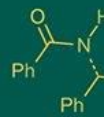


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Studies on preparation of toffee from Jamun (*Syzygium cumini* L.)

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Abstract

The experiment was conducted at the Post Graduate Laboratory, Department of Horticulture, VNMKV, Parbhani during the year 2023-2024 with aim to study the recipe and to determine nutritional quality of prepared toffees. The experiment was laid out in Completely Randomized Design (CRD) with five treatments replicated four times. Among the all treatments T₁ (1:0.25 pulp: sugar + 0.1% pectin + 20% fat + 30% skimmed milk powder) found nutritionally superior for the chemical parameters like pH (1.25), ascorbic acid (31.26 mg/100 g), total sugars (60.95%) etc and also phyto-chemically rich in terms of total phenols (146.80 mg GAE/100 g), flavonoid (34.39 mg QE/100 g), antioxidant (22.88%), anthocyanin (60.13 mg/100 g) while treatment T₂ (1:0.50 pulp: sugar + 0.2% pectin + 20% fat + 30% skimmed milk powder) found to be statistically at par with treatment T₁ whereas, treatment T₃ (1:0.75 pulp: sugar + 0.3% pectin + 20% fat + 30% skimmed milk powder) found superior and secured highest score in sensory evaluation like color (8.13), taste (8.00), aroma (8.38), texture (8.00) and overall acceptability (8.25) while treatment T₅ (1:1.25 pulp: sugar + 0.5% pectin + 20% fat + 30% skimmed milk powder) found to be inferior among all treatments.

Keywords: Physico-chemical, phyto-chemical, recipe and toffee

1. Introduction

Jamun (*Syzygium cumini* L.) is a large shrub belonging to the Myrtaceae family. It is one of the sturdy fruits and can be grown easily even in neglected and swampy areas, dry and arid areas, poor and wasteland areas where other fruit trees cannot grow well. The homeland of *Syzygium cumini* is India or East India. It is found in Thailand, Philippines, Madagascar and other countries. In India, the jamun tree and its fruits are known as Jamun, Jambul, world wide it is known by other names such as Black Plum, Java Plum, Indian Blackberry, Portuguese purple Plum and Damson Plum (Kannan and Puraikalan., 2013) [18]. Jamun fruits are elongated and dark purple or blue-black in color. The flesh is pink-purple and the fruit is sweet and salty (Achrekar *et al.*, 1991) [2].

Jamun fruit plays an important role in controlling diabetes because it lowers blood sugar (Helmstadter., 2008) [17]. Jamun has antitumor and chemopreventive (Parmar *et al.*, 2010) [21] effects. All of these substances are used to treat cancer. Ripe fruits are good for urinary tract infections and dysentery, syrup or vinegar made from ripe jamun is good for treating muscle enlargement and is good for chronic diarrhea. Fruit pulp extraction inhibits lipid peroxidation (Benherlal and Arumughan., 2007) [11]. Jamun has a stimulating effect on the liver and spleen. It is a good remedy for urinary disorders and controls heart failure. It purifies the blood, cures anemia and prevents skin aging. It cures sore throats and other respiratory disease. Many components of Jamun have been discussed for their antioxidant, anti-inflammatory, pharmacological neuropsychological, antibacterial, anti-HIV, anti-tylshmanial and antifungal, nitric oxide and free radical scavenging properties (Ramteke *et al.*, 2015) [22].

Jamun is a rich in nutrients like vitamins, minerals, flavonoids, essential oils, anthocyanins, phenolic compounds and other antioxidants. Each part of the Jamun fruit holds its significant values. The Jamun fruit is loaded with sugars like glucose and fructose along with lesser calories. Jamun fruit comprises almost 83.70-85.80 g moisture, 0.70-0.13 g protein, 0.15-0.30 g fat, 14.00 g carbohydrate, 0.320.40 g ash, 0.30-0.90 g crude fiber, 8.30-15.00 mg calcium, 35.00 mg magnesium, 15.00 16.20 mg phosphorus, 1.20-1.62 mg iron, 26.20 mg

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sodium, 0.23 mg copper, 13.00 mg sulfur, 8.00 mg chlorine, 0.01-0.03 mg thiamine, 55.00 mg potassium, 8 I.U vitamin A, 0.009 0.01 mg riboflavin, 0.20 0.29 mg niacin, 5.70 18.00 mg ascorbic acid, 7.00 mg chlorine and 3.00 mcg folic acid per 100 g of edible portion (Baliga *et al.*, 2011) ^[19]. The constituents that are reported in the seeds of *Syzygium cumini* are protein 6.3-8.5%, 1.18% fat, 16.9% crude fiber, 21.72% ash, 0.41% calcium, 0.17% phosphorus, fatty acids (palmitic, stearic, oleic and linoleic), fatty oils (30 g/kg), including lauric (2.8%), myristic (31.7%), palmitic (4.7%), stearic (6.5%), oleic (32.2%), linoleic (16.1%), malvalic (1.2%), stercu-lic (1.8%) and vernolic acid (3%) 41% starch, 6.1% dextrin, a trace of phytosterol (β - sitosterol) and tannin (predominantly corilagin, ellagitannins, ellagic acid, galloyl-galactoside and gallic acid) (6-19%) (Lock *et al.*, 2009; Ranjan *et al.*, 2011) ^[19, 25]

