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A study on nutritional, functional and anti-nutritional properties of basil seed incorporated products

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Abstract

Present study was conducted to develop value added products with incorporation of basil seeds (BS) and to study their physical, nutritional, anti-nutritional and functional parameters. Nutritional composition of BS showed that it contained protein (9.62 g/100 g), iron (40.5 mg/100 g) and fiber (10 g/ 100 g) along with antioxidant (22.27%), total phenol (50.25 mg) and flavonoids (30 µg). Basil seed incorporated wide diversified products such as laddu (10 g BS) jelly and soup (2 g BS) were found to be acceptable with an overall acceptability sensory score of 8, 7.82 and 7.50 respectively on nine hedonic points. Nutritional evaluation of basil seed incorporated laddu showed significantly higher protein (23.62 g), fiber (8 g/ 100 g) and iron (10.6 g/ 100 g) compared to rest of the products. Further, basil seed incorporated laddu, jelly and soup were found to contain flavonoids (60, 90 and 98 µg), total phenols (78, 31 and 14.5 mg) and antioxidant activity to the tune of 93.12, 79.38 and 40.16% inhibition respectively, while tannins were significantly higher in jelly (27.33 mg) compared rest of the products. Storage study of the developed products (laddu and jelly) indicated that laddu can be kept up to 30 days in PET covers, jelly up to 60 days in glass jars in term of biochemical and microbial changes.

Keywords: Basil seeds, sensory quality, anti-nutrient, tannin, flavonoids, total phenol and antioxidant

Introduction

Iran and Africa are the primary producers of the herb basil (*Ocimum basilicum* L.) which requires warm temperature Fekri *et al.*, (2008) [10]. As natural remedies basil seeds to treat dyspepsia, ulcers, diarrhea, sore throat, and kidney disease have been used from ages and as the source of dietary fiber, basil seeds were added into various desserts and beverages Simon *et al.*, (1999) [25].

Outer pericarp swells into gelatinous mass when soaked in water due presence of polysaccharides such as glucomannan (43%) and (1-4)-linked xylan (24.29%) and glucan (2.31%) are the polysaccharides present in basil seeds. Beverages such as falooda and sharbat have traditionally prepared with Asian basil seeds; also seeds are traditionally used to treat dyspepsia, ulcer, diarrhea, diuretic, antipyretic, antispasmodic, stomachic and other illness Hosseini *et al.*, (2010) [11].

Heterogeneity in preparation of food with variations from liquid to solid was known to be prepared in our country from the time memorial. Various food ranging from liquid (soup, juice, sauce and rasam), semisolid (jelly, jam and fruit bar), solid (laddu, burfi, bars and chocolates) and such others products are known to consumers due to their accessibility. However, the healthy choice of foods which are incorporated with natural organic ingredients such as basil seeds are lesser known to the consumers, as they are not available plenty as well as lack of awareness regarding their health benefits. Various products such as soup from mushroom and morgina leaf Tasnim *et al.*, (2016) [26], protein enriched soup with incorporation of fish powder Monirul *et al.*, (2018) [18], soup prepared with sprouted horse gram and radish leaves Mathangi *et al.*, (2016) and soup prepared using millet Anita *et al.*, (2016) [4], laddu prepared with various ingredients such as flax seeds and multigrain flour Luxita *et al.*, (2017) [15], multi grain laddu prepared for galactogouge property Bhargavi *et al.*, (2013) [9] and iron enriched laddu with incorporation of eclipta alba leaves (Alka *et al.*, 2013) [2] as well as jelly prepared and its storage studies with wood apple fruit Awadhesh *et al.*, (2017) [8], preparation of guava jelly bar Kuchi *et al.*, (2015) and studies on preparation its storage studies of dragon fruit jelly Panchal *et al.*, (2018) [20] are already available however, lot of scope exist for value added basil seed incorporated products

Hence the study was taken to develop various value added products from basil seeds incorporation and assess its sensory, nutritional, anti-nutritional, functional and shelf life of the developed products due to their medicinal benefits.

Materials and Methods

Raw Materials like basil seeds others ingredients such as coconut powder, almonds, ghee, sugar and corn flour were procured from local market in a lot and stored at $4\pm 1^\circ\text{C}$ until further use.

Physical characteristics

Physical parameters of basil seeds were analyzed in triplicate in terms of length (mm), width (mm), thousand seed weight (g), bulk density (kg/m^3) and thickness (mm) as per Razavi *et al.*, (2008).

