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Sensory Evaluation of Chhana Burfi Process with Jackfruit (*Artocarpus hetrophyllus* L.) Pulp

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ABSTRACT

The study was conducted at Dept. of Animal Husbandry and Dairy Science, Dr. BSKKV, Dapoli, Ratnagiri, Maharashtra, India during August 2021 to May 2022 to evaluate the suitability of Jackfruit pulp as flavouring agent in developing flavoured *Chhana Burfi* and its production cost. Basically, cow milk required for preparation of *Chhana,* citric acid used for coagulation of milk, sugar and jackfruit pulp etc. was required to conduct this research. The curd mass obtained when milk is coagulated with the organic acids such as citric acid at higher temperature and after subsequent drainage of whey, mass of curd obtained is called *chhana*. *Chhana* was used as base material for preparation of *chhana burfi*. The *Chhana Burfi* was prepared from cow milk by incorporating jackfruit pulp @ 10% (F_1), 15% (F_2), and 20% (F_3) and two sugar level i.e. 15% (S_1) and 18% (S_2) on the basis of weight of *Chhana*. All treatment is analyzed for sensory characteristic i.e. colour and appearance, body and texture, flavour and overall acceptability by using 9-point Hedonic scale. Present study investigated that jackfruit pulp could be successfully utilized for preparation of flavoured *chhana burfi*. The most acceptable quality flavour *Chhana Burfi* could be prepared by using 15% jackfruit pulp and 18% sugar. Prepared delicious milk product i.e. Jackfruit flavour *Chhana Burfi* rich taste and flavour along with nutritional value. The production cost of Jackfruit flavour *Chhana Burfi* (most acceptable level i.e.S_2F_2) was Rs. 355.8/- per kg.

KEYWORDS: Burfi, chhana, cow milk, jackfruit pulp, sensory

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

India is the largest milk producing country in the world with its 230.6 mt milk production and 459 g person^{-1} daily milk consumption, enjoys number one position in terms of milk production (Anonymous, 2024) Out of the total milk produced, about 45 to 50% is converted into indigenous dairy products. The coagulation of milk with organic/inorganic acid at a higher temperature, followed by chilling and filtering of the coagulum, results in heat and acid coagulated dairy products (Sahu and Das, 2010). Under acid precipitated milk product, chhana and paneer are the main products. *Chhana,* a well-known traditional indigenous milk product is used extensively as a base material for large variety of Indian delicacies namely *Sandesh, rasogolla, chamcham*, *rasmalai* and many other such product. Sandesh is a very popular and one of the oldest chhana based sweetmeat (Aneja, 1987). *Chhana,* a heat-acid coagulated product of milk forms the base material for the preparation of Sandesh. *Chhana* is kneaded into a uniform dough, mixed with sugar, and cooked over low flame with constant scraping until the mixture gets the desired consistency and flavour (Poonia, 2015). Burfi is an incredibly popular sweet candy from the Indian subcontinent, made from partially dried, heat desiccated whole milk (khoa) with a suitable amount of sugar (Arora et al., 2010; Chetana et al., 2010). It could be concluded that chocolate flavoured whey protein powder could be successfully utilized for the manufacture of *Chhana Burfi* (Gharatkar, 2020*) Chhana Burfi* and *Sandesh* is nearby similar product.

Konkan region of Maharashtra is a humid western coastal track, where Jackfruit (*Artocarpus heterophyllus* L.) crop is found commonly. It is an ancient fruit that is widely consumed as fresh fruit. The health benefits of jackfruit have been attributed to its wide range of physico-chemical applications (Bhalekar et al., 2022).

The whole part of the plant has a lot of economic importance. Jackfruit is referred as "Poor man's fruit" as well as "nutrients of giant" (Singh et al., 2015, Chattopadhyay et al., 2018) Jackfruit is a rich source of potassium with 303 mg found in 100 g. Studies show that food rich in potassium helps to lower blood pressure. Another benefit of eating jackfruit is that it is a good source of vitamin C. Vitamin C is an antioxidant that protects the body against free radicals, strengthens the immune system and keeps our gums healthy (Jagtap et al., 2010). Anti-cancer, anti-hypertensive, anti-ulcer, and anti-aging qualities are among the many health advantages of jackfruit. As a result, phytonutrients present in jackfruit can help to prevent the formation of cancer cells in the body, decrease blood pressure, combat stomach ulcers, and slow down the deterioration of cells that keep the skin looking young and attractive (Swami et al., 2012). The polysaccharides of jackfruit pulp include 79.12% total sugar, 5.83% protein and 15.65% uranic acid, as well as 15 different amino acids, including significant quantities of asparagine, glycine, valine, leucine and lysine (Zhu et al., 2017).

