5 percent. Swami *et al.* (2012) [25] reported that the protein content ranges between 6.6 and 7.4 percent. Mittal (2018) [16] observed that protein content in pumpkin seed flour was decreased from 31.02 to 30.27 percent during 2 months storage.

Table 2: Changes in protein (%) in jackfruit seed flour during storage.

Treatments	Protein (%)
T ₁	6.94
T ₂	5.55
T ₃	4.68
T ₄	3.85
Mean	5.26
S.Em. $\pm$	0.012
C.D. at 1%	0.05

Crude fibre (%)

The data regarding to changes in crude fibre content in jackfruit seed flour is presented in Table 3. The Crude fibre content in jackfruit seed flour on an average was 2.30 percent. The significantly highest crude fibre content was obtained in T₁ (2.80 %) and minimum crude fibre content was observed in T₄ (1.39 %) i.e., at 3 months during storage. The crude fibre content was found to decreased from T₁ (2.80%) i.e. at '0' month to T₄ (1.39%) i.e. at 3 months storage. The decrease in crude fibre content in jackfruit seed flour from 2.80 to 1.38 may be due to increase in moisture during storage.

Similar results were found by Hossain *et al.* (2014) and reported that the amount of crude fibre was ranging between

2.1 and 4.09 percent present in jackfruit seed flour. Maibam *et al.* (2016) [14] carried out a study on quality characteristics of jackfruit seed flour and its suitability for the preparation of dumplings and reported that crude fiber content of jackfruit seed flour was 3.15 percent. Mittal (2018) [16] he observed that crude fibre content in pumpkin seed flour was slightly decreased from 12.26 to 12.24 percent during 2 months storage.

Table 3: Changes in crude fibre (%) in jackfruit seed flour during storage.

Treatments	Crude fibre (%)
T ₁	2.80
T ₂	2.67
T ₃	2.32
T ₄	1.39
Mean	2.30
S.Em. $\pm$	0.015
C.D. at 1%	0.066

Fat (%)

The data related to changes in the fat content of jackfruit seed flour during storage are presented in the Table 4. An average fat content in jackfruit seed flour was 1.50 percent. The highest fat content was obtained in '0' month i.e. at T₁ (1.67 %) and it was at par with T₂ (1.62%). The minimum fat content was observed in T₄ (1.25%) i.e. at 3 months during storage.

The slight decrease in fat content in jackfruit seed flour from 1.67 (T₁) to 1.25 (T₄) percent may be due to increase in moisture from T₁ to T₄ during storage. This increased moisture might have diluted the native fat content of jackfruit seed flour.

Similar results were observed by Mukprasit and Sajjaanantakul (2004) [17] who studied the properties of flour and starch from jackfruit seed. The fat percent obtained from wet milled and dry milled flour was 1.94 and 2.19 percent, respectively. Noor *et al.* (2014) [18] studied physico-chemical properties of flour and extraction of starch from jackfruit seed. In this study they found the variation in fat content among jackfruit seed flour of different varieties which varied from 1.18 to 1.40 percent. Mittal (2018) [16] observed that fat content in pumpkin seed flour was decreased from 37.54 to 36.14 percent during 2 months storage.

Table 4: Changes in fat (%) in jackfruit seed flour during storage.

Treatments	Fat (%)
T ₁	1.67
T ₂	1.62
T ₃	1.45
T ₄	1.25
Mean	1.50
S.Em. $\pm$	0.017
C.D. at 1%	0.070

Ash (%)

The data related the changes in ash content of jackfruit seed flour are presented in Table 5

From the data it was observed that there is no change in ash content of jackfruit seed flour (4.8 percent) during 2 months storage (T₁ to T₃). At 3 months (T₄) storage the ash content in seed flour was slightly decreased from 4.8 to 4.0. Maximum ash content recorded by T₁, T₂ and T₃ (4.8%) was significantly superior over T₄ (3 months storage).

