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Effect of jackfruit (*Artocarpus heterophyllus*) pulp powder on qualitative characters of chocolate preparation

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Abstract

The present experiment entitled "Effect of jackfruit (*Artocarpus heterophyllus* Lam.) pulp powder on qualitative characters of chocolate preparation" was carried out at Post Harvest Technology Research Station, Venkataramannagudem, Dr. Y.S.R. Horticultural University, West Godavari District, Andhra Pradesh. The experiment was conducted in Completely Randomized Design with eight treatments and three replications. In this experiment first prepared the jackfruit pulp powder after that prepared the chocolate by incorporation of jackfruit variants with different levels (5 g, 10 g, 15 g, 20 g, 25 g, 30 g and 35 g) by double boiling method. Then the moulded chocolates were wrapped with aluminum foil and studied the storage life (up to 2 months) of chocolate. The findings revealed that, lowest moisture content (2.27%), titratable acidity (5.30%) and highest total soluble solids (70.04° Brix), Ascorbic acid (95.09 mg), reducing sugars (4.40%), total sugars (47.04%), non-reducing sugars (42.83%) in T₃ (chocolate with 15 g jackfruit pulp powder + 20 g Cocoa powder + 15 g Milk powder + 60 g Sugar powder + 50 g Cocoa Butter) was recorded and highest β-carotene (0.85) and sensory score for overall acceptability (8.73) in T₇ (chocolate with 35 g jackfruit pulp powder + 20 g Cocoa powder + 15 g Milk powder + 60 g Sugar powder + 50 g Cocoa Butter) jackfruit pulp powder chocolate which was stored under refrigerated condition. Finally T₇ treatment was found be best among all treatments.

Keywords: Jackfruit, jackfruit pulp powder, cocoa butter, cocoa powder

Introduction

India holds a unique position in the world by growing number of fruits. Jackfruit (*Artocarpus heterophyllus* Lam.) is one of the Under Utilized fruits, belongs to the family Moraceae which includes evergreen or deciduous trees producing maximum yield than any other fruit tree species. It is the largest edible fruit in the plant kingdom and occupies a top position in quantity of food produced per unit area.

The tree is valued for its money earning capacity and there are instances where in a single tree is reported to have generated an income of thousand rupees in one season alone. Hence, jackfruit cultivation is gaining popularity among the farming community. Owing to its multipurpose uses right from its roots to fruits, it is much credited tree in the tropical world. Jackfruit is cheaply available in large quantities during the season and the energy available to human in jackfruit has been estimated to be 2 MJ per Kg of wet ripe perianth (Ahmed *et al.*, 1986) [1].

The ripe jackfruit bulbs are rich in sugars with a calorific value of about 90 calories per 100 g fresh weight. Jackfruit is nutritious, rich in vitamins (A and B), minerals (Ca, K and Fe) and contains considerable amounts of carotene and vitamin-C. Fruit is a highly fibrous and has nutritive value, containing 18.9 g carbohydrates, 0.8 g minerals, 30 IU vitamin-A and 0.25 mg thiamine for every hundred grams (Samaddar, 1985) [12]. For this reason, it is commonly referred as "Poor man's food".

Materials and Methods

Freshly harvested jackfruit flakes were used for preparation of jackfruit pulp powder. Then chocolate was prepared with cocoa powder, cocoa butter, sugar powder, milk powder and pulp powder by double boiling method. After that prepared chocolate was wrapped with aluminium foil and stored at 4 °C.

