The Andhra Agric. J 70 (2): 273-276, 2023
10.61657/aaj.2023.41

Standardisation and Quality Evaluation of Betel Leaf based Syrup

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ABSTRACT

The present study aimed to develop value added product such as syrup incorporating various proportions of betel leaf (*Piper betle* L.) along with lemon juice and ginger extract in varying composition. Organoleptic evaluation of all the treatments were carried among 15 judges and the best treatment selected from various treatments was T_1-BLE 90 %+ LJ 9 % + GE 1 %. The syrup was packed in glass bottles and stored for 3 months in refrigerated and ambient temperature. The nutritional composition of the syrup was carried in initially and at monthly intervals till 3 months. All the nutritional parameters seem to reduce as the storage period increased. The nutrients were more stable in refrigerated condition than the ambient temperature. The results of the present study suggest that betel leaves based syrup can be used as a value added product in Southeast Asia and also this can be done with incorporating other fruits in order to enhance the flavour and make it more consumers acceptable. Hence, the development of betel leaves syrup allows the consumers to enjoy the nutritional and therapeutical benefits of the leaves with a enhanced taste and ease of use.

Keywords: *Ambient temperature, Lemon, Refrigerated condition and Syrup, Tirur betel leaves.*

Betel leaf (*Piper betle* L.) is an aromatic creeper, which belongs to Piperaceae family comprising approximately 10 genera sprawling over 2000 species (Chakraborty and Shah, 2011). Betel leaf (*Piper betle* L.) is a commercial crop, which is traditionally consumed in the raw state as a mouth freshener and stimulant in Southeast Asia since antiquity (Roy and Guha, 2021). It is widely consumed in India in the form of 'Paan' or betel quid. A quid is prepared with green or decolorized betel leaf incorporating many other ingredients, such as slaked lime, areca nut chips, aniseed, clove, sweeteners, tobacco etc. The quid is chewed to get stimulating, mouth freshening and digestive effects (Garg *et al*., 2014).

The leaf is composed a variety of bioactive compounds. The leaf extract helps in curing hypertension, diabetes, brain toxin, heliotosis, boils, abscesses, headache, hysteria, itches, mastoiditis, leucorrhoea, otorrhoea, cuts and injuries, ringworm infestation, swelling of gum, voice problems, rheumatism, wound healing, obesity, conjunctivitis, constipation and abrasion (Aishwarya *et al*., 2016).

The use of fresh leaf seems to be difficult, as it have a sharp taste, which is not acceptable by all. As, the uses and benefits of betel leaves are enormous, researches on the development of value added products incorporating betel leaves is utmost important. Conversion of betel leaves into syrup is of a novel idea and also this can be done with incorporating other fruits in order to enhance the flavor and make it more consumer acceptable.

Hence, the present study aimed to develop value-added product such as syrup incorporating various proportions of betel leaves.

MATERIAL AND METHODS

Procedure for preparation of syrup: Young, fresh betel leaves collected was washed two to three times and the leaves were soaked in lukewarm water for 15 minutes to remove the dirt and other impurities. The leaves were then taken and ground into smooth paste without addition of water. The extract was then strained through mesh to get juice. The juice was clarified by adding one per cent citric acid and allowing it to settle for 4 hours. The clarified juice was then

strained carefully to remove the sediments. This clear juice was incorporated into sugar syrup along with lemon juice and ginger extract in varying composition. The syrup was prepared as per the regulations of FSSAI (2020). The treatments included in the study are T_0 - BLE 100 % ; T_1 - BLE 90 % + LJ 9 % + GE 1 % ; T_2 - BLE 80 % + LJ 18 % + GE 2 %; T_3 - BLE 70 % + LJ 27 % + GE 3 %; T_4 - BLE 60 % + LJ 36 % + GE 4 %; T_5 - BLE 50 % + LJ 45 % + GE 5 % (BLE – Betel Leaf Extract, LJ – Lemon Juice, GE – Ginger Extract)

Standardisation of syrup: Organoleptic evaluation of betel leaf syrup was conducted by using score cards by a panel of fifteen judges. Based on the organoleptic scores, the best treatment was selected for the further studies

Quality evaluation of syrup: the selected treatment was packed in glass bottles and stored for 3 months in refrigerated and ambient temperature. The nutritional composition of the syrup was carried in initially and at monthly intervals till 3 months. The standard procedures were used to estimate the nutritional composition.