Results analogous to present finding are also reported by Petenuci *et al.* (2002) [27]. From their study they concluded that the amount of ash in jackfruit flesh was 2.61 percent. Tulyathan *et al.* (2002) [26] reported that the amount of ash content in jackfruit seed flour with brown spermoderm and without brown spermoderm was 3.97 and 3.92 percent, respectively and Ocloo *et al.* (2010) [19] reported that in jackfruit seed flour the amount of ash found was 2.70 percent. Mittal (2018) [16] he observed that ash content in

pumpkin seed flour was decreased from 3.99 to 3.74 percent during 2 months storage.

Table 5: Changes in ash (%) in jackfruit seed flour during storage.

Treatments	Ash (%)
T ₁	4.8
T ₂	4.8
T ₃	4.8
T ₄	4.0
Mean	4.6
S.E.m. $\pm$	0.003
C.D. at 1%	0.013

Carbohydrate

It is evident from data presented in Table 6. The carbohydrate of jackfruit seed flour increased significantly from T₁ (77.37 %) i.e. '0' month to T₄ (82.8 %) i.e. 3 months during storage. The increase in carbohydrate content might be due to decrease in protein, crude fibre, fat and ash during storage, as carbohydrate was calculated by difference method as per details given in material and methods chapter. The highest carbohydrate content recorded by T₄ (82.80%) was significantly superior over others. In confirmation with the present findings are the observations recorded by Ocloo *et al.* (2010) [19]. From their study concluded that the amount of carbohydrates present in jackfruit seed flour was 79.34 percent. Wanniarachchi *et al.* (2022) [3] reported that the carbohydrate present in dried soaked jackfruit seed flour was 76.32 percent which was more than the fried jackfruit seed sample (75.40%). Mittal (2018) [16] observed that carbohydrate content in pumpkin seed flour was increased from 10.08 to 11.68 percent during 2 months storage.

Table 6: Changes in carbohydrate (%) in jackfruit seed flour during storage.

Treatments	Carbohydrate (%)
T ₁	77.37
T ₂	77.68
T ₃	78.80
T ₄	82.80
Mean	79.16
S.E.m. $\pm$	0.97
C.D. at 1%	3.99

Calcium (mg/100 g): The data regarding the changes in calcium content in jackfruit seed flour is presented in Table 7. On an average the calcium content in jackfruit seed flour was 4.01 mg/100 g. The significantly highest calcium content was obtained at '0' month i.e. T₁ (6.72 mg/100 g)

and it was significantly superior over others. The minimum calcium content was observed in T₄ (2.26 mg/100 g) i.e. 3 months during storage.

The calcium content was found to be decreased from T₁ ('0' month) to T₄ (3 months). The decrease in calcium content in jackfruit seed flour from 6.72 mg/100 g to 2.36 mg/100 g may be due to increase in moisture during storage which might have diluted native calcium content.

Similar result was found by Petenuci *et al.* (2002) [27] who reported that in soft flesh jackfruit seed flour the calcium content was found to be 8.10 mg/100 gram.

Table 7: Changes in calcium (mg/100 g) in jackfruit seed flour during storage.

Treatments	Calcium (mg/100 g)
T ₁	6.72
T ₂	4.42
T ₃	2.54
T ₄	2.36
Mean	4.01
S.E.m. $\pm$	0.16
C.D. at 1%	0.65

Magnesium (mg/100 g): The data regarding the changes in magnesium content in jackfruit seed flour is presented in Table 8

The magnesium content in jackfruit seed flour on an average was 4.29 mg/100 g. The highest magnesium content was obtained in '0' month i.e. T₁ (5.08 mg/100 g) and it was at par with T₂ (4.40 mg/100 g) and T₃ (4.20 mg/100 g). The minimum magnesium content was observed in T₄ (3.48 mg/100 g) i.e. at 3 months during storage.