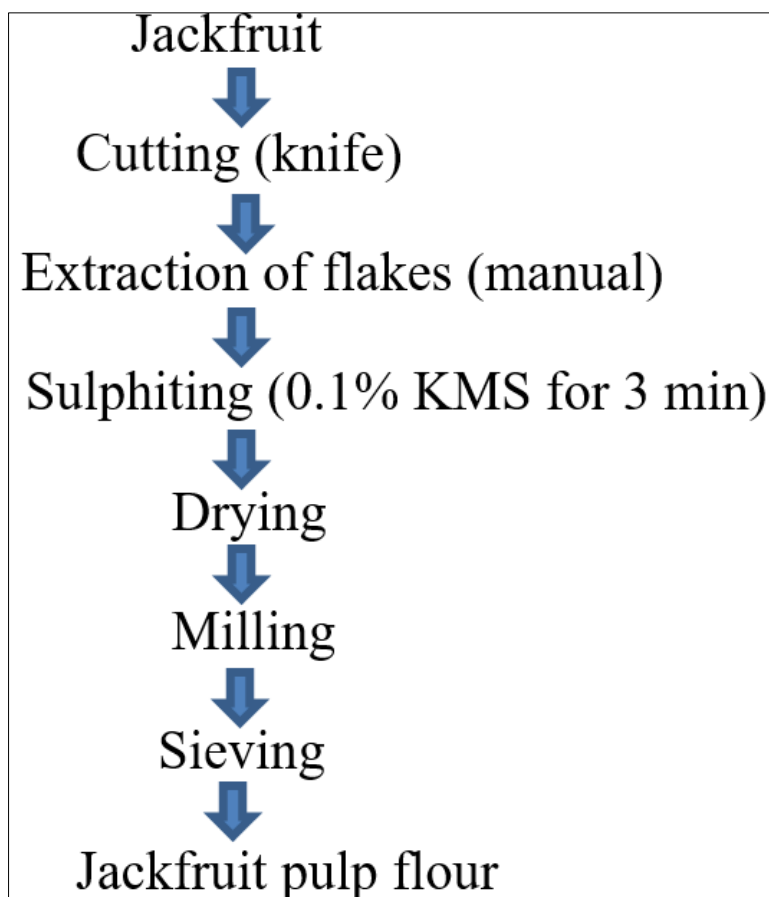


Fig 1: Flow Chart for Preparation of Jackfruit Pulp Powder

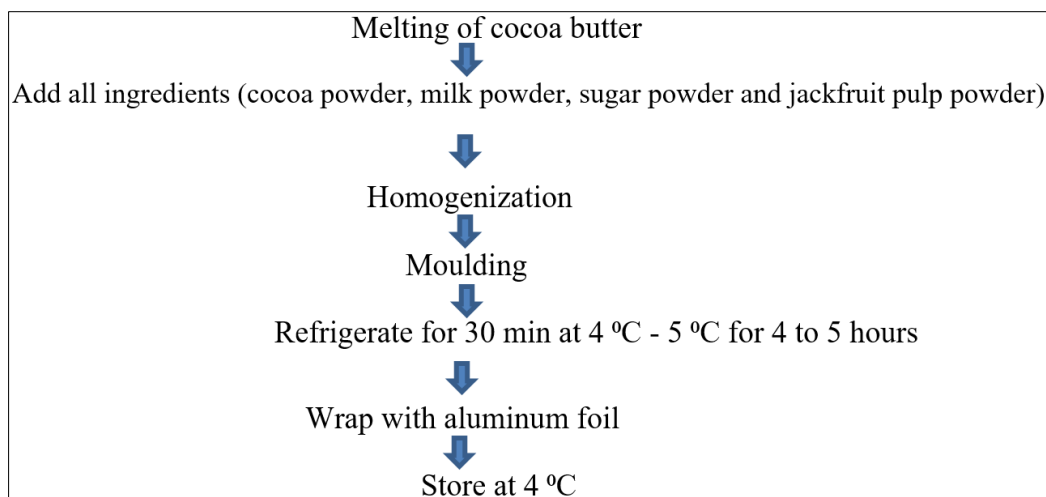


Fig 2: Flow Chart for Preparation of Chocolate

Results and Discussion

The effect of jackfruit pulp powder on different qualitative parameters like moisture content (%), total soluble solids (° brix), total sugars (%), titratable acidity (%), ascorbic acid (mg), β -carotene (mg), overall acceptability of chocolate during storage period were studied, statistically analyzed, findings tabulated.

Moisture content (%)

There was increase in moisture content of chocolate prepared with jackfruit pulp powder from initial day to 60th day of storage. During the entire storage period, the moisture content was gradually increased from initial day to 60th day of the

storage. It might be due to water retaining capacity of fibres which are present in the jackfruit pulp powder. Similar results were observed by Joel *et al.* (2013) ^[3] in chocolates prepared on different days by fermentation of cocoa beans and Pandey and Singh (2011) ^[7] reported in soy flour incorporated chocolate bars.