The ripe jackfruit pulp has high nutritive value as well as a peculiar taste. So far jackfruit pulp has been successfully utilized for the value addition of milk products like yogurt (Rahman et al., 2001 and Jayalalitha et al., 2023), low fat yogurt (Remya et al., 2019), Bio-Yoghurt (Remya et al., 2024), Ice-cream (Rajeesha et al., 2023) *Basundi* (Naik et al., 2017), flavoured milk (Sonwalkar, 2017), whey beverage (Bhalekar et al., 2022) lassi (Vaishnavi, 2022). Cake (Haque et al., 2015), Pudding (Pinchu and Biju, 2020) and Shrikhand (Midde Sridevi et al., 2024) Thus, considering the nutritive value and peculiar flavour of jackfruit, the present study was aimed to evaluate the suitability of Jackfruit Pulp as flavouring agent in developing Flavour *Chhana burfi.*

2. MATERIALS AND METHODS

The present work was carried out at the Department of Animal Husbandry and Dairy Science, College of Agriculture, Dapoli (DR. BSKKV DAPOLI)- 415 712, Ratnagiri, Maharashtra, India during August, 2021–May, 2022.

2.1. Materials

Cow milk collected from dairy farm of College of Agriculture, Dapoli was used for the study. Coagulant Citric acid Laboratory Grade used for study. Ingredients cane sugar, processed jackfruit pulp was purchased from local market.

2.2. Methodology

2.2.1. Chhana

Chhana was prepared as per the procedure given by Kadam (2014), as follows (Figure 1).

2.2.2. Chhana burfi preparation

With minor modification, *Chhana Burfi* was made according to the process specified by Aneja et al. (2002) and Gharatkar (2020) and as shown in the flow diagram below (Figure 2).

2.2.3. Treatments

The research trials were carried out with the following different levels of processed jackfruit pulp added in chhana for preparation of chhana burfi. Levels of sugar @ 15% (S_1) and 18% (S_2) o and jackfruit pulp @ 10% (F_1,) 15% (F_2) and 20% (F_3) of weight of chhana (w/v). Treatment combination are S_1F_1=15% sugar and 10% jackfruit Pulp (w/v), S_1F_2=15% sugar and 15% jackfruit pulp (w/v), S_1F_3=15% sugar and 20% jackfruit pulp (w/v),