Development of value added products

a) Development of laddu

Laddus were standardized by incorporating basil seeds at 10, 15, and 20 g as shown in Table 1 and other ingredients such as dates, almonds, raisins and desiccated coconuts were kept constant. In order to select the best acceptable ratio, sensory evaluation was carried out by 25 semi-trained judges of ZARS V.C. farm, mandya.

Table 1: Formulation of dry fruit laddu prepared by incorporating basil seeds

Test material	Control	BDFL2	BDFL3	BDFL4
Dates (g)	50	50	50	50
Raisin (g)	50	50	50	50
Almonds (g)	15	15	15	15
Dry coconut (g)	15	15	15	15
Ghee (g)	1	1	1	1
Basil seeds (g)	-	10	15	20

* BDFL- Basil dry fruit laddu

b) Development of soup

Soup was standardized by incorporating basil seeds at 1, 2 and 3 g as shown in Table 2 other ingredients such as vegetables, sweet corn, salt and pepper were kept constant. In order to select best acceptable ratio, sensory evaluation was carried out by 25 semi-trained judges of ZARS V.C. farm, mandya.

Table 2: Formulation of soup prepared by incorporating basil seeds.

Test material	Control	BS2	BS3	BS4
Onion (g)	15	15	15	15
Carrot (g)	20	20	20	20
Beans (g)	12	12	12	12
Cabbage (g)	13	13	13	13
Sweet corn (g)	30	30	30	30
Salt (g)	3	3	3	3
Pepper (g)	2	2	2	2
Corn flour (g)	3	-	-	-
Basil seed (g)	-	1	2	3

* BS-Basil soup

c) Development of jelly

Pectin content was standardized with different ratios of water (75, 50 and 25 ml) followed by pulp (25, 50 and 75 g) as depicted in Table 3 by incorporating basil seeds at 1, 2 and 3 g as shown in Table 4. Other ingredient such as sugar was added at different levels (50, 55 and 60%). In order to select the best acceptable ratio, sensory evaluation was carried out by 25 semi-trained judges of ZARS V.C. farm, mandya.

Table 3: Organoleptic quality of jelly prepared from different pectin extract of guava fruits

Sl. No.	Water/pulp ratio	Extraction recovery (%)	Alcohol test for pectin
1	25:75	30	Low
2	50:50	150	High
3	75:25	43	Moderate

Table 4: Formulation of jelly prepared by incorporating basil seeds

Test Material	RTJ	RETJ
Fruit (g)	1000	1000
Fruit extract (ml)	314.5	300
Sugar (g)	157.25	150
Citric acid (g)	9.43	9
Pectin (g)	1.572	1.5
Basil seeds (g)	2	2

* RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

Nutritional composition

Developed products were analyzed for their nutritional composition such as moisture, crude protein, crude fat, crude fiber, total ash and carbohydrates content (AOAC, 1980) [6] whereas minerals such as iron and zinc according to Page *et al.*, (1992) [19] and calcium (Piper, 1966) [21] respectively.

Anti -nutrients of basil seed, laddu, jelly and soup

Anti-nutritional components such as phytic acid and tannin content were determined as per Shuaib *et al.*, (2015) [24].

Functional parameters of basil seed, laddu, jelly and soup

Functional parameter such as flavonoids calculated as gallic acid equivalent in mg (GAE) g^{-1} , total phenols calculated as quercetin equivalent in $\mu\text{g (QE) g}^{-1}$ and antioxidant expressed as% inhibition were determined by standard procedure as per Urszula *et al.*, (2016) [27].

Storage studies

Storage a studies of laddus was carried out by storing in polyethylene terephthalate (PET) covers for period of 45 days kept at room temperature. All the samples were periodically analyzed at regular interval of 15 days for moisture, free fatty acid peroxide value and alcohol acidity AACC (2000) [1] where as storage studies of jelly were carried out by storing in glass jars for a period of 60 days kept at room and refrigerated temperatures. All samples were periodically assessed at regular interval of 30 days for non-enzymatic browning (Ranganna 2010) [22], TSS by refractometer according to (AOAC 2012) [7], while titratable acidity and ascorbic acid was determined by titrimetric method according to Ranganna, (2010) [22].

Microbial analysis of jellies and laddu was analyzed by standard plate count method as per Ranganna, (2010) [22].

