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Organoleptic acceptability of value added products using unripe and ripe bael fruit pulp and its powder (*Aegle marmelos*)

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Abstract

The *bael* fruit is known for its medicinal properties and is one of the most nutritious fruits. Storage study of *bael* fruit and pulp were conducted to find out suitable storage life to extent the availability of the fruit and produce the value added product in form of fruit. In the present study, unripe and ripe *bael* fruit pulp and its powder was used to developed various products i.e., *muraba*, jam, squash, candy, *idli* mix and *panjiri* in the laboratory. Sensory characteristics like colour, appearance, aroma, texture, taste and overall acceptability were evaluated on nine point hedonic ranking scales at the interval of 15 days for 60 days. Results of the present study indicated that all the developed products ranged between “like moderately to like very much” on the organoleptic parameters judged on nine point hedonic ranking scale. The highest scored was achieved by unripe *bael muraba* and lowest score achieved by ripe *bael* candy as compared to other products. Hence, it can be concluded that value added and preserved products have suitable storage life and have good nutritional properties if consumed in a meal.

Keywords: *Bael*, unripe, ripe, fruit pulp products, aegle marmelos

Introduction

Aegle marmelos Linn. Sub tropical species is a perennial tree wild in the Sub Himalaya tract, Central and South India. Tree grows wild in dry forests on hills and plains of central and southern India and Burma, Pakistan and Bangladesh, also in mixed deciduous and dry dipterocarp forests. Among the natural herbs and plants, *bael* (*Aegle marmelos*) fruit is beneficial for the chronic dysentery, diarrhoea, anticancer, cholesterol, peptic ulcer, inflammation and constipation. It is very cheap and easily available source of nutrient for common people (Sharma *et al.*, 2006) [4]. The ripe fruit of *bael* is sweet aromatic, nutritious and very palatable being highly esteemed and eaten by all classes of society. The fruit has excellent aroma which is not destroyed even during processing thus there is untapped potentiality for processing *bael* into various products being highly nutritive and therapeutically important. The unripe fruits are astringent, digestive, stomachic which improves appetite and anti scorbutic and are generally prescribed for treating diarrhoea and dysentery (Mishra and Srivastava, 2013) [3]. Ravani and Joshi (2014) [8] studied process technology for production of value added preserved products from *bael* fruit. Fresh *bael* fruit can be stored for 15 days at 30°C when harvested at full maturity and 3 months at 9°C. Fruit pulp can be stored for 6 months, when stored in heat-sealed containers. Fruit powder can be stored for a year when packed in 400 gauge polypropylene pouches and stored under dark, cool place while fruit jam, squash and preservatives can be stored for several months. Similarly Singh *et al.* (2014) [5] reported that *bael* fruit can be stored for 10-15 days at normal temperature whereas fruit harvested at ripe stage can be stored for a week. After extraction of *bael* pulp, it can be commercially exploited for preparation of various fruit viz., preserve, candy, jam, RTS, nectar, squash/ leather/ slab powder etc. The present review attempts to summarise the method of preserving unripe and ripe *bael* fruit during the peak season of its availability along the shelf life of its value added and preserve products.

Materials and Methods

Procurement of unripe and ripe *bael* fruit

Selection of unripe and ripe *bael* fruit

Unripe and ripe *bael* were purchased from orchard of Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan for present investigation.

Cleaning and sorting of unripe and ripe *bael* fruit**Cleaning and sorting of *bael***

Damaged and non edible portion were discarded. *Bael* fruit was first washed with tap water for few minutes and then rinsed with distilled water to remove the dust, dirt and other adhering impurities.

Pulping: Pulp was removed from the fruit after applying the force to crack fruit.

Destoning: Removed seeds & other non edible part manually from pulp.

Drying: Drying the fruit pulp under different methods of drying.

Dehydration of fruit pulp

Standardization of drying method for unripe and ripe *bael* fruit pulp was carried out using standard methods of drying (CFTRI, 1996)^[1].

Method used for drying

Unripe and ripe *bael* fruit pulp were dried using different methods i.e. sun drying, shade drying, solar tray drying and oven drying. Method of drying conditions was standardized before conducting the experiment.

Selection of panel members for evaluation of developed products

Threshold test was used for selection of the panel member as given by Potter, 1987. Convenience, experience, knowledge, willingness, interest and sincerity were the criteria for consideration of panel members. Ten members were enlisted in the panel comprise of staff members of the college of Home Science, SKRAU, Bikaner, Rajasthan.