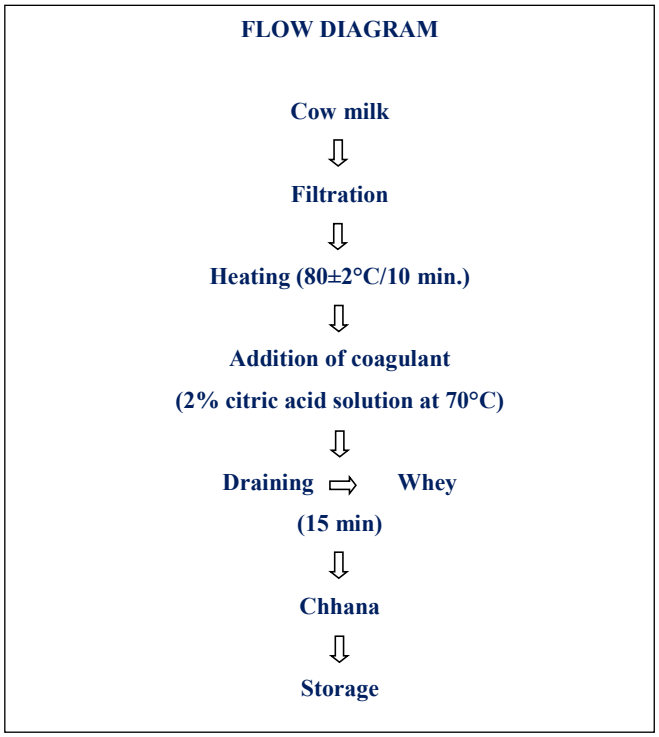

Figure 1: Flow chart for chhana preparation

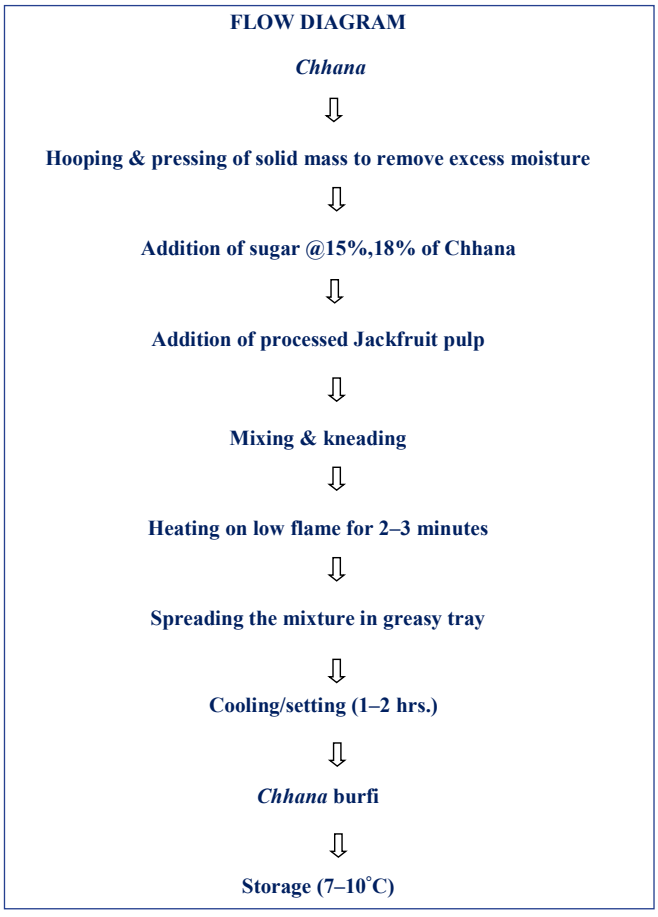

Figure 2: Flow chart for chhana burfi preparation

S_2F_1=18% sugar and 10% jackfruit pulp (w/v), S_2F_2=18% sugar and 15% jackfruit pulp (w/v) and S_2F_3=18% sugar and 20% jackfruit pulp (w/v) conducted with six replications.

2.2.4. Analytical methods for sensory evaluation of flavour chhana burfi

The product was evaluated for sensory attributes, viz. colour and appearance, flavour, body and texture, overall acceptability using 9 points hedonic scale by panel of not less than 8–10 semi-trained judges as per Anonymous (1971).

2.2.5. Statistical analysis

For present investigation, FCRD i.e., Factorial completely randomized block design was employed using six replications. The data were tabulated and analysed according the statistical to Snedecor and Cochran (1994).

2.2.6. Economics of product (Production cost)

The cost structure (Rs./kg) of the *Chhana Burfi* was worked out by taking into consideration the prevailing retail rates of the ingredients used as chhana, Jackfruit Pulp, sugar, etc. during experimental period. Procedure followed for estimation of cost was on the lines of standard economic procedure.

3. RESULTS AND DISCUSSION

The present investigation was undertaken to evaluate sensory quality of *Chhana Burfi* by using different level of processed jackfruit pulp. The results of present research work are average of six-time replicated data tabulated, presented, and discussed along with statistical analysis under following main heads.

3.1. Sensory evaluation of chhana burfi

Sensory evaluation of any consumable product is the best method of judging the acceptability of the product by the consumers. Sensory evaluation plays vital role in product development as well as in determining the shelf-life of a product. The sensory assessment was done by studying the parameters like colour and appearance, body and texture, flavour, and overall acceptability of the product by the panel of judges by using "Nine Point Hedonic Scale" score card. The results of the study presented herein under in Table 1.