Statistical analysis

Data were analyzed statistically for mean, standard deviation for nutritional component and sensory studies whereas storage study data was analyzed using completely randomized design of variance.

Result and discussion

Physical parameters of basil seeds

The perusal Table 5 depicted the physical characteristics of basil seeds on dry basis. Basil seeds are oval in shape, black in colour the average values for length (3.01 mm), width (1.60

mm), thousand kernel weight (2 g), bulk density (0.73 kg/m³) and thickness (2.09 mm) were recorded. Similar study was conducted by Razavi *et al.*, (2008) and Hosseini *et al.*, (2007) [12] found that physical characteristic of seeds were black in colour and oval in shape, length as well as width showed quite similar values were reported in this study.

Sensory evaluation of laddu, soup and jelly

The sensory evaluation score for laddu incorporated with 10, 15 and 20% basil seeds as depicted in Fig 1. Among the variation tested basil dry fruit laddu (BDFL2) received higher scores for overall acceptability (8.0) compared to other variation tested. Basil dry fruit laddu (BDFL3, BDFL4) were received scores for appearance (7.86), colour (7.76), texture (7.89), flavour (7.84) and taste (7.9) and was quite comparable to control.

Soup prepared with different combination of soaked basil seeds with 1, 2 and 3% addition is depicted in Fig 2. Among the four variation tested, basil soup (BS3) received higher values for sensory parameters i.e., overall acceptability (7.5) on a nine point hedonic scale.

Jelly prepared with various ingredients like guava fruit and sugar as major ingredients long with basil seed incorporation 1, 2 and 3% incorporated as shown in Fig 3. Among three variations tested, refrigerated jelly (BREJ) received higher overall acceptability (7.82) compared other variation tested at room temperature jelly (BRJ), where as appearance (7.96), colour (8.12), firmness (7.77), flavour (7.81), cutting edge (7.62), transparency (8.22) and taste (8) respectively.

Nutritional composition of basil seed incorporated laddu and soup

Nutritional quality of basil seed and value added products such as laddu and soup were indicated in Table 6. Higher protein (23.62 g), fiber (8 g) and iron (10.6 mg) were reported in basil dry fruit laddu; whereas basil soup was found to contain more of fiber (10.6 g), ash (16.89%) and iron (10.9 mg) compared to basil seed. The values for basil seed nutrients were quiet comparable with values reported by Masooma *et al.*, (2017) [16]. Similar study conducted on dry fruit laddu by Anil *et al.*, (2018) were moisture (6.6%), fat (12 g), carbohydrates (46 g), ash (2.75%) crude fiber (10 g), calcium (24.81 mg) and energy (483.23 kcal) contents. Study by Tansim *et al.*, (2017) on mushroom moringa soup found to contain higher ash (16.05%) and protein (10.85 g) respectively.

Anti-nutrients of basil seeds and value added products

Anti-nutrient content of basil seed value added products is clearly depicted in Table 7. Higher tannins are found to be present in refrigerated jelly (27.33 mg), followed by room temperature stored jelly (18.24 mg) and basil dry fruit laddu (26.22) when compared to basil seeds (3.32 mg). The phytic acid content was found to be lowered in value added products such as laddu, soup and jelly compared to basil seeds (1.80 mg) respectively. Similar analysis conducted for presence of anti-nutrient by Anudurga *et al.*, (2016) [5] which confirmed the presence conducted saponins, terpenoids, tannins, steroids and alkaloids found to have anti-inflammatory effects.

Functional parameters of basil seeds and value added products

Functional parameters as depicted in Table 8 indicated that flavonoids content was higher at room temperature stored

jelly (90 µg), dry fruit laddu (100 µg) and soup (120 µg) where as total phenols of laddu (78 mg) and refrigerated jelly (23.5 mg) and antioxidant percentage of basil dry fruit laddu and soup (93.12, 80.83) were higher compared to basil seeds. Similar result was reported by Masooma *et al.*, (2017) [16] where in the total phenol content and antioxidant content of basil seeds were 63.78 mg and 34.20% respectively as reported by Anudurga *et al.*, (2016). So also the study of Zahid *et al.*, (2011) [28] confirmed the phenol content and anti-nutrients as 5.67 mg and 84.59% respectively.