Preparation of score card

Nine- point hedonic rating scale suggested by Ranganna (1986)^[7] was provided to the judges for scoring acceptability of products on the basis of certain qualities looked for in food preparation such as appearance, colour, aroma, texture and overall acceptability.

The aim of standardization of value added products

To obtain consistently good quality outcome which means that every repetition of procedure will result in a standard quality product. Standardization is must for introducing any product for circulation in market as a standard quality and to ensure that product is acceptable to the consumer. The shade dried powder from unripe and ripe *bael* fruit were selected by the panelist for conducting the present study. The two products *panjiri* and *idli* mix were developed with the incorporation of selected shade dried unripe and ripe *bael* fruit powder. Which were standardised at various proportions (10% and 15%) out of which 10% proportion of powder is acceptable and products were made. Rest of the products were developed from unripe and ripe *bael* fruit pulp like jam, squash, *muraba* and candy. Samples of 10 gm of unripe and ripe *bael* fruit pulp was taken for their standardisation and preserve them at room temperature after that the products were developed and preserved.

Organoleptic evaluation of developed products

Standardization of the developed products was carried out thorough organoleptic evaluation. At the interval of 15 days

for a period of two months of storage the developed products were evaluated for their sensory characteristics like colour, aroma, texture and overall acceptability by selected panel of ten semi trained panel members.

Shelf life study

The shelf life study of any product determined its wholesomeness during the definite period of time. Therefore, the quality of developed products during storage for 60 days was evaluated for its organoleptic characteristics.

Statistical analysis

The data of the organoleptic acceptability, nutritional assessment and shelf life study were statistically analyzed to find out significance of the results (Chandel, 1997)^[2]. The results are expressed as mean \pm SD. The obtained data statistically analyzed by using SPSS statistics (Ver. 20)

Results***Bael* squash**

Mean acceptability scores for organoleptic characteristics of unripe and ripe *bael* squash given in Table 1, Plate 1-Fig. (a) were found to be organoleptically acceptable by the panelists. Mean acceptability scores viz.7.9 was achieved by both unripe and ripe *bael* squash. Both were categorized as “liked very much” by the panel members. The obtained results were found to be statistically non – significant ($p>0.05$).

***Bael* candy**

According to selected panel of ten semi – trained panel members mean acceptability scores for organoleptic characteristics of unripe and ripe *bael* candy were found to be organoleptically acceptable [Table 1, Plate 1-Fig.(b)]. The highest scores i.e; 7.2 were achieved by unripe *bael* whereas the lowest scores i.e; 6.6 were achieved by ripe *bael* candy. Both unripe and ripe *bael* candy fell under category of “liked moderately” on nine point hedonic rating scale. Mean organoleptic scores for the sensory parameters i.e. colour, appearance, flavour, texture, taste and overall acceptability for both unripe and ripe *bael* fruit pulp were found to be non significant at ($p>0.05$).

***Bael* muraba**

Unripe and ripe *bael muraba* ranged from “liked very much” to “like moderately” category in terms of sensory evaluation. Unripe *bael muraba* was “liked very much” for the sensory parameters viz., colour, appearance, flavor, texture, taste and overall acceptability and secured mean scores viz. 8.4, 8.3, 8.2, 8.2, 8.3 & 8.2 respectively [Table 1, Plate 1-Fig.(c)]. Scores of sensory attributes of ripe *bael muraba* recorded least as 7.9, 7.7, 7.8, 7.7, 7.7 and 7.7, respectively on nine point hedonic rating scale by the panel of judges. However, the difference in the scores were found to be non significant ($p>0.05$).

***Bael* jam**

Mean acceptability scores for organoleptic characteristics of unripe and ripe *bael* jam depicted in Table 1, Plate 1-Fig.(d) indicated that the unripe jam had highest acceptability mean scores in the range of 8.0 to 8.2 on the nine point hedonic rating scale and “liked very much” by the panel members. However, the ripe jam had lowest acceptability scores ranged from 7.5 to 7.7 as compared to unripe jam on nine point hedonic rating scale which might be due to its astringent flavor which was also “liked very much” in terms of all

sensory parameters. Results of the present study revealed that both types of jams (unripe and ripe) were “highly acceptable” by the judges.