The fruits are highly perishable in nature and available only for a short time in June-July. Surplus produce cannot be transported to distant markets for consumption. The disposal of unsold surplus products can be prevented by turning them into tasty and highly refreshing drinks such as RTS drinks, nector, syrup, etc. and other additional products such as jam, jelly, chutney, sauces, toppings, plates, bars, cheese and toffee. Jamun's products can also attract the domestic and international market because there is still a high demand from international consumers for fresh food products that are nutritious, cured, and sweet, hungry and bright color and shape. Only a few researchers have worked on this important product, so there are few articles on the processing technology of various jamun products. Considering the nutritional and medicinal value of jamun fruit, the present project was prepared with the following objectives

- To study the recipe for preparation of toffee from jamun.
- To determine nutritional qualities, phytochemical properties of toffee.

2. Materials and Methods

The experiment was conducted in the laboratory of Department of Horticulture, Post Graduate Institute at Vasant Rao Naik Marathwada krishi Vidyapeeth, Parbhani during 2022-2024

2.1 Procurement of raw material

The important ingredients for the preparation of toffee such as jamun fruits, sugar, pectin, fat, skimmed milk powder and packaging material like butter paper LDPE plastic bags were purchased from local market of Parbhani

2.2 Procedure of Preparation of jamun toffee

Cook the jamun pulp until the contents are reduced to 1/3 of the original size. At this point, amount of sugar, pectin and butter as per the treatment detailed are added to

Cook the jamun pulp until the contents are reduced to 1/3 of the original size. At this point, amount of sugar, pectin and butter as per the treatment detailed are added to the pulp and cooked again until the dough is very firm and begins to pull away from the sides of the pan. Add a desired amount of skimmed milk powder with little amount of luke warm water in it. Add the mixture in given mass. Cooked until the mixture gives its 83% TSS aproximatly. Spread the mass on thik sheet cuted squire shaped, let them cool for while and

raped in butter paper and stored in container for further analysis (Dagadkhair *et al.*, 2017) ^[16]

Table 1: Treatment details for jamun toffee.

Treatments	Jamun pulp to sugar ratio	SMP(g)	Fat (g)	Pectin (%)
T ₁	1:0.25	30	20	0.1
T ₂	1:0.50	30	20	0.2
T ₃	1:0.75	30	20	0.3
T ₄	1:1	30	20	0.4
T ₅	1:1.25	30	20	0.5

2.4 Chemical Analysis

Estimation of sugars was carried out by the Lane and Eynon (1923) ^[27] method reported by the Ranganna (1986) ^[23]. TSS and PH was determined by the Digital Refractometer and Digital PH meter while ascorbic acid was estimated by the method given by (Ranganna 1986) ^[23].

2.5 Phytochemical Analysis

The phytochemical parameters like total phenols, flavonoids and Anthocyanin was determined by the Spectrophotometric method. The antioxidant activity was determined by the DPPH method.

2.6 Sensory Evaluation

The organoleptic score was given by the semi trained panel on the basis of hedonic scale which ranges from 9 (Like extremely) to 1 (Dislike extremely) given by (Ranganna 1986) ^[23].

2.7 Mineral Analysis

The iron and calcium content of jamun toffee was determined by the method given by (Ranganna 2011) ^[24].

2.8 Statistical analysis

The information got in the present investigation was dissected utilizing Completely Randomized Design (CRD) with four replications for assessment of factual importance as per Panse and Sukhatme (1967) ^[20]

3 Result and Discussion

3.1 Chemical analysis

The jamun toffee prepared using the recipe T₅ (1:1.25 pulp: sugar with 0.5% pectin) was found significantly superior in reserving chemical parameters like TSS, reducing sugars, total sugars, acidity and pH (83.93%, 35.50%, 65.15%, 1.05% and 3.39) respectively, while T₁ has recorded maximum amount of ascorbic acid (31.26 g/100 g) and non reducing sugars (30.45%) but the said treatment recorded lowest value for other chemical parameters among rest of the treatments under study

3.2 Phytochemical analysis

The jamun toffee prepared with the recipe treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin) has phytochemically superior and recorded maximum amount of TPC (146.80 mg GAE/100 g) and the lowest (132.00 mg GAE/100 g) score observed in treatment T₅ (1:1.25 pulp: sugar ratio + 0.5% pectin + 20% fat + 30% SMP)

The maximum (34.39 mg QE/100 mg) amount of flavonoids was observed in T₁ (1:025 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP), while T₅ (1:1.25 pulp: sugar ratio +

0.5% pectin + 20% fat + 30% SMP) recorded less amount of flavonoids i.e. (30.61mg QE/100 g)

Among all treatments the maximum (22.88%) Antioxidant activity was observed in treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) while minimum (21.37%) in treatment T₅ (1:1.25 pulp: sugar ratio + 0.5% pectin + 20% fat + 30% SMP) Further, treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) had the highest anthocyanin level (60.13 mg/100 g), followed by T₂ (60.01 mg/100 g), while treatment T₅ (1:1.25 pulp: sugar ratio + 0.5% pectin + 20% fat + 30% SMP) recorded the lowest Anthocyanin content (59.66 mg/100 g).