Storage stability of laddu and jelly

Developed laddu stored in polyethylene terephthalate (PET) covers with a initial moisture content of 2.7% in dry fruit laddu (DFL) and 4.5% in basil dry fruit laddu (BDFL) which increased to 7.8% and 8.1% at end of storage period. Peroxide value (PV) was 4 meqvO₂/ kg of fat in DFL and BDFL which increased to 17.2 meqvO₂/ kg of fat and 20 meqvO₂/ kg of fat at end of storage period. Even the free fatty acid (FFA) content was 0.09 and 0.24% in DFL and BDFL which increased to 1 and 1.33% at end of storage period and alcohol acidity (AA) of DFL and BDFL was 0.04 and 0.19% increased to 2 and 1.93% at end of storage period Table 9.

Total soluble solids was constant throughout the storage period for commercial jelly (CJ), but jelly stored at room temperature (RTJ) and refrigerated condition (REJT) increased from 0th day to 60th day of storage. At room temperature brix increased from 23° to 29° but at refrigerated condition the brix increased from 18° to 25° as shown in (Table 10). This increase in brix can be due to conversion of polysaccharides to sugar in presence of organic acid. Similar results were also reported by Awadshesh, (2017) [8] in wood apple jelly.

Acidity and pH of commercial jelly (CJ) remain unchanged throughout storage period. At room temperature (RTJ) acidity increased from 0.25 to 0.98% and refrigerated condition (REJT) acidity increased from 0.64 and 1.28% as shown in (Table 10). Increase in acidity due to degradation of pectin content into soluble solid and formation of organic acid due decrease in ascorbic acid. Since the acidity increases, pH decreases 6 to 4.9. Similar results were noticed for acidity by Panchal *et al.*, (2018) [20] in dragon fruit jelly.

Ascorbic acid content of jelly at refrigerated condition (RETJ) was higher 72.58 mg compared to room temperature (RTJ) 45.39 mg; at the end of storage period ascorbic acid was 70.10 mg in RETJ and 42.25 mg in RTJ. In commercial jelly (CJ) ascorbic acid was 29.14 mg which was same throughout storage period as shown in Table 10. Decrease in ascorbic content noticed due to formation of dehydroascorbic to 2, 3 diketogulonic acids to furfural compound. Maximum retention of vitamin C was found in refrigerated conditions in the present study. Even the results for guava jelly bar were in line with our result as reported by Kuchi *et al.*, (2014) [14].

Browning reaction of jelly at refrigerated condition (RETJ) was 0.15 to 0.18% and at room temperature (RTJ) 0.17 to 0.25% where as browning reaction was constant for commercial jelly (CJ) was 0.58% throughout the storage period as shown in Table 10. Browning reaction was due to non-enzymatic reaction which in turn due to oxidation of organic acid to sugars or phenol compound and decrease in ascorbic acid content. Similar results were reported by Jaydeep, (2012) [13] for guava carrot jelly.

Microbial analysis of laddu and jelly

Microbial analysis of laddu is depicted in Table 11. There was no bacterial and fungal growth observed up to 15 days of storage, but at end of storage period DFL and BDFL showed bacterial growth (4×10^{-4} , 2×10^{-3} cfu/ml and 3×10^{-3} , 3×10^{-2} cfu/ml) and fungal growth (4×10^{-4} , 3×10^{-3} cfu/ml and 3×10^{-3} , 2×10^{-2} cfu/ml). The microbial growth recorded low in this study was due to use of PET covers which are having low absorption moisture because of 420 gauge capacity. Similar study was conducted by Bhargavi *et al.*, (2013) [9] in multi grain laddu reported microbial growth of 4×10^{-1} and 2×10^{-2} ; whereas jelly tested at room temperature bacterial growth at end of storage period was (2×10^{-4} and 1×10^{-3} cfu/ml) and fungal growth (2×10^{-2} and 1×10^{-3} cfu/ml) which was compared with refrigerated condition stored jelly, where bacterial growth (1×10^{-3} and 1×10^{-4} cfu/ml) and fungal growth (1×10^{-2} and 1×10^{-3} cfu/ml) were shown in Table 12. Low microbial growth in jelly can be due to addition of sugar which acts as a preservative and storage at low temperature, increased the keep quality of jelly. Similar study was observed by Panchal *et al.*, (2018) [20] and Awadshesh, (2017) [8] in dragon fruit jelly and wood apple jelly.

