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A STUDY ON NUTRITIONAL AND ORGANOLEPTIC PROPERTIES OF HERBAL TEA DEVELOPED USING DRY BAEL LEAVES AND ITS POWDER

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Abstract: Herbal tea is commonly considered as an immunity booster with many therapeutic benefits. The purpose of this study was to determine the nutritional properties and organoleptic properties of herbal tea developed using either bael leaf powder (commercially available) or dried bael leaves. Tulsi, ginger, and cardamom were the other flavor-enhancing herbs and spices used in this herbal tea. The samples with different concentrations were prepared and standardized. The organoleptic acceptability of all the herbal tea samples was assessed using a nine-point hedonic scale. The commercial lab analysis of the final herbal tea samples and the control herbal tea sample (without bael leaves) was performed to obtain tannins, iron, and saponin content. The most acceptable herbal tea samples were powdered bael leave with tulsi and dry bael leave with cardamom. The iron and saponin concentrations in powdered bael leaves with ginger herbal tea were 21.30 mg and 148 mg per 100 g; dry bael leaves with ginger herbal tea contained 19.25 mg and 142 mg per 100 g, whereas the control herbal tea contained 3.90 mg and 12.39 mg per 100 g, respectively. There were no tannins in any of the samples. As a result, it is advised to drink this tea 3-5 times per day to reap the benefits of its therapeutic properties.

***Keywords*- Bael leaves, aegle marmelos, antioxidants, herbal tea, saponins, tannins**

1. INTRODUCTION

The scientific name for bael is *Aegle marmelos*. The bael tree is a medium-sized tree which can grow up to a height of 1200 metres. [1] The plant includes a variety of active ingredients for a wide range of therapeutic applications. The bael fruit can be consumed as a juice or as a shake. It is also available in the form of candies, murabbas, squash, jellies, toffee, probiotic chocolates, Ready To Serve, etc.[2,3] Bael leaves contain a variety of bioactive compounds that can aid in the treatment of a variety of ailments, but they are only available on the market as a powder. The bael fruit and leaves have been reported to show various properties like antioxidant [4,5,6,7], anti-ulcer [3,4], antibacterial [8,9], antifungal [3,4,10,11], antiviral [3,4,10,12,13], anticancer [6,12,14,15,4], radioprotective [4], anti-inflammatory [3,12,16,17], anti-diabetic [4,5,7,18], antihypercholestrolemic, antilipidemic [4,19,20,21] etc. The bael leaves have also shown some properties such as immunomodulatory, neuroprotective, anxiolytic, antidepressant, antihistaminic, antithyroid, etc. [3, 4, 12, 22, 23, 24, 25, 26]

Various compounds like **skimmianine, aegelin, lupeol, cineole, citral, citronellal, cuminaldehyde, eugenol,** and **marmesinin** have been found in the leaves of bael. [4, 27–38] According to some sources, the presence of skimmamine has an anti-cancer effect.[40] Sedative, hypnotic, analgesic, anticonvulsive, antipyretic, antimalarial, hypothermic, and antidiuretic effects are all present. [4, 12, 36, 37] Table 1 shows the nutritional values of bael leaves per 100gm.

Table 1- Nutritional Value of Bael leaves (Amount: 100g) [41]

Nutrients	Amount in bael leaves
Moisture	66.6gms
Crude protein	5.9 gms
Crude fat	1.8 gms
Crude fiber	14.8 gms
Energy	47 Kcal
Zinc	6.5 gms
Chromium	19.5 gms
Iron	22.5 gms
Tannins	2.3 gms
Saponins	3.7 gms
Phytic acid	0.6 gms

There have been no studies on the production of food or beverages from bael leaves, and since tea is a common beverage among Indians, the development of herbal tea from bael leaves could appeal to them and provide therapeutic benefits. It may be difficult to consume bael leaves because of their jittery flavour, but adding tulsi, cardamom, or ginger to the herbal tea will not only boost the flavour but also the benefits. The purpose of this study was to standardise and evaluate the nutritional constituents as well as the consumer acceptability of herbal tea made from its leaves in powdered as well as dried form.

2. MATERIALS AND METHOD

The bael leaves were procured from Faridabad. The bael leaves were gathered and washed twice with fresh water before being dried in the sun for 2-3 days. After drying in the sun, the leaves were crushed. During the pandemic, the bael leaf powder was obtained via e-commerce. The other ingredients, such as tulsi, ginger, and cardamom, were purchased from a local market. The samples were prepared in the laboratory of Manav Rachna International Institute of Research and Studies (MRIIRS), Faridabad.