3.3 Sensory evaluation

The sensory evaluation of jamun toffee showed that treatment T₃ (1:0.75 pulp: sugar ratio + 0.3% pectin + 20% fat + 30% SMP) found superior for sensory attributes viz., color, aroma, taste, texture and overall acceptability which was 8.13, 8.38, 8.00, 8.00 and 8.25 respectively.

3.4 Mineral composition of jamun toffee

Iron content was found maximum (2.05 g/100 g) in treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) and minimum (0.90 g/100 g) was found in T₅ (1:1.25 pulp: sugar ratio + 0.5% pectin + 20% fat + 30% SMP)

The calcium was found maximum (1.63 g/100 g) in treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) while lowest (1.31 g/100 g) in T₅ (1:1.25 pulp: sugar ratio + 0.5% pectin + 20% fat + 30% SMP) which was also found to be non significant.

3.5 Cost of production of jamun toffee

The minimum 134.7 /kg cost was recorded in T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) also the treatment said to be nutritious and delicious than the other treatments, while the maximum 166.5/kg cost of production recorded for the treatment T₅ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP)

Table 2: Effect of chemical parameters on treatments of jamun toffee

Treatments	Total sugars (%)	Reducing sugars (%)	Non reducing sugars	Acidity (%)	pH	Ascorbic acid mg/100 g	TSS (%)
T ₁	60.95	30.50	30.45	3.03	1.25	31.26	79.81
T ₂	61.95	31.73	30.22	2.95	1.41	30.49	80.61
T ₃	62.43	32.31	30.12	2.53	2.04	30.07	82.05
T ₄	63.33	33.67	29.66	1.42	2.69	29.36	83.28
T ₅	65.12	35.50	29.62	1.05	3.39	29.34	83.93
SE±	0.49	0.44	0.85	0.22	0.17	0.83	0.73
CD at 5%	1.49	1.34	2.56	0.68	0.53	2.41	2.23

Table 3: Effect of phytochemicals on treatments of jamun toffee

Treatments	TPC (mg GAE/100 g)	TFC (mg QE/100 g)	Antioxidant activity (%)	AC (mg/100 g)
T ₁	146.80	34.39	22.88	60.13
T ₂	146.50	32.11	22.54	60.01
T ₃	136.75	31.83	22.40	59.96
T ₄	135.25	31.55	21.95	59.78
T ₅	132.00	30.61	21.37	59.66
SE±	2.31	0.81	0.54	1.29
CD at 5%	6.98	2.44	NS	NS

NS= Non significant

Table 4: Effect of Sensory qualities on treatments of jamun toffee

Treatments	Color	Aroma	Taste	Texture	O.A
T ₁	7.75	6.50	6.38	7.50	7.25
T ₂	7.00	6.88	7.00	7.25	8.00
T ₃	8.13	8.38	8.00	8.00	8.25
T ₄	6.75	7.38	7.50	7.00	7.00
T ₅	7.50	6.38	7.50	6.13	6.63
SE±	0.30	0.65	0.25	0.39	0.26
CD at 5%	0.92	1.96	0.77	1.19	0.79

Table 5: Effect of Minerals on treatments of jamun toffee

Treatments	Iron (g/100 g)	Calcium(g/100 g)
T ₁	2.05	1.63
T ₂	1.01	1.48
T ₃	1.06	1.43
T ₄	0.92	1.36
T ₅	0.90	1.31
SE±	0.03	0.29
CD at 5%	0.09	0.90

Table 6: Techno-economic feasibility for composite jamun toffee

Ingredients	Price (kg)	T ₁	T ₂	T ₃	T ₄	T ₅
JP	80	80	80	80	80	80
SMP	225	6.75	6.75	6.75	6.75	6.75
Sugar	30	7.5	15	22.5	30	37.5
Fat	150	30	30	30	30	30
Pectin	450	0.45	0.9	1.35	1.8	2.25
Packaging material	1/unit	10	10	10	10	10
Total		134.7	142.65	150.6	158.55	166.5
Processing cost @ 20%		150.6				

4. Conclusion

In respect to the jamun toffee, treatment T₁ (1:0.25 pulp: sugar ratio + 0.1% pectin + 20% fat + 30% SMP) found to be nutritionally superior treatment and also cost effective among all other treatments. However this treatment fails to obtain highest preferences in sensory evaluation. Whereas the treatment T₃ (1: 0.75 pulp: sugar ratio + 0.3% pectin + 20% fat +30% SMP) was found to be significantly best among all other treatments and secured highest score for sensory evaluation.

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