Development and standardization of wood apple jujube

ABSTRACT:

Soft candy possesses a jelly-like composition that incorporates fruit and sweeteners in the form of sucrose syrup and/or glucose, in addition to gelling agents, acids, flavors, and food dyes. Limoniaacidissima is renowned for its therapeutic benefits and boasts numerous documented medicinal applications. The goal of this research is to develop and standardize premium products, assess their acceptability and storage longevity, and to evaluate the physico-chemical characteristics of the resulting products. The control group achieved the highest score in comparison to WAJ=1 (which was made with the addition of 45g of wood apple pulp), recording scores of 8.00, 7.65, 7.70, 7.30, 7.75, and 7.55 for appearance, texture, color, aroma, flavor, and overall acceptability, respectively. Jujubes exhibited a protein content of 18.25%, a notable moisture level of 47.55%, followed by 32.20% carbohydrates, with the lowest attributed to fat at 0.2%. The amount of crude fiber was measured at 1.00%, alongside its calorific value. The most favored jujubes, WAJ-1 (which comprises 45 g of wood apple and 30 g of sugar), were packed in HDPE and kept under normal conditions. A decline in mean scores was observed for appearance (4.65), texture (5.4), color (5.5), aroma (5.75), flavor (5.2), and overall acceptability (4.6) when stored at ambient temperature over a nine-day span compared to the starting values. The microbial load of the jujubes indicated that as storage days increased, the colony-forming units for molds and yeast rose from 1.67X10^4 and 1.00X10^4 to 12.33X10^4 and 9.00X10^4, respectively, over a nine-day timeframe.

KEY WORDS: wood apple, Jujube, nutritive value, storage studies, sensory evaluation, soft candy

INTRODUCTION:

Jellies and gummies are extremely popular among children under 17 because of their natural and chewy texture, as noted by Moloughney in 2011. These products are made up of a gel-like composition that consists of at least 45g of fruit per 100g, as well as sugars in the form of sucrose syrup and/or glucose, at concentrations of around 55g per 100g. Additionally, they contain gelling agents, acids, flavors, and food colorings, as indicated by Cappa et al. in 2015 and Mutlu et al. in 2018.

Jujube, also called jube or juju, is a type of chewy candy. The excessive consumption of jellies and gummies is believed to have a negative impact on public health due to their high

sugar and food additive content, as well as the presence of undesirable compounds formed during heat treatment, such as hydroxymethyl-2-furaldehyde and acrylamide. These products have indeed been linked to a high incidence of tooth decay, hyperglycemia, and obesity (Khawaja., 2019 and Rippe and Angelopoulos., 2016).

Limoniaacidissima is widely recognized for its medicinal properties and has multiple documented medicinal applications. It exhibits various biological activities such as adaptogenic activity, hepatoprotective effects, and its use against blood impurities, leucorrhea, dyspepsia, and jaundice (Anon, 1992).

The wood apple fruit has a round to oval shape and measures 5 to 12.5 cm wide. It has a woody, extremely hard rind that is challenging to crack and appears greyish-white and scurfy, with a thickness of about six mm. The pulp is brown, mealy, odorous, resinous, astringent, and can be either acid or sweetish, containing numerous small, white seeds scattered throughout.

Keeping this view as the main source, and after a thorough review of the literature, one of these fruits was chosen to inform the traditional scientific claims of the famous tree apple fruit, known as the elephant apple.or apple tree, is widely used.

in the regions of South India for this research and the following objectives.
1. Development and comparison of products with added value, acceptance and stability of storage.
2.Analyzingthe physico-chemical properties of the products developed and

To prepare the jujube product, materials such as apples, sugar, gelatin and citric acid were purchased from the local market in Bangalore.1. Preparation of jujube apple tree (WAJ)Four types of jujube apple tree in different levels of pulp (45, 35, 25 and 15%) were prepared and compared to the control (citric acid) as below. The method used to produce jujube is shown in Figure 1. Table 1. According to beetroot and orange important properties, jelly contains important compounds such as pectin, acid and sugar. Beetroot jelly enriched with orange in the ratio 60:40.

MATERIALS AND METHODS;

For the preparation of jujube product ingredients like wood apple, sugar, gelatine, and citric acids were procured from local market of Bangalore.

1. Preparation of Wood apple Jujubes (WAJ)

Four variations of wood apple jujubes containing different levels of pulp (45, 35, 25 and 15 per cent) were prepared and compared with control (citric acid) as indicated below. Method used in preparation of jujubes is given in. table 1. According to Saindane. and Nakade

2018., fortified Beetroot and orange Jelly making involves important constituents such as pectin, acid, and sugar. Beetroot jelly fortified with orange which is in the proportion of 60:40 respectively.

Table 1: Development and Standardization of Wood apple jujubes.