RESULT AND DISCUSSION

a. Standardization of syrup

The mean organoleptic scores were calculated for the sensory parameters such as appearance, colour, flavour, texture and taste. The mean scores of the organoleptic evaluation of all the treatments are tabulated in Table 1.

The highest score for all the parameters in the present study was recorded for T_1. Based on the scores obtained for various parameters, the highest score for all the parameters was for T_1 (BLE 90% + LJ 9% + GE 1%) and so it was selected as the best treatment for the rest of the analysis. Based on Kendall's coefficient of concordance (W) value, significant agreement among judges was noticed in the evaluation of different quality attributes of betel leaf based syrup. The sensory parameters of the syrup are highly depended on the flavor, colour and taste of the fruit included in it. Similar to the present study, the appearance of all the treatments of fig leaf syrup was equally accepted by the judges. The scores for the aroma, taste and flavor was the highest for the one with mint incorporated fig leaf syrup (Li *et al.*, 2020).

Table 1: Mean organoleptic scores of betel leaves syrup

Parameters	Treatments						
	T_0	T_1	T_2	T_3	T_4	T_5	W
Appearance	8.6 (3.73)	8.79 (3.70)	8.72 (3.17)	8.73 (3.47)	8.72 (3.33)	8.76 (3.60)	0.037*
Colour	8.6 (3.37)	8.88 (4.67)	8.64 (3.43)	8.61 (3.47)	8.54 (3.13)	8.52 (2.93)	0.183**
Flavour	8.8 (4.50)	8.86 (5.07)	8.62 (3.37)	8.6 (3.20)	8.44 (2.53)	8.42 (2.33)	0.515**
Texture	8.72 (3.70)	8.93 (4.93)	8.58 (2.93)	8.79 (4.07)	8.54 (2.93)	8.47 (2.43)	0.355**
Taste	8.72 (4.03)	8.95 (5.17)	8.60 (3.30)	8.51 (2.93)	8.51 (2.93)	8.46 (2.63)	0.382**
Overall acceptability	8.71 (4.00)	8.92 (5.30)	8.62 (2.67)	8.71 (4.07)	8.55 (2.60)	8.53 (2.37)	0.503**
Total mean score	8.69	8.88	8.63	8.65	8.55	8.52	

(T_0 - BLE 100 % ; T_1 - BLE 90 % + LJ 9 % + GE 1 % ; T_2 - BLE 80 % + LJ 18 % + GE 2 % ; T_3 - BLE 70 % + LJ 27 % + GE 3 %; T_4 - BLE 60 % + LJ 36 % + GE 4 % ; T_5 - BLE 50 % + LJ 45 % + GE 5 %) (BLE – Betel Leaf Extract, LJ – Lemon Juice, GE – Ginger Extract)

**Significant at 1 % level; Values in parentheses indicate mean rank scores.

b. Quality evaluation of syrup

Total soluble sugar (TSS) was a parameter which is important in the preparation of syrups. The syrup had 65 % TSS on the initial day and it increased in both the storing condition. The variation in glass bottles stored in refrigerator was less compared to that of ambient temperature. Jadhav *et al.* (2022) developed lemon syrup and stored in ambient conditions for 12 months. The TSS of the syrup was 65 % at the initial day which increased to 66.3 % by 8 months and 67 % by 12 months. Similar pattern of increase was noticed in the present study. The TSS content of syrup increases slightly during storage owing to hydrolysis of polysaccharides into monosaccharide's and soluble disaccharides (Gould, 1983).

Acidity was evaluated in the syrup on a monthly interval for three months in both refrigerated and ambient temperature. The acidity on the initial day was 1.57 % which changed to 1.46 % in the refrigerated bottles and 1.33 % in the bottles kept in ambient temperature. Acidity of the lemon syrup stored in ambient condition as recorded by Jadhav *et al.* (2022) was 1.50 % at the initial and by 8th month it became 1.41 %, which is on par with the findings of present study.