TABLE 2: Different variations of herbal tea using bael leave powder or dry bael leaves in experiment 1 & 2

	CONTROL SAMPLE (C.S)	SAMPLE A1/B1	SAMPLE A2/B2	SAMPLE A3/B3
BAEL LEAVES POWDER /DRY LEAVES	-	1 gm	1 gm	1 gm
TULSI	0.5 gm	0.5 gm	-	-
CARDAMOM	0.5 gm	-	0.5 gm	-
GINGER	1 gm	-	-	1 gm

C.S- Control Sample; A-samples containing bael leaves powder + other spices; B-samples containing fresh bael leaves + other spices

The different variations of herbal tea were prepared and the concentrations of samples are given in table 2. The tulsi, cardamom or ginger were adding variety and flavor to the herbal tea. The powder or dried leaves were added to 1 cup (250 ml) of water and it was boiled for 2.5 minutes in each variation. In control sample tulsi, ginger, and cardamom were combined in a cup of water and boiled for 2.5 minutes. The samples of different variations prepared in the college laboratory have been shown in Images 2.1 and 2.2.

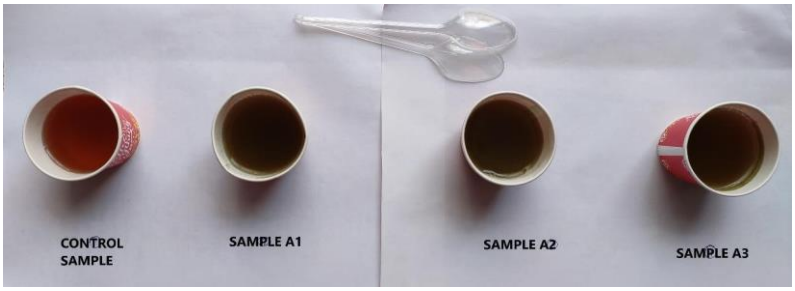

IMAGE 2.1: Samples of Experiment 1 prepared in the laboratory

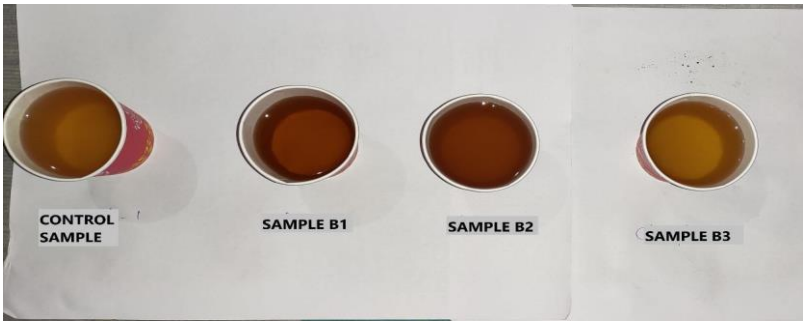

IMAGE 2.2: Samples of Experiment 2 prepared in the laboratory

2.1 Sensory evaluation

A nine-point hedonic scale, ranging from extremely liked to extremely disliked (9-1) was used for sensory evaluation. The 35 untrained panel members from the college had done the sensory evaluation of samples prepared by bael leaf powder and dried bael leaves. Due to the COVID-19 situation, safety precautions were taken during sensory assessment. For the testing, each panel member was given disposable spoons for different samples. In the sensory evaluation, color, flavor, aroma, aftertaste, and overall taste were considered as organoleptic characteristics.

2.2 Determination of iron, tannin, and saponin content in the developed product.

The estimations for iron, tannins and saponins were conducted among three samples – CS, A3 and B3 (selected randomly). The laboratory tests were conducted at Opal Research & Analytical Services, Ghaziabad using 100 mL of each selected samples. The colorimetric method was used to determine the amount of iron in the sample.[38] The method by Kiyoshi Iwasa (1975) was used for the estimation of tannins in products.[40] Saponin was quantified using the methods described by Ejikeme et al. and Obadoni and Ochuko.[43]

3. RESULT AND DISCUSSION

3.1 Sensory evaluation

Organoleptic characteristics color, flavor, aroma, aftertaste, and overall taste of the herbal tea were tested by 35 members.

