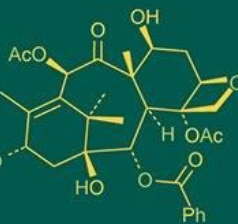
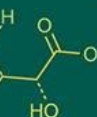
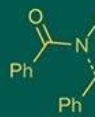


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Studies on physical parameters of jackfruit, their seeds and kokum

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Abstract

The present investigation entitled 'Value addition in jackfruit (*Artocarpus heterophyllus* L.) bulb and seeds' was conducted at the Fruit and Vegetable Processing Unit of College of Horticulture, Dapoli-415712, Dist. Ratnagiri, Maharashtra State (India) during the year 2021-2022. First the physical parameters of fresh soft flesh jackfruit and kokum were studied. The average weight of jackfruit was found 5.816 kg and has 3.175 kg (54.59%) of non-edible material and 2.641 kg (45.41%) of bulbs, carpel weighed 2.328 kg (40.03%) and the seed 0.313 kg (5.38%). The pulp recovered from the fruit weighed 2.295 kg and had a 39.46 percent pulp recovery rate based on the weight of the fruit. 0.033 kg (0.57%) of pulp residue was measured. Kokum fruit had a 30.30 g average weight and it has 14.75 g (48.68%) weight of pulp with seeds and 15.55 g (51.32%) weight of rind. The weight of the rind juice was 7.53 g (24.85%), whereas the weight of the rind pulp was 13.18 g (43.50%). 48.42 percent of the juice was recovered from the rind, while the juice residue weighed 5.65 g (18.65%). It was observed that the original fresh weight of seeds was 13.4 kg from this dry weight of the seeds obtained was 5.971 kg (44.56%). The weight of the seed cover after drying was 1.280 kg (21.44%). The weight of the dried seed without the seed cover was 4.691 kg (78.56%) and the weight of the flour made from the dried seed without the seed cover was 4.409 kg. The recovery of seed flour from dried seed without seed cover was 93.99 percent and recovery of seed flour from fresh seeds was 32.90 percent.

Keywords: Jackfruit, seeds, kokum, juice, seed flour

Introduction

The primary economic part of jackfruit is the fruit which is used both mature and immature. The ripe jackfruit is considered to be delicious and nutritious. It is sweet in taste and has an exotic flavour. The seeds are eaten when boiled and roasted. The ripe jackfruit pulp is processed dehydrated and sold as dried pulp. Juice, biscuits, chutney, jam, jelly, toffee, pastes, leathers, bar, nectar, squash, pickle, seed flour, jackfruit chocolate, jackfruit candy, jackfruit cake, muffins, pudding, jackfruit wine, dehydrated raw jackfruit slices, jackfruit rind jelly and frozen jackfruit can also be prepared from jackfruit (Thomas *et al.*, 2020) [9].

An extensive range of products are prepared from the kokum fruits. Processing of kokum fruit for extraction of juice revealed that heating the kokum crushed at 60 °C yielded maximum juice recovery up to 71.6 percent. A few value-added products are prepared from the kokum fruits like kokum squash, kokum powder, nectar, jam, pickle, RTS, syrup, dry rind (Amsol) and kokum butter are being prepared commercially.

Even though the jackfruit and kokum fruits have good nutritional and medicinal properties, 60-70 percent post-harvest losses are observed in these fruits. In order to reduce these post-harvest losses value addition will be the best option. Hence, research on innovative products from these fruits is the present need.

Objective and Hypothesis

In order to prepare various value-added products, it is necessary to analyse the physical parameters of both kokum and Jackfruit in order to determine how much should be obtained from the fruit.

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.

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Physical parameters of soft flesh jackfruit**1. Weight of fruit (kg)**

The selected soft flesh jackfruit was weighed on electronic weighing balance and an average of 10 fruits was recorded in kg.

2. Weight of bulbs (kg)

The weight of the bulb with seeds of individual soft flesh jackfruit was measured on an electronic top pan balance and an average of 10 jackfruit was recorded in kilograms.

3. Weight of carpel (kg)

The weight of carpel without seeds of individual soft flesh jackfruit was measured on electronic top pan balance and an average of 10 fruits was recorded in kilograms.

4. Weight of seed (kg)

The weight of seeds of individual fruit was measured on electronic top pan balance and an average of 10 fruits was recorded in kilograms.

5. Weight of non-edible portion (kg)

After separating the bulbs and seeds the remaining portion of individual soft flesh jackfruit i.e. non-edible portion was measured on an electronic top pan balance and average of 10 fruits was recorded in kilograms.

6. Weight of pulp (kg)

The pulp extracted from the carpels of individual jackfruit was weighed on an electronic top pan balance and an average of 10 fruits was recorded in kilograms.