Bael idli mix

Mean acceptability scores for organoleptic characteristics of *bael idli* mix are presented in Table 1, Plate 2. The two types of *idli* mix preparations based on unripe and ripe *bael* powder organoleptically evaluated for acceptable variation. The unripe *Idli* mix were “liked moderately” for the sensory parameters viz., colour (7.5), appearance (7.5), flavor (7.4), texture (7.4), taste (7.5) and overall acceptability (7.4). however, the ripe *bael* powder *idli* mix rated similar scores (7.4) in each category viz., colour, appearance, flavor, texture, taste and overall acceptability on nine point hedonic rating scale by the panel of judges (Table 1). The difference in the scores were found to be statistically non significant ($p>0.05$).

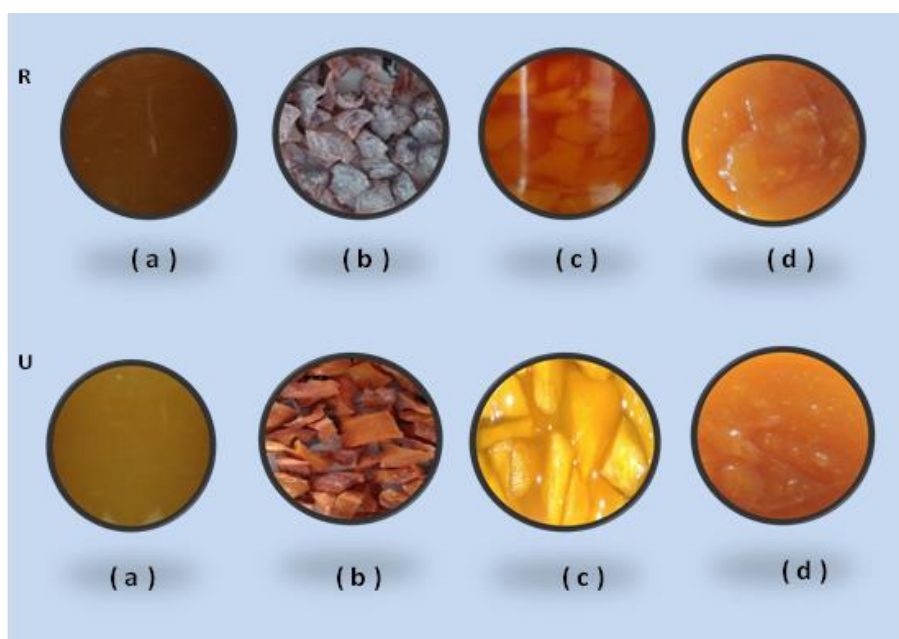
Bael panjiri

Two different types of *panjiri* were prepared using unripe and ripe *bael* powder. Both samples were found to be “liked very much” in terms of sensory evaluation (Table 1, Plate 3). All organoleptic characteristics of *panjiri* from unripe *bael* rated non significantly ($p>0.05$) higher mean scores as compared to that of ripe *bael panjiri*. Mean organoleptic scores for unripe *bael* evaluated for various sensory parameters is colour (8.0), appearance (8.0), flavor (8.0), texture (8.0), taste (8.1) and overall acceptability (8.0). whereas for the ripe *bael* powder *panjiri* score is (7.9) in each category viz., colour, appearance, flavor, texture, taste and overall acceptability on nine point hedonic rating scale. Both the unripe and ripe *bael* powder *panjiri* were categorized as “liked very much” on the basis of scores achieved by them from the panel of judges. However, the difference in the scores were found to be statistically non significant ($p>0.05$).