Conclusion

The present study was undertaken to evaluate basil seeds and its incorporated products such as laddu, soup and jelly. Basil laddu with (10 g BS), basil soup and jelly with (2 g BS) were overall acceptable. Laddu were nutritional superior in protein (23 g) and soup in fiber (10.6 g) and ash (16.89%). Anti-nutritional components such as tannins in (laddu and jelly) were higher compared to phytic acid in developed products. Functional parameters such flavonoids in (laddu and soup), total phenols in (laddu and jelly) and antioxidant in (basil laddu and jelly) were higher compared other tested products. Developed laddu and jelly were stable up to 30 and 60 days of storage.

Table 5: Physical parameters of basil seeds

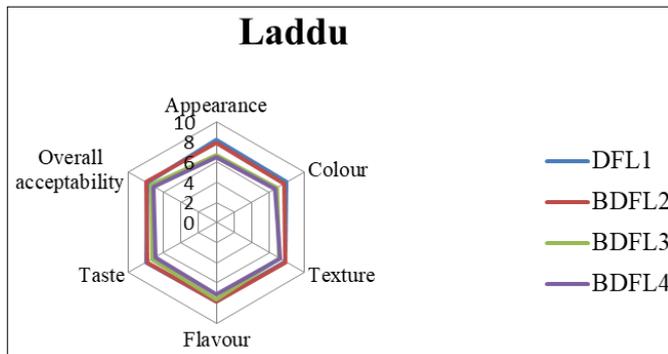
Physical properties	Mean value
Seed shape	Oval
Seed colour	Black
Length (mm)	3.01±0.02
Width (mm)	1.60±0.03
1000 seed weight (g)	2±0.09
Bulk density (kg/m ³)	0.73±0.01
Thickness (mm)	2.09±0.05

Table 6: Nutritional composition of basil seed incorporated laddu and soup per 100 g

Nutrients	B1	DFL1	BDFL1	SS1	BSS1
Moisture (%)	4.5±0.55	2.7± 0.25	3.1±0.17	9.3±0.74	9.4±0.24
Energy (kcal)	368.98±0.23	463.24±0.74	413.8±0.87	307.46±0.12	284.94±0.35
Carbohydrates (g)	59.2±0.45	58.44±0.62	50.58±0.49	67.13±0.36	53.73±0.78
Protein (g)	9.62±0.72	17.87±0.33	23.62±0.1	4.11±0.18	2.88±0.42
Fat (g)	10.5±0.54	22±0.55	13±0.23	2.5±0.75	6.5±0.4
Crude fiber (g)	10±0.12	6.8±0.29	8±0.19	2.6±0.48	10.6±0.87
Ash (%)	6.18±0.0	2.19±0.41	1.7±0.17	14.36±0.63	16.89±0.3
Calcium (mg)	40.08±0.80	40.08±0.78	40.08±0.18	20.04±0.58	30.06±0.41
Iron (mg)	40.5±0.0	12.3±0.24	10.6±0.22	13.05±0.35	10.9±0.36
Zinc (mg)	8.71±0.0	10.5±0.61	2.02±0.00	3.18±0.40	3.73±0.25

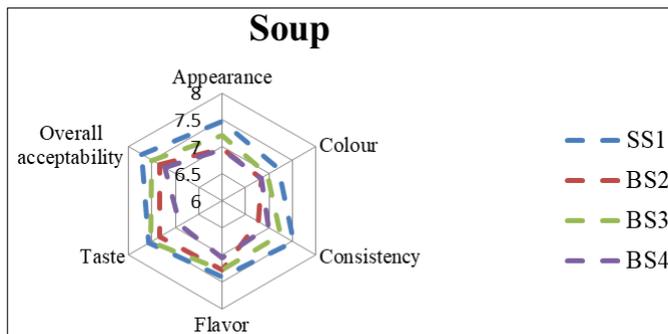
(n=3), Values are indicated as mean and it's SD

*BS1- Basil seed, DFL- Dry fruit laddu, BDFL- Basil dry fruit laddu, SS1- Standard soup, BSS1-Basil soup