Total sugar and reducing sugar was evaluated. The total sugar was 68.10 % and total sugar 27.19 % for the syrup. The reducing sugar content increased as the storage period increased while the total sugar content decreased as the storage period increased. The increase in reducing sugars during storage in ambient temperature than refrigerated condition may be attributed to starch hydrolysis into sugars, and greater increases in sugars may be attributed to faster reactions caused by high temperatures under ambient conditions (Bhatt *et al.*, 2022). Similar results were reported by Thakur and Thakur (2017) who developed box myrtle syrup.

Minerals such as calcium, iron, potassium and sodium were estimated in the syrup during storage. It was found that the mineral content decreased as the storage period increased. The content of calcium, iron, potassium and sodium at the initial day was 180 mg, 4.69 mg, 2.10 mg and 24.01 mg respectively. It was clear from the data recorded, that storing refrigerated condition preserved minerals for a longer period compared with stored in ambient temperature.

Beta carotene and vitamin C was also estimated in the syrup throughout the storage period at monthly intervals. Like minerals, loss of vitamins was less in refrigerated condition compared with ambient condition. The initial beta carotene was 957.85 µg and that of vitamin C is 42.08 mg. There were significant differences in the mean values of vitamin C. The ascorbic acid of lemon syrup at initial month was recorded 19.26 mg/100 g which gradually decreased and recorded 11.65 mg/100 g at 12th month storage (Jadhav *et al*., 2022). The vitamin C content of the syrup prepared in present study is higher, which may because of the incorporation of betel leaves and lemon. The degradation of ascorbic acid into dehydro-ascorbic acid or furfural may be responsible for the decrease in ascorbic acid content during storage. Since ascorbic acid is particularly heat sensitive, it degrades faster in ambient conditions than refrigerated conditions (Bhatt *et al.*, 2020). The slower auto oxidation of beta carotene in refrigerated conditions may be the improved retention of this compound in the syrup (Thakur *et al*., 2018).

Table 2 : Nutritional composition of betel leaves syrup

Nutrients	Initial		1 MAS		2 MAS		3 MAS		C. D. Value	
	R	A	R	A	R	A	R	A	R	A
TSS (%)	65	65.00^{c}	66	66.00^{bc}	66	67.00^{b}	67	69.00^{a}	NS	1.937
Acidity (%)	1.57	1.57	1.54	1.51	1.51	1.45	1.46	1.33	NS	NS
Total sugar (%)	68.10^{a}	68.10^{a}	67.95^{a}	67.50^{ab}	67.07^{b}	66.98^{b}	66.38^{c}	65.16^{c}	0.93	1.592
Reducing sugar (%)	27.19	27.19	27.72	27.84	27.98	28.02	28.17	28.98	NS	NS
Calcium (mg)	180	180	179.78	179.52	179.19	179.01	178.22	177.94	NS	NS
Iron (mg)	4.69	4.69	4.55	4.34	4.38	4.18	4.25	4.01	NS	NS
Potassium (mg)	2.1	2.1	2	1.95	1.91	1.83	1.88	1.34	NS	NS
Sodium (mg)	24.01^{a}	24.01^{a}	24.00^{a}	23.98^{a}	23.87^{a}	23.05^{b}	23.08^{b}	22.77^{b}	0.346	1.049
Beta Carotene (µg)	957.85	957.85^{a}	956.04	951.15^{b}	954.29	943.38^{c}	952.41	933.24^{d}	NS	2.764
Vitamin C (mg)	42.08^{a}	42.08^{a}	41.89^{ab}	39.84^{b}	41.13^{bc}	38.12^{c}	40.92^{c}	36.85^{d}	0.886	1.645

MAS – Month after storage

R – refrigerated condition ; A – ambient temperature

Betel leaves are known as 'Neglected Green Gold'. Despite the fact that they are beneficial in the treatment of many ailments, they are often overlooked by customers who believe the myths. The inclusion of betel leaf into value added products such as syrup allows consumers to use and benefit from the leaves' positive effects. The study was successful in developing syrup by combining betel leaves and lemon juice. The study also looked into different ways to store the syrup, such as refrigerated and at room temperature. The results showed that storage in refrigerated circumstances locked in more nutrients than storage at room temperature. More research is needed to understand the bioactive chemicals in the product.

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Received on 07.04.2023 and Accepted on 30.06.2023