Table 1: Organoleptic acceptability of unripe and ripe *bael* products

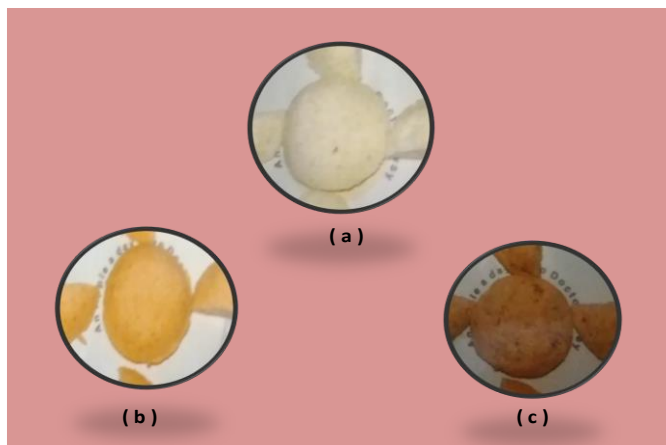
S. No.	Product		Mean Score of Sensory Characteristics on Nine Point Hedonic Rating Scale					Overall Acceptability
			Colour	Appearance	Aroma	Texture	Taste	
1.	Jam “t” value	U	8.0±0.66	8.0±0.66	8.0±0.66	8.0±0.66	8.0±0.66	8.0±0.66
		R	7.7±0.67	7.6±0.69	7.7±0.82	7.5±0.64	7.6±0.69	7.6±0.69
			1.89	1.88	2.84	2.26	3.28	3.28
2.	<i>muraba</i> “t” value	U	8.40±0.51	8.30±0.48	8.20±0.42	8.20±0.42	8.30±0.48	8.20±0.42
		R	7.90±0.56	7.70±0.48	7.81±0.52	7.70±0.48	7.70±0.48	7.70±0.48
			1.98	2.00	1.88	2.05	2.06	1.85
3.	squash “t” value	U	8.0±0.66	7.9±0.56	7.8±0.42	8.0±0.66	8.1±0.56	7.96±0.63
		R	7.9±0.56	7.9±0.56	7.9±0.56	7.9±0.56	8.0±0.66	7.90±0.56
			2.45	2.49	2.54	2.60	2.63	2.60
4.	candy “t” value	U	7.2±0.91	7.0±0.23	6.8±0.63	6.8±0.63	7.0±0.63	6.9±0.65
		R	7.1±0.35	6.7±0.71	6.4±0.67	6.4±0.67	6.7±0.71	6.6±0.47
			3.80	3.86	3.89	3.90	3.56	3.75
5.	<i>Idli mix</i> “t” value	U	7.5±0.52	7.5±0.52	7.4±0.51	7.4±0.51	7.5±0.52	7.4±0.51
		R	7.4±0.51	7.4±0.51	7.4±0.51	7.4±0.51	7.4±0.51	7.4±0.51
			2.45	2.56	2.50	2.52	2.58	2.60
6.	<i>panjiri</i> “t” value	U	8.0±0.66	8.0±0.66	8.0±0.66	8.0±0.66	8.1±0.63	8.0±0.66
		R	7.9±0.56	7.9±0.56	7.9±0.56	7.9±0.56	8.0±0.65	7.9±0.56
			1.67	1.70	1.76	2.05	2.10	1.75

Values are mean ±SD of ten panelists NS=Non Significant U= Unripe, R= Ripe



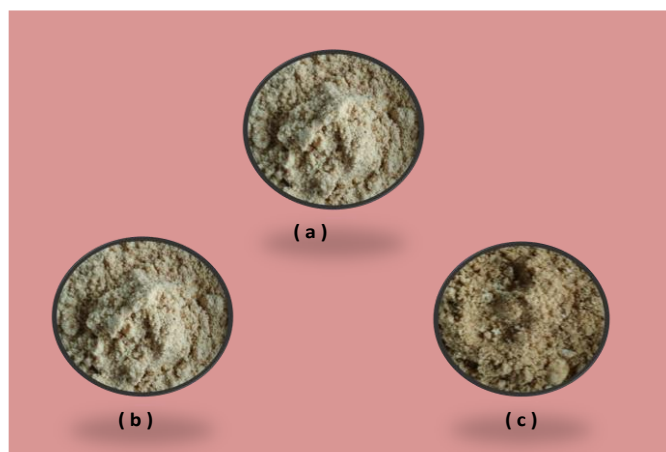
R= Ripe (a) Squash (b) Candy (c) *Muraba* (d) Jam
U= Unripe

Plat 1: Bael fruit pulp products



(a) Rava idli mix (b) Unripe (c) Ripe

Plate 2: Bael powder idli mix



(a) Control panjiri (b) Unripe (c) Ripe

Plate 3: Bael powder panjiri

Conclusion

The products developed from unripe and ripe bael fruit pulp and powder including *muraba*, jam, squash, candy, *panjiri* and *idli* mix were accepted by panel of semi-judges on the basis of nine point hedonic scale. Inclusion of these products in the diet will definitely improving the nutritional value of the meals. In future the commercialization of unripe and ripe *bael* powder and its value added products.

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Disclosure Statement

No potential conflict of interest was reported by the author.

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