Ascorbic acid (mg/g)

There was decrease in Ascorbic acid of chocolate prepared with jackfruit pulp powder from initial day to 60th day of storage. There was degradation of oxidation of L- Ascorbic acid to dehydro ascorbic acid during storage period. It might be reason for the decreasing the ascorbic acid. Similar

findings observed by Bisen and Verma (2020) [2] in guava and papaya mixed fruit bar and Kumar *et al.* (2017) [5] in papaya and guava bar.

Total soluble solids (° Brix)

The data referring to total soluble solids of chocolate prepared

with jackfruit pulp powder were presented in Table 1. Total soluble solids were increased with increasing storage period. It might be due to hydrolysis of polysaccharides which are present in the chocolate. Similar trend of increase observed by Pandey and Singh (2011) [7] in soy flour incorporated chocolate bars.

Table 1: Effect of jackfruit pulp powder on total soluble solids (°Brix) of chocolate at different days of storage

Treatments	TSS (° Brix)					Mean for treatments
	Initial	15 th day	30 th day	45 th day	60 th day	
T ₁	66.70	66.90	67.10	67.50	67.70	67.18
T ₂	68.00	68.25	68.40	68.55	68.60	68.36
T ₃	69.80	69.90	70.00	70.20	70.30	70.04
T ₄	68.70	68.80	68.90	69.06	69.10	68.91
T ₅	67.90	68.20	68.40	68.80	69.10	68.48
T ₆	69.20	69.30	69.50	69.60	69.80	69.48
T ₇	68.80	69.00	69.10	69.20	69.30	69.08
T ₈	56.20	56.80	57.30	57.70	57.90	57.18
SE(m)±	1.182	0.972	1.137	0.798	1.052	
CD @ 5%	3.574	2.939	3.437	2.413	3.181	

Titrateable acidity (%): There was increase in titrateable acidity of chocolate prepared with jackfruit pulp powder from initial day to 60th day of storage. Decrease in titrateable acidity was may be due to organic acids which are present in the chocolate were converted to sugars. Similar results observed by Hamid *et al.* (2017) [13] in RTS beverage of mulberry and Shivanna (2008) [9] in Mango RTS.

Reducing sugars (%): The data referring to reducing sugars of chocolate prepared with jackfruit pulp powder were presented in Table 2. Present examined data showed that there was decrease in the reducing sugars might be due to hydrolysis and oxidation of reducing sugars. Similar findings observed by Rai and Chauhan (2008) [8]; they observed in drum-dried papaya-cereal flakes and also by More.

Table 2: Effect of jackfruit pulp powder on total sugars (%) of chocolate at different days of storage

Treatments	Reducing sugars (%)					Mean for treatments
	Initial	15 th day	30 th day	45 th day	60 th day	
T ₁	4.03	4.00	3.98	3.97	3.94	3.98
T ₂	4.27	4.15	4.13	4.11	4.08	4.15
T ₃	4.50	4.41	4.39	4.37	4.34	4.40
T ₄	4.37	4.32	4.26	4.24	4.11	4.26
T ₅	4.20	4.17	4.15	4.13	4.10	4.15
T ₆	4.17	4.12	4.10	3.99	3.96	4.07
T ₇	4.07	4.02	4.00	3.98	3.95	4.00
T ₈	4.00	3.95	3.93	3.91	3.88	3.93
SE(m)±	0.046	0.053	0.072	0.07	0.044	

Total sugars (%): The data referring to total sugars of chocolate prepared with jackfruit pulp powder were presented in Table 3. The results found that, there was a significant difference among all treatments. Total sugars were increased

in chocolate prepared with jackfruit pulp powder during storage period may be due to low respiration rate and fermentation under low temperature storage. Similar findings observed by Salvi (2013) [10] and More (2014) [6].