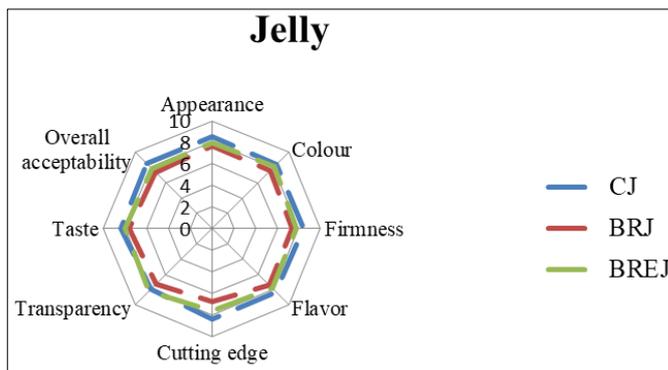
*DFL- Dry fruit laddu (control), BDFL- Basil dry fruit laddu

Fig 1: Sensory scores of laddu prepared by incorporating basil seeds



*SS1- Standard soup (control), BS-Basil soup

Fig 2: Sensory scores of soup prepared by incorporating basil seeds



*CJ – Commercial jelly, RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

Fig 3: Sensory scores of jellies prepared by incorporating basil seeds

Table 7: Anti-nutritional composition of basil seed incorporated laddu, soup and jelly mg/100 g

Parameters	Phytic acid (mg)	Tannins (mg)
BS1	1.80	3.32
SS1	0.16	0.48
BSS2	0.57	0.21
DFL	0.32	3.18
BDFL	0.18	26.22
CJ	0.13	2.60
RTJ	0.11	18.24
RETJ	0.09	27.33

(n=3)*BS1- Basil seed, DFL- Dry fruit laddu, BDFL- Basil dry fruit laddu, SS1- Standard soup, BSS1-Basil soup, CJ-Commercial jelly, RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

Table 8: Functional parameters of basil seed incorporated laddu, soup and jelly

Parameters	Flavonoids (µg)	Total phenol (mg)	Antioxidant (%)
BS1	30	55.25	22.27
DFL	100	78.1	61.50
BDFL	60	78	93.12
SS1	120	10.5	80.83
BSS2	98	14.5	40.16
CJ	46	8.5	57.52
RTJ	90	31	79.38
RETJ	80	23.5	51.66

(n=3)*BS1- Basil seed, DFL- Dry fruit laddu, BDFL- Basil dry fruit laddu, SS1- Standard soup, BSS1-Basil soup, CJ-Commercial jelly, RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

Table 9: Storage stability of laddu

Parameters	Variation	Moisture (%)	Peroxide value mEqvO ₂ /gm	Free fatty acid (%)	Alcohol acidity (%)
0 th day	DFL1	2.7	4	0.09	0.04
	BDFL1	3.1	4	0.24	0.19
15 th day	DFL1	3.6	8	0.47	0.5
	BDFL1	4.5	10	0.47	0.39
30 th day	DFL1	5.6	13.6	0.65	0.51
	BDFL1	7.2	14	0.76	0.65
45 th day	DFL1	7.8	17.2	1	2
	BDFL1	8.1	20	1.33	1.93
	SEm±	0.58	1.30	0.09	0.11
	CD at 5%	0.03	0.01	0.06	0.15

(n=3)* DFL- Dry fruit laddu, BDFL- Basil dry fruit laddu

Table 10: Storage stability of jelly

Parameters	Variation	pH	TSS	Acidity (%)	Browning (%)	Vitamin C (mg/100g)
0 th day	CJ	5	30	0.96	0.58	29.41
	RTJ	6	23	0.25	0.17	45.39
	RETJ	5	18	0.64	0.15	72.58
30 th day	CJ	5	30	0.96	0.58	29.41
	RTJ	5.5	26	0.62	0.20	44.11
	RETJ	5	23	0.96	0.16	71.52
60 th day	CJ	5	30	0.96	0.58	29.41
	RTJ	5	29	0.98	0.25	42.25
	RETJ	4.9	25	1.28	0.18	70.10
	SEm±	0.26	2.48	0.16	0.13	12.47
	CD at 5%	0.67	0.54	0.34	0.94	0.96

(n=3) *CJ – Commercial jelly, RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

Table 11: Microbial content of laddu

Microbial content cfu/ml	0 th day		15 th day		30 th day		45 th day			
	DFL	BDFL	DFL	BDFL	DFL	BDFL	DFL	BDFL		
Bacteria	10 ⁻³	0	0	0	0	0	2	1	4	3
	10 ⁻⁴	0	0	0	0	0	2	1	2	3
Fungi	10 ⁻²	0	0	0	0	0	3	2	4	3
	10 ⁻³	0	0	0	0	0	4	2	3	2