3.1.1 Colour and appearance

The data presented in Table 1 showed that the score for colour and appearance was increased due to addition of Processed Jackfruit Pulp. The highest score for colour and appearance recorded for (S_2F_2) (7.67) i.e. *Chhana Burfi* with 15% processed jackfruit pulp followed by treatment (S_1F_3) (7.46) i.e. *Chhana Burfi* with 20% processed jackfruit pulp. The lowest score was recorded by (S_1F_1) (6.98).

There was increase in dark colour of *Chhana Burfi* due to jackfruit pulp colour of processed jackfruit Pulp. As

Table 1: Effect of different levels of processed jackfruit pulp and sugar on sensory characteristics of chhana burfi

Treatment		Sensory parameter (Score out of Nine)			
		Colour and appearance	Body and texture	Flavour	Overall acceptability
		Average score of six replication			
S_1F_1		6.98	7.44	7.45	7.41
S_1F_2		7.39	7.49	7.47	7.46
S_1F_3		7.46	7.55	7.54	7.53
S_2F_1		7.16	7.72	7.71	7.69
S_2F_2		7.67	7.70	7.74	7.71
S_2F_3		7.22	7.76	7.75	7.70
SEm±	S	0.101	0.025	0.036	0.025
	F	0.082	0.020	0.030	0.020
	S×F	0.143	0.035	0.051	0.035
CD (p=0.01)	S	0.393	0.097	0.142	0.097
	F	0.321	0.079	0.116	0.0791
	S×F	2.750	2.750	2.750	2.750

processed jackfruit pulp increases, the burfi resembles lite yellowish to dark yellowish in colour. From the Table 1 it was observed that treatment differences are statistically significant at 1% level of significance, which indicates that there is significant difference in colour and appearance of *Chhana Burfi* due to the addition of processed jackfruit pulp.). Nearby similar score observe jackfruit herbal lassi i.e.7.56–8.13 (Vaishnavi, 2022), i.e. jackfruit flavour ice-cream 6.89–8.89 (Rajeesha et al., 2023). Chocolate flavoured whey protein powder *Chhana Burfi* i.e.7.24–8.05 (Gharatkar, 2020)

3.1.2. Body and texture

The perusal of data from Table 1 showed that, as far as body and texture is concerned the highest score was recorded for (S_2F_3) (7.76) i.e., *Chhana Burfi* with 20% processed jackfruit pulp followed by treatment (S_2F_1) i.e., *Chhana Burfi* with 10% processed jackfruit pulp (7.72). The lowest score was recorded at (S_1F_1) i.e., *Chhana Burfi* with 10% processed jackfruit pulp (7.44). Similarity in sensory score (body and texture) for jackfruit herbal lassi i.e.7.63–8.28, jackfruit flavour ice-cream i.e 6.84–8.78, chocolate flavoured whey protein powder *Chhana Burfi* i.e.7.52–8.43 for was found by Vaishnavi, 2022 , Rajeesha et al., 2023 and Gharatkar, 2020 respectively. Presence of processed jackfruit pulp results in sticky texture to the burfi. It was observed that, as the level of processed jackfruit pulp increased the burfi became stickier and softer.

3.1.3. Flavour

The perusal of data from Table 1 showed that in case of flavour, the *Chhana Burfi* with 10% processed jackfruit pulp (S_2F_3) recorded highest score of (7.75) followed by (S_2F_2) i.e. *Chhana Burfi* with 15% processed jackfruit pulp (7.74). The *Chhana Burfi* with 5% processed jackfruit pulp (S_1F_1) had significantly lowest score of (7.45). Similar score finds for Jackfruit herbal lassi i.e.7.51–8.29 (Vaishnavi, 2022), i.e. jackfruit flavour ice-cream 6.84–8.76 (Rajeesha et al., 2023) and chocolate flavoured whey protein powder burfi i.e.7.38–8.34 (Gharatkar, 2020). Processed jackfruit pulp used in the burfi is of yellowish flavored. Consequently, the resultant product obtained yellowish flavour. As the processed jackfruit pulp increases in *burfi* the yellowish flavour of the product also increases at each increasing level.