Table 3: Effect of jackfruit pulp powder on total sugars (%) of chocolate at different days of storage

Treatments	Total sugars (%)					Mean for treatment
	Initial	15 th day	30 th day	45 th day	60 th day	
T ₁	44.57	45.57	45.03	47.45	49.67	46.46
T ₂	44.37	45.37	46.36	47.57	49.47	46.63
T ₃	44.77	45.77	46.87	47.94	49.87	47.04
T ₄	44.10	44.43	45.53	46.43	47.33	45.56
T ₅	44.73	45.40	46.73	47.34	49.43	46.73
T ₆	44.83	45.50	46.63	47.73	49.8	46.90
T ₇	44.53	45.53	46.43	47.34	49.23	46.61
T ₈	43.40	44.20	44.06	46.50	47.4	45.11
SE(m)±	0.155	0.151	0.499	0.131	0.131	
CD @ 5%	0.47	0.456	1.508	0.397	0.396	

β – carotene (mg/100 g)

The data related to β – carotene of chocolate prepared with jackfruit pulp powder was presented in Table 4. Decrease in β – carotene during storage period was might be due to non-

oxidative and oxidative changes of chocolate. Similar findings were observed by Sadhu *et al.* (2013) [11] in biscuits incorporated with carrot powder and Jixy Josheela (2015) [4] in carrot incorporated chocolate bars.

Table 4: Effect of jackfruit pulp powder on β - carotene (mg) of chocolate at different days of storage

Treatments	β -carotene (mg/100 g)					Mean for Treatment
	Initial	15 th day	30 th day	45 th day	60 th day	
T ₁	0.30	0.27	0.24	0.22	0.20	0.25
T ₂	0.32	0.30	0.29	0.26	0.23	0.28
T ₃	0.50	0.43	0.40	0.39	0.34	0.41
T ₄	0.70	0.69	0.68	0.66	0.60	0.67
T ₅	0.80	0.79	0.74	0.73	0.70	0.75
T ₆	0.87	0.80	0.75	0.74	0.71	0.77
T ₇	0.90	0.87	0.83	0.82	0.80	0.85
T ₈	0.10	0.07	0.05	0.04	0.02	0.06
SE(m)±	0.012	0.021	0.014	0.012	0.012	
CD @5%	0.036	0.063	0.042	0.036	0.037	

Over all acceptability

The data pertaining to overall acceptability of chocolate prepared with jackfruit pulp powder were presented in Table 5. The results revealed that, there was a significant difference among all treatments.

There was decrease in overall acceptability of chocolate prepared with jackfruit pulp powder from initial day to 60th day of storage period in all the treatments. The highest score was recorded in T₃ (Chocolate with 15 g of jackfruit pulp

powder + 20 g cocoa powder + 60 g sugar powder + 15 g milk powder + 50 g cocoa butter) with 8.73 followed by T₄ (Chocolate with 20 g of jackfruit pulp powder + 20 g cocoa powder + 60 g sugar powder + 15 g milk powder + 50 g cocoa butter) with 8.70 among all treatments. The minimum score was recorded for overall acceptability in T₈ (Chocolate with 20 g cocoa powder + 60 g sugar powder + 15 g milk powder + 50g cocoa butter) with 8.41.

Table 5: Effect of jackfruit pulp powder on overall acceptability of chocolate at different days of storage

Treatments	Overall acceptability					Mean for treatments
	Initial	15 th day	30 th day	45 th day	60 th day	
T ₁	8.79	8.75	8.65	8.5	8.47	8.63
T ₂	8.83	8.77	8.65	8.52	8.49	8.65
T ₃	8.91	8.78	8.68	8.58	8.53	8.70
T ₄	8.92	8.82	8.72	8.6	8.57	8.73
T ₅	8.88	8.73	8.7	8.59	8.56	8.69
T ₆	8.82	8.73	8.61	8.5	8.48	8.63
T ₇	8.77	8.76	8.58	8.48	8.45	8.61
T ₈	8.69	8.45	8.37	8.27	8.26	8.41
SE(m)±	0.001	0.008	0.007	0.032	0.006	

T₁: 5g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₂: 10g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₃: 15g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₄: 20g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₅: 25g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₆: 30g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₇: 35g JPP + 20g CP + 15g MP + 60g SP + 50g CB

T₈: 20g CP + 15g MP + 60g SP + 50g CB

JPP - Jack fruit pulp powder

CP - Cocoa Powder

CB - Cocoa Butter

MP - Milk Powder

SP - Sugar Powder)

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