* DFL- Dry fruit laddu, BDFL- Basil dry fruit laddu

Table 12: Microbial content of Jelly

Microbial content cfu/ml	0 th day			30 th day			60 th day			
	CJ	RTJ	RETJ	CJ	RTJ	RETJ	CJ	RTJ	RETJ	
Bacteria	10 ⁻³	0	0	0	0	0	0	1	2	3
	10 ⁻⁴	0	0	0	0	0	0	1	1	2
Fungi	10 ⁻²	0	0	0	0	0	0	0	2	1
	10 ⁻³	0	0	0	0	0	0	0	1	1

(n=3) *CJ – Commercial jelly, RTJ-Room temperature jelly, RETJ-Refrigerated temperature jelly

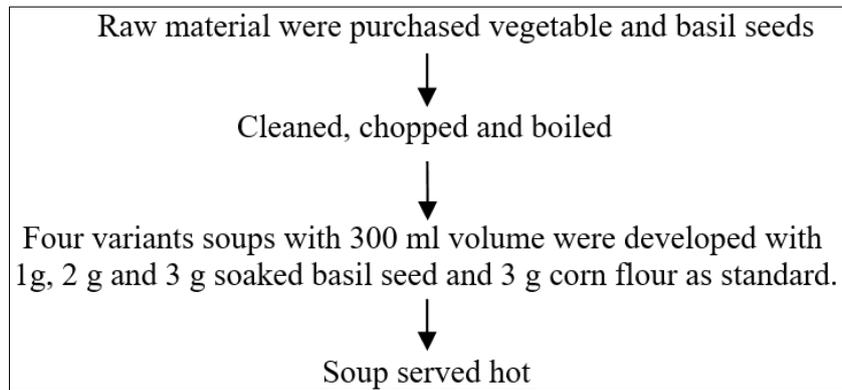


Fig 4: Standardization of soup prepared with basil seeds incorporation

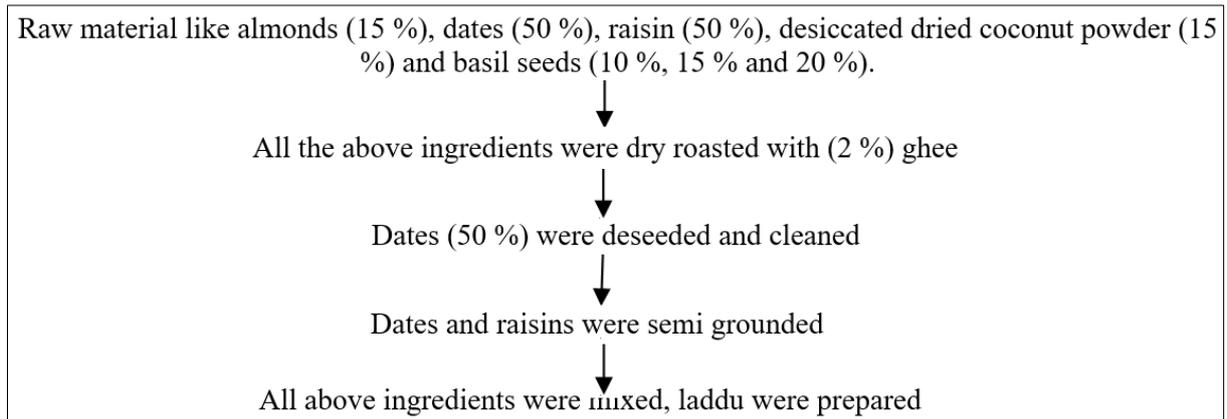