The magnesium content decreased from T₁ ('0' month) to T₄ (3 months) during storage. The decrease in magnesium content in jackfruit seed flour from T₁ (5.08 mg/100 g) to T₄ (3.48 mg/100 g) may be due to increase in moisture during storage which might have diluted native magnesium content in jackfruit seed flour.

The results are supported by Petenuci *et al.* (2002) [27] who carried out research on chemical composition of jackfruit seed flour. They reported high amount of magnesium content i.e., 215.09 mg/100 gram in soft flesh jackfruit seed. Abedin *et al.* (2012) [2] studied the nutritive composition of locally available jackfruit seed in Bangladesh. In this research magnesium content was found 150.7 mg /100 gram in Khaja, 168.7 mg /100 gram in Gala and 210.0 mg/100 g in Durosha seeds, which was higher than the results obtained in present study.

Table 8: Changes in magnesium (mg/100 g) in jackfruit seed flour during storage.

Treatments	Magnesium (mg/100 g)
T ₁	5.08
T ₂	4.40
T ₃	4.20
T ₄	3.48
Mean	4.29
S.E.m. $\pm$	0.30
C.D. at 1%	1.21

Phosphorus (mg/100 g): The data regarding the changes in phosphorus content in jackfruit seed is presented in Table 9.

The phosphorus content in jackfruit seed flour on an average was 0.108 mg/100 g. The highest phosphorus content was obtained at '0' month i.e. at T₁ and T₂ (0.119

mg/100 g) and it was at par with T₃ (0.112 mg/100 g). The minimum phosphorus content was observed in T₄ (0.079 mg/100 g) i.e. at 3 months during storage.

The phosphorus content was found to be decreased during storage. The decrease in phosphorus content in jackfruit

seed flour from 0.119 mg/100 g (T₁ and T₂) to 0.079 mg/100 g (T₄) may be due to increase in moisture during storage. Sharon and Usha (2006) [23] in their study on the effect of storage on nutritional and sensory qualities of breadfruit flour reported higher phosphorus content in breadfruit flour which was 67.3 mg/100 g. Rengsutthi and Charoenrein (2011) [22] carried out study on physico-chemical properties of jackfruit seed starch and its application as thickener and stabilizer in chilli sauce and also reported that the phosphorus content in jackfruit seed flour (43.7 mg/100 g).

Table 9: Changes in phosphorus (mg/100 g) in jackfruit seed flour during storage.

Treatments	Phosphorus (mg/100 g)
T ₁	0.119
T ₂	0.119
T ₃	0.112
T ₄	0.079
Mean	0.108
S.Em. $\pm$	0.007
C.D. at 1%	0.027

Potassium (mg/100 g):- It is observed from data presented in Table 10 that, the potassium content of jackfruit seed flour gradually decreased from T₁ (0.794 mg/100) to T₄ (0.573 mg/100 g) during storage. The decrease in potassium content in seed flour may be due to increase in moisture during storage period. Results analogous to present findings are also reported by Abedin *et al.* (2012) [2] in three type of jackfruit seeds. The maximum potassium reported by T₁ ('0' month) was significantly superior over others.

Table 10: Changes in potassium (mg/100 g) in jackfruit seed flour during storage.

Treatments	Potassium (mg/100 g)
T ₁	0.794
T ₂	0.686
T ₃	0.619
T ₄	0.573
Mean	0.668
S.Em. $\pm$	0.025
C.D. at 1%	0.105

Conclusion

The jackfruit seed flour was prepared and stored at room temperature for three months, and then its various chemical compositions and organoleptic qualities were evaluated at '0' month and after the three months period of storage. In the current study, during three months storage of jackfruit seed flour, protein, crude fibre, fat, calcium, magnesium, phosphorus and potassium were found to be decreased from T₁ ('0' month) to T₄ (3 months), whereas moisture and carbohydrate were found to be increased. Ash content was constant for two months, but then it decreased during the three months storage period.

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