7. Pulp recovery of fruit (%)

For the determination of pulp recovery, 10 soft flesh jackfruits were weighed on 100 kg capacity electronic balance. Bulbs were removed and from these bulbs carpel was separated. From this carpel pulp was prepared by using Helicoidal juice extractor. The pulp recovery from fruit was calculated by using following formula

$$\text{Pulp recovery of fruit (\%)} = \frac{\text{Weight of pulp (kg)}}{\text{Weight of soft flesh jackfruit (kg)}} \times 100$$

8. Weight of juice residue (kg)

While extracting the pulp from carpel with the help of helicoidal juice extractor, the pulp residue obtained separately was weighed on balance and an average of ten fruits was recorded in kilograms.

Physical parameters of kokum fruit**1. Weight of fruit (g)**

The 33 fruits were taken for the experiment and fruits were weighed on an electronic balance and an average weight of 33 fruits was expressed in grams.

2. Weight of rind (g)

The rind was removed from the fruits taken for experiment, weighed on an electronic balance and an average weight of 33 fruits rind was expressed in grams.

3. Weight of pulp with seed (g)

The weight of pulp with seed was measured on an electronic top pan balance and an average of 33 fruits was recorded in grams.

4. Weight of rind pulp (g)

The rind obtained from 33 fruits was grinded in a mixer and weighed on an electronic balance. The average weight of pulp obtained from the rind of 33 fruits was expressed in grams.

5. Weight of juice (g)

The pulp obtained from the whole rind of 33 fruits was pressed in a basket press machine and juice obtained was strained and weighed on an electronic balance. The average weight was expressed in grams.

6. Recovery of juice from rind (%)

To record juice recovery percentage from rind the following formula was used

$$(\%) \text{ Juice recovery from rind} = \frac{\text{Weight of juice (g)}}{\text{Weight of rind (g)}} \times 100$$

7. Weight of juice residue (g)

While extracting the juice from rind pulp with the help of basket press. The juice residue obtained separately was weighed on balance and average of 33 fruits was recorded in grams.

Physical parameters of jackfruit seeds**1. Fresh weight of jackfruit seed (kg)**

The fresh weight of jackfruit seeds was taken on electronic weighing balance and recorded in kilograms.

2. Dry weight of seeds (kg)

All the seeds taken for experiment were dried in a cabinet dryer (60 ± 2 °C) for 2 days and the weight of dry seeds was taken on electronic weighing balance and expressed in kilograms.

3. Weight of seed cover (kg)

The seed cover was removed from the seed and weight was taken on electronic weighing balance and expressed in kilograms.

4. Weight of seeds without seed cover (kg)

After the removal of seed cover the weight of the seeds was taken on electronic weighing balance and expressed in kilograms.

5. Weight of seed flour (kg)

The seeds were grinded in a pulveriser and weighed on top pan balance and weight recorded in kilograms.

6. Seed flour recovery from dried seed (g)

After removal of seed cover seeds were dried in a cabinet dryer (60 ± 2 °C) for 2 days grinded in a pulveriser and then seed flour was prepared. The seed flour recovery from dried seeds was calculated by following formula

$$\text{Recovery of seed flour from dried seed (\%)} = \frac{\text{Weight of seed flour (kg)}}{\text{Weight of dried seed (kg)}} \times 100$$

Experimental material**1. Raw Material**

Soft flesh jackfruit (*Barka*) and kokum fruits were used for preparation of jackfruit- kokum blended jelly and seeds were used for preparation of seed flour. The experimental material was collected from the College of Horticulture,

Dapoli and Central Experimental Station, Wakawali, Tal. Dapoli- 415712. Dist. Ratnagiri, Maharashtra State.

Result and Discussion

The data obtained of the physical parameters of soft flesh jackfruit is presented in Table 1.

Table 1: Physical parameters of soft flesh jackfruit

Sr. No.	Parameters	Values
1	Weight of fruit (kg)	5.816
2	Weight of bulbs (kg)	2.641 (45.41%)
3	Weight of carpel (kg)	2.328 (40.03%)
4	Weight of seeds (gm)	0.313 (5.38%)
5	Weight of non-edible portion (kg)	3.175 (54.59%)
6	Weight of pulp (kg)	2.295 (39.46%)
7	Pulp recovery of fruit (%)	39.46%
8	Weight of pulp residue (kg)	0.033 (0.57%)

(Figures in parenthesis indicates percentage on fruit weight basis)

It is observed from the table that the average weight of jackfruit was 5.816 kg. The weight of different parts of fruit with its percentage on fruit weight basis indicates that jackfruit had 2.641 kg (45.41%) weight of bulbs and 3.175 kg (54.59%) weight of non-edible portion. Among bulb weight, the weight of carpel was 2.328 kg (40.03%) and weight of seed was 0.313 kg (5.38%). Weight of pulp extracted from carpel was 2.295 kg and its percentage on fruit weight basis i.e. pulp recovery of fruit was 39.46 percent. Weight of pulp residue was 0.033 kg (0.57%).