Fig 5: Standardization of dry fruit laddu prepared with basil seed incorporation

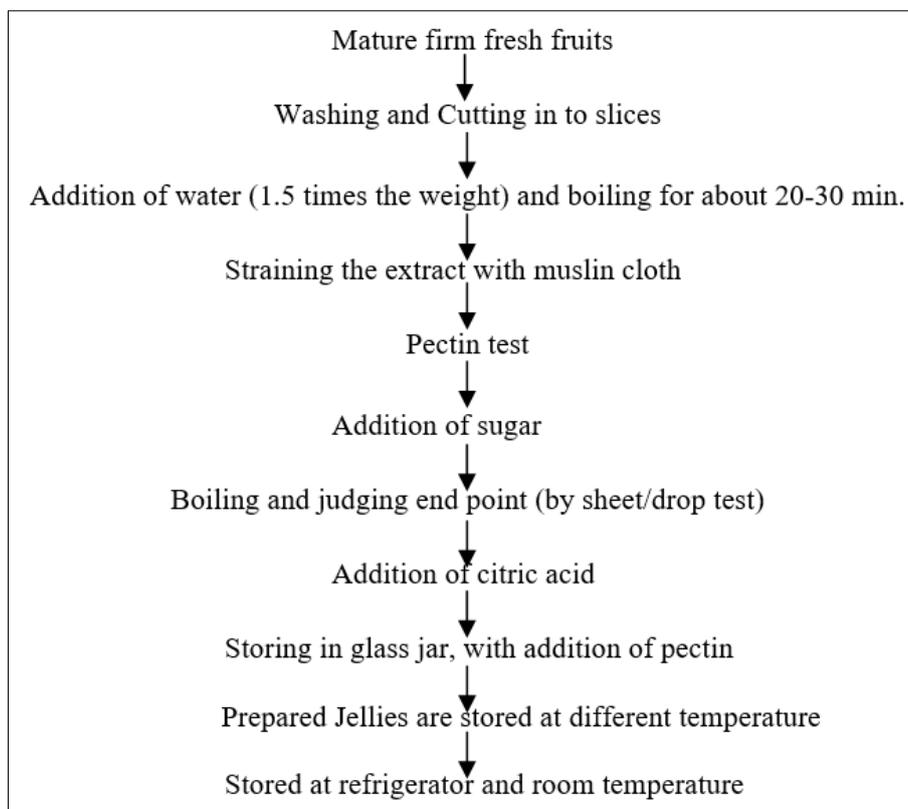


Fig 6: Standardization of jelly prepared with basil seed incorporation

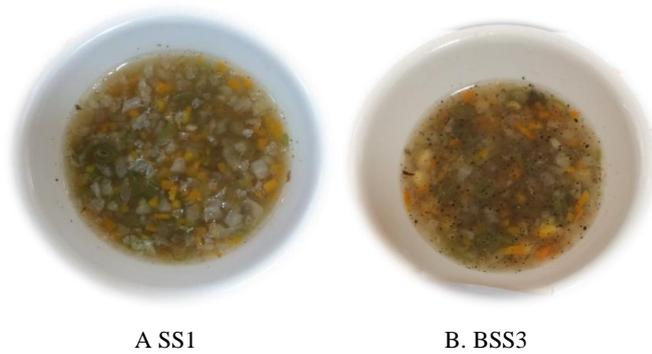


Fig 7: Soup prepared incorporating basil seeds

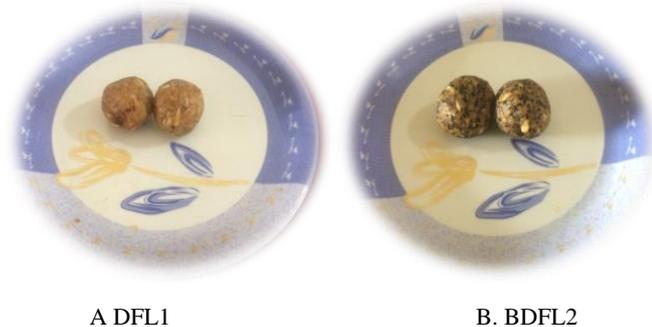


Fig 8: Dry fruit laddu prepared incorporating basil seeds.



Fig 9: Storage stability of packed dry fruit laddu in PET packaging material

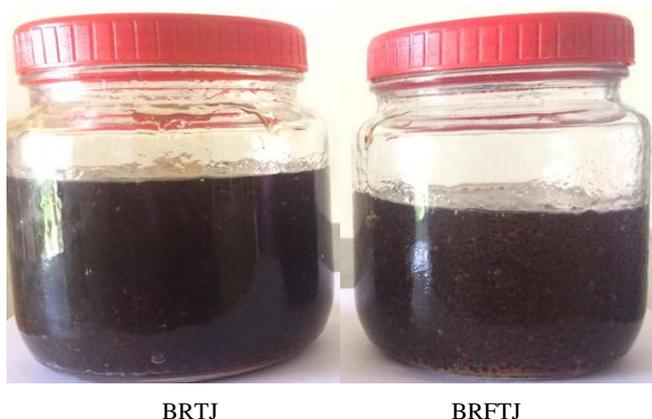


Fig 10: Jelly prepared incorporating basil seed

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