Sl. No.	Ingredients (g)	Control	WAJ-1	WAJ-2	WAJ-3	WAJ-4
1.	Fruit Pulp (g)	-	45	35	25	15
2.	Sugar (g)	50	30	40	50	60
3.	Gelatine (g)	40	25	25	25	25
4.	Citric acid (g)	10	-	-	-	-
	Total	100	100	100	100	100

WAJ- Wood apple jujubes

2. Organoleptic evaluation and shelf-life study of developed products.

Sensory evaluation was carried out using 9-point hedonic scale and evaluated by a panel of semi trained judges (n=20). Wood apple jujubeproducts were aseptically packed in HDPE polythene covers and sealed, Jujubes were analysed for a period of 9 days. Microbial study was conducted for moulds and yeast.

3. Physicochemical analysis of the product

Wood apple pulp was used for the analysis of nutrients namely moisture, protein, fat, ash, crude fibre, calcium, phosphorus, iron and zinc. Carbohydrate content of samples was computed by difference method. Analysis was conducted in triplicates using analytical grade chemicals. Results were expressed on dry weight basis.

RESULTS AND DISCUSSION

Organoleptic evaluation of value-added products from wood apple fruit;

Control sample observed higher sensory scores of 8.74, 8.44, 8.42, 8.13, 8.18 and 8.59 for appearance, texture, colour, aroma, taste and overall acceptability respectively as compared to the other two treatments. It was followed by A (prepared by adding 50gms of wood apple pulp) which scored 8.00, 7.65, 7.70, 7.30, 7.75, 7.55 for appearance, texture, colour, aroma, taste and overall acceptability, respectively. The lowest score for overall acceptability was recorded by WAJ-4 (7.06). There was a significant difference between the treatments for all sensory attributes of jujubes (Table-2).

Table 2: Organoleptic scores of jujubes (n=20)

Treatments	Appearance	Texture	Colour	Aroma	Taste	Overall acceptablity
Control	8.74	8.44	8.42	8.13	8.18	8.59
WAJ-1(45%)	8.00	7.65	7.70	7.30	7.75	7.55
WAJ-2(35%)	7.75	7.25	7.50	7.30	7.43	7.19
WAI-3(25%)	7.53	7.39	7.25	7.20	7.30	7.09
WAJ-4(15%)	7.35	7.21	7.13	7.05	7.16	7.06
F-Value	*	*	*	*	*	*

SEm±	0.17	0.17	0.17	0.17	0.18	0.18
CD at 5%	0.47	0.42	0.48	0.48	0.50	0.50

*Significant at 5 per cent

The use of natural juices or purees of orange, strawberry, and other red fruits or even fruit by-products have been considered for the manufacturing of jellies (Mutlu *etal*. 2018).These can not only improve the organoleptic properties(color, flavour, and texture) of gummies and jellies but also[the use of anthocyanin extracts, when added into gelatin and pectin gels, can provide an alternative to synthetic colorants.

MACRONUTRIENT COMPOSITION

Table 3: Macro nutrient composition of developed products (per 100g)

Products	Moisture (g)	Protein (g)	Fat (g)	Total Ash (g)	Crude Fibre (g)	Carbohydrates (g)	Energy (KCal)
Jujubes (45%)	47.55	18.25	0.20	0.80	1.00	32.20	203

Product jujubes, fresh wood apple 45% added.

Nutrient analysis of the developed products;

Table 3 depicts the WASC (Wood apple soft candy) Jujubesshowed protein content of 18.25%, had high content of moisture (47.55%), followed by carbohydrates (32.20%) and the least was observed in fat (0.2%). The crude fibre was found to be (1.00%) whereas calorific value (203 Kcal) was observed. According todeveloped for the two gummy formulations, one with orange juice and honey and the other with a mix of berries.Both formulations according to Edwards, 2002 showed moisture content valueslower than recommended (24%) for this type of product[24], thus ensuring that the moisture content and wateractivity are low and enable possibly good conservation. results showed the moisture content in the range 18–21% Edite Teixeira-Lemos et al 2021.being in accordance with previous studies, which reported awater content of 18–22% in jelly candies (Mutluand et al. 2018, Bussiere G, Serpelloni, 1985.and Periche., 2016).

Micronutrient composition

Table 4: Micro nutrient composition of developed products (mg per 100g)

Products	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Zinc (mg)	Copper (mg)	Manganese (mg)
Jujubes (45%)	154.50	69.5	0.27	0.30	0.18	0.16

Product jujubes, fresh wood apple 45% added.

Table 4 shows calcium content in jujubes is 154.50 mg, followed by 69.5gms of phosphorous.