Similar results were reported by Bhatia (1953) ^[1] reported 46.9 percent of edible parts constitutes jackfruit. Teotia and Awasthi (1968) ^[12] while studying on dehydration in jackfruit reported that they recovered 40 percent of a carpel by total weight of the fruit. Kambale *et al.* (2014) ^[3] reported that the weight of the juice residue of aonla was 27.805 kg i.e., 31.75 percent of aonla fruit. Madhu *et al.* (2015) ^[4] reported that the weight of non-edible portion was 2.887 kg i.e., 55.99 percent of the total weight of fruit. Nickhil *et al.* (2016) ^[8] reported that the weight of the

jackfruit seed varied from 0.26 to 1.04 kg per fruit. Seleim and Hassan (2019) ^[11] observed that the weight of jackfruit varied from 4.01 to 5.34 kg, and weight of jackfruit pulp varied from 1.96 to 2.74 kg and the recovery of pulp from jackfruit varied from 47.33 to 51.31 percent.

Table 2: Physical parameters of kokum

Sr. No.	Parameters	Values
1	Weight of fruit (gm)	30.30
2	Weight of rind (gm)	15.55 (51.32%)
3	Weight of pulp with seed (gm)	14.75 (48.68%)
4	Weight of rind pulp (gm)	13.18 (43.50%)
5	Weight of juice (gm)	7.53 (24.85%)
6	Recovery of juice from rind (%)	48.42
7	Weight of juice residue (gm)	5.65 (18.65%)

(Figures in parenthesis indicates percentage on fruit weight basis except recovery of juice from rind)

The data regarding physical parameters of kokum fruit is presented in Table 2. It is evident from table that average weight of kokum fruit was 30.30 g. The weight of different parts of fruit with its percentage on fruit weight basis indicated that kokum fruit had 15.55 g (51.32%) weight of rind and 14.75 g (48.68%) weight of pulp with seed. The weight of rind pulp was 13.18 g (43.50%), the weight of rind juice was 7.53 g (24.85%). The recovery of juice from rind was 48.42 percent and weight of juice residue was 5.65 g (18.65%).

The results analogous to present findings are also reported by Nair (1986) ^[6] that the weight of kokum fruit at maturity stage was 34.01 g. Weight of rind of ripe kokum fruit was ranged between 9.10 to 14.40 g and the weight of pulp was 10.59 g. Nawale (1987) ^[7] observed that the juice content in different types of cashew apple varied from 44.4 to 77.9 percent. Dalvi (1998) ^[2] reported juice recovery in kokum was 29.84 percent.

Physical parameters of jackfruit seeds

Table 3: Physical parameters of jackfruit seed flour

Sr. No.	Parameters	Values
1	Fresh weight of seeds (kg)	13.4
2	Dry weight of seeds (kg)	5.972 (44.56%)
3	Weight of seed cover from dried seeds (kg)	1.280 (21.44%)
4	Weight of seed without seed cover (kg)	4.691 (78.56%)
5	Weight of seed flour (kg)	4.409
6	Recovery of seed flour from dried seed without seed cover (%)	93.99
7	Recovery of seed flour from fresh seeds (%)	32.90

From Table 3 of physical parameters of jackfruit seed flour it is evident that from the original 13.4 kg fresh weight of seeds the dry weight of seeds was 5.971 kg (44.56%) and weight of seed cover from dried seed was 1.280 kg (21.44%). The weight of dried seed without seed cover was 4.691 kg (78.56% from dried seeds) and weight of flour prepared from dried seed without seed cover was 4.409 kg. The recovery of seed flour from dried seed without seed cover was 93.99 percent and recovery from fresh seeds was 32.90 percent. Similar results were found by Rupanawar *et al.* (2016) ^[10] reported that the seed of jackfruit weighed 3.88 g. Mittal (2018) ^[5] reported that the recovery percentage of dried seed varied from 44.2 to 59.6 percent in jackfruit seed flour. Petenuci *et al.* (2022) ^[13]. Studied the

physico-chemical properties of jackfruit seed. In this study they observed 44.89 percent flour yield of soft flesh jackfruit.

Conclusion

The average weight of jackfruit was found 5.816 kg. Based on the weight of the various fruit components and their proportions, it can be concluded that 5.816 kg jackfruit has 3.175 kg (54.59%) of non-edible material and 2.641 kg (45.41%) of bulbs. In terms of bulb weight, the carpel weighed 2.328 kg (40.03%) and the seed 0.313 kg (5.38%). The pulp recovered from the fruit weighed 2.295 kg and had a 39.46 percent pulp recovery rate based on the weight of the fruit. 0.033 kg (0.57%) of pulp residue was measured.

Kokum fruit had a 30.30 g average weight. The kokum fruit has 14.75 g (48.68%) weight of pulp with seeds and 15.55 g (51.32%) weight of rind. The weight of the rind juice was 7.53 g (24.85%), whereas the weight of the rind pulp was 13.18 g (43.50%). 48.42 percent of the juice was recovered from the rind, while the juice residue weighed 5.65 g (18.65%).

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