3.1.4. Overall acceptability

Data presented in table 1 was discussed here under that most acceptable product in the present study was observed to be (S_2F_2) i.e. *Chhana Burfi* prepared by using 15% processed jackfruit pulp with overall acceptability score of (7.71) followed by (S_2F_3) i.e. *Chhana Burfi* with 20% processed jackfruit pulp, with score of (7.70), while lowest score was obtained by (S_1F_1) (7.41) i.e. *Chhana Burfi* with 10% processed jackfruit pulp. Nearby Similar score observe different level of jackfruit pulp in herbal lassi i.e.7.65–8.46 (Vaishnavi, 2022), i.e. jackfruit flavour ice-cream 7.62–8.81 (Rajeesha et al., 2023) low fat yogurt i.e 7.40–8.67 (Remya et al., 2019). chocolate flavoured whey protein powder burfi i.e.7.53–8.62 (Gharatkar, 2020). Sandesh enrich with dietary fiber Wheat and Soya i.e. 8.03–8.24 and 7.35–7.71 respectively (Manjunatha et al., 2022) chocolate- and caramel-coated chhana delights enrich with grap powder i.e 7.4–7.9. (Simranjeet et al., 2018) statistical analysis of the data presented in table 1 revealed that the results are significant at 1% level of significance indicating that there is a significant difference in overall acceptability of the product due to addition of processed jackfruit pulp.

3.2. Production cost of chhana burfi

To work out the production cost of *Chhana Burfi* processed with jackfruit pulp is one of the main objectives of this present study. The cost of *Chhana Burfi* production, was worked out by considering the prevailing retail costs of ingredients only. It was concluded that addition of processed jackfruit pulp and sugar increases the production cost of *Chhana Burfi* at different treatment combinations of processed jackfruit pulp. The data of production cost are presented in Table 2

The increase in cost of *Chhana Burfi* was mainly due to addition of processed with jackfruit pulp which was the costlier ingredient than other. However, as the improvement in nutritive value and acceptability of the product, its use

Table 2: Cost of production of chhana burfi incorporated with different level of processed jackfruit pulp (Rs) (based on cost of ingredients only)

Treatments		S_1F_1	S_1F_2	S_1F_3	S_2F_1	S_2F_2	S_2F_3
Chhana	Qty (g)	150	150	150	150	150	150
	Cost (₹)	30	30	30	30	30	30
Jackfruit pulp	Qty (g)	15	22.5	30	15	22.5	30
	Cost (₹)	3	4.5	6	3	4.5	6
Sugar	Qty (g)	22.5	22.5	22.5	27	27	27
	Cost (₹)	0.9	0.9	0.9	1.08	1.08	1.08
Yield of Chhana Burfi obtained (g)		187.5	195	202.5	192	199.5	207
Total cost per 100 g (₹)		33.9	35.4	36.9	34.08	35.58	37.08
Total cost of chhana burfi per kg (₹)		339.0	354.0	369.0	340.08	355.8	370.8

While calculating cost of chhana the cost of buffalo milk @ ₹ 48/- lit, per cent recovery of chhana, cost of LPG utilized and cost of Citric Acid @ ₹ 9.6 per 100 g have been considered; 1 US$=INR 77.30 (average value of May, 2022)

seems beneficial.

The higher cost (₹ 370.8 per kg) was recorded in case of *Chhana Burfi* prepared with 20% Processed Jackfruit Pulp i.e. (S_2F_3) while lowest cost (₹ 339.0 per kg) recorded in case of *Chhana Burfi* prepared with 10% Processed with Jackfruit Pulp i.e. (S_1F_1) It was observed that the cost of *Chhana Burfi* was increased with the increase in the level of processed jackfruit pulp. The increase in cost was obviously due to higher rates of processed jackfruit pulp.

4. CONCLUSION

The processed jackfruit pulp was successfully utilized/ suitable as flavouring agent in developing flavoured *Chhana Burfi*. The most acceptable quality flavour *Chhana Burfi* was prepared by using 15% jackfruit pulp and 18% sugar. The production cost of most acceptable level (S_2F_2) was ₹ 355.8/- per kg. Being enriched with processed jackfruit pulp, it could increase nutritional quality of burfi.

5. ACKNOWLEDGEMENT

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