PHYSICOCHEMICAL ANALYSIS OF WOOD APPLE PRODUCTS

Table; 5 depicts the effect of storage on pH and titrable acidity of wood apple products. An increase in pH of jujubes from 4.42 to 4.45 was observed under ambient condition for a period of nine days. Statistical analysis revealed that there was non-significant difference in pH during storage period. Titrable acidity decreased from 0.69 to 0.68 during storage period

of nine days.According to Asna Urooj., 2021, there was no change in the pH during the entire storage.

Table 5: Effect of storage on pH content and titrable acidity in wood apple products

pH		Titrable acidity	
Duration	Jujubes	Duration	Jujubes
Initial	4.42	Initial	0.69
Final	4.45	Final	0.68
Mean	4.43	Mean	0.688
F-value	NS	F-value	*
SEM±	0.005	SEm±	0.001
CD at 5%	0.021	CD at 5%	0.004

2 Effect of storage on organoleptic evaluation of the developed products

Best accepted product was selected for shelf life study. Environmental conditions may vary the sensory quality profile of products. In the present study, the effect of factors such as temperature and duration on jujubes was studied for a period of 9 days.

SENSORY SCORES OF JUJUBES

Effect of storage on sensory parameters of jujubes is depicted in Table-6. The jujubes were stored in HDPE covers and stored under both refrigerated and ambient conditions for shelf life study. Among the two conditions deterioration is rapid at ambient condition whereas decrease was slow under refrigerated conditions. Decrease in mean scores was observed for appearance (4.65), texture (5.4), colour (5.5), aroma (5.75), taste (5.2) and overall acceptability (4.6) under ambient temperature storage condition over the period of 9 days compared to initial. The sensory attributes were maintained well under refrigerated storage. Under ambient conditions overall acceptability decreased from 7.55 to 4.6 whereas under refrigerated conditions it decreases to 6.95 on 9^{th} day of storage. Temperature and duration play important role in maintaining the shelf life of product.

Table 6: Effect of storage on sensory characteristics of jujubes (n=20)

Temperature	Duration (days)	Appearance	Texture	Colour	Aroma	Taste	Overall acceptability
Ambient	Initial	8.00	7.65	7.70	7.30	7.75	7.55
	3days	6.80	7.65	8.00	7.50	7.45	7.30
	6days	5.65	7.15	7.50	6.8	6.45	7.25
	9days	4.65	5.4	5.50	5.75	5.20	4.60
Refrigerated	Initial	8.00	7.65	7.70	7.30	7.75	7.55
	3days	7.65	7.35	7.40	7.30	7.85	7.50
	6 days	7.50	6.90	6.95	7.15	7.70	7.45
	9days	7.20	6.60	6.45	6.95	7.40	6.95
Temperature	F value	**	NS	NS	**	**	**
	SEM±	0.07	0.08	0.09	0.08	0.06	0.08
	CD @ 5 %	0.21	0.21	0.24	0.23	0.17	0.22
Duration	F value	**	**	**	**	**	**
	SEM±	0.11	0.11	0.12	0.12	0.09	0.11
	CD @ 5 %	0.29	0.30	0.33	0.32	0.24	0.32
Interaction	F value	**	**	**	**	**	**

	SEM±	0.15	0.15	0.17	0.16	0.12	0.16
	CD @ 5 %	0.41	0.42	0.47	0.38	0.29	0.45

*Significant at 5 per cent level **Significant at 1 per cent level

NS- non significant

Effect of storage on microbial load of developed products

Microbial load (moulds and yeast) of the best accepted products at initial, 30th day, 60th day and 90th days of storage was estimated by using standard plate count method and results are depicted.

Table 7: Effect of storage on microbial load of jujubes

Duration	Moulds (× 10^4 CFU)	Yeast (× 10^4 CFU)
Initial	1.67	1.00
3rd day	5.00	2.67
6th day	10.33	5.00
9th day	12.33	9.00
F-value	*	*
SEM±	1.23	0.53
CD at 5%	3.99	1.72

MICROBIAL LOAD OF JUJUBES

Best accepted jujubes WAJ-1(45 g of wood apple and 30 g of sugar) was packed in HDPE and stored under ambient conditions. Table 25depicts the microbial load of jujubes and results revealed that, as the number of days of storage increased, the CFU for moulds and yeast, increased from 1.67X10^4 and 1.00X10^4 to 12.33X10^4 and 9.00X10^4, respectively for a period of 9 day. Significant difference was observed for moulds and yeast count at five per cent level. According to Asna Urooj., 2021t here was no change in the pH during the entire storage.

CONCLUSION:

The control group achieved the highest sensory ratings, followed by WAJ-1 wood apple jujubes, which incorporated 45% wood apple pulp. As the duration of storage extended, microbial contamination also escalated. Titrable acidity saw a decrease from 0.69 to 0.68 during the nine-day storage period.

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