3.1.1 Organoleptic characteristics of herbal tea with bael leaf powder

The mean scores obtained in each organoleptic characteristic of the samples prepared using bael leave powder are given in table 3. The sample A1 was most acceptable as compared to the other two variations of herbal tea.

TABLE 3- Mean scores of organoleptic characteristics of sample with bael leaves powder

SAMPLES/ ATTRIBUTES	COLOUR	AROMA	FLAVOUR	AFTER TASTE	OVERALL ACCEPTABILITY
C.S	6.8±1.6	7.2±1.5	6.8±1.4	7±1.5	6.9±1.7
A1	7.0±1.1	7.1±1.4	6.7±1.4	6.8±1.3	6.9±1.4
A2	6.8±1.8	6.8±1.5	6.6±1.8	6.2±2.0	6.8±1.4
A3	6.6±1.5	6.4±1.6	6.4±1.9	6.1±1.9	6.6±1.7

The values reflect the mean ± SD

C.S- Control Sample; **A1** – Sample of herbal tea containing bael leaves powder and tulsi; **A2**– Sample of herbal tea containing bael leaves powder and cardamom; **A3** – Sample of herbal tea containing bael leaves powder and ginger

3.1.2 Organoleptic characteristics of herbal tea with dry bael leaf

Acceptability of the prepared sample by sensory evaluation of experiment 2 has been shown in table 4. The mean scores obtained in each organoleptic characteristic of the samples prepared using dry bael leave powder was given in table 4. The sample B2 was most acceptable as compared to the other two variations of herbal tea. The B2 sample was equally accepted as the control sample.

TABLE 4- Mean scores of organoleptic characteristics of sample with dry bael leaves

SAMPLES/ ATTRIBUTES	COLOUR	AROMA	FLAVOUR	AFTER TASTE	OVERALL ACCEPTABILITY
C.S	7.45±1.4	7.22±1.5	7±1.59	6.97±1.79	7.4±1.35
B1	7.48±1.35	6.86±1.6	6.62±1.75	6.22±2	6.82±1.82
B2	7.62±1.57	6.85±1.95	6.94±1.9	6.65±2.14	7.2±1.51
B3	7.05±1.86	6.54±1.78	6.42±2.04	6.08±2.25	6.68±2.01

The values reflect the mean± standard deviation of 35 panelists.

C.S- Control Sample; **B1** – Sample of herbal tea containing dried bael leaves and tulsi; **B2**– Sample of herbal tea containing dried bael leaves and cardamom; **B3** – Sample of herbal tea containing dried bael leaves and ginger

3.2 **Content of iron, saponin, and tannin**

TABLE 5 – Estimation of iron, tannin and saponin content in the developed products

SAMPLES/ TEST RESULTS	IRON (mg/100gm)	TANNINS (mg/100gm)	SAPONINS (mg/100gm)
C.S	3.90	Absent	12.39
Sample A3	21.30	Absent	148
Sample B3	19.25	Absent	142

C.S- Control Sample; **A3** – Sample of herbal tea containing bael leaves powder and ginger; **B3** – Sample of herbal tea containing dried bael leaves and ginger.

The table 5 shows the content of iron, saponin and tannin present in CS, A3 and B3 samples. The iron content was found to be highest in sample A3 (21.30 mg/100 g). In sample B3, it was 19.25 mg/100 g. The iron content in the control sample was 3.90 mg/100 g.

The saponin content of the herbal tea sample with powdered bael leaves (A3) was 148 mg/100 g, which is higher than the saponin content of the herbal tea sample with dried bael leaves (B3) (142 mg/100 g). The control sample has the least saponin, with 12.39 mg/100 g. In all of the samples, the tannin amount in the formulated product was found to be zero.

3.3 **Proximate analysis**

The proximate composition including energy, protein, iron, chromium and zinc content per 100g of each variation of herbal tea samples has been given in table 6. The values of each nutrient in Experiment 1 and 2 were equal in all variations.

TABLE 6 –Proximate analysis (per 100 g sample)

SAMPLES	ENERGY (Kcal)	PROTEIN (g)	ZINC (mg)	CHROMIUM (mg)	IRON (mg)
C.S	195	8.9	4.6	-	7.3
A1/B1	60	7.4	6.9	0.195	24.07
A2/B2	160	11	7.9	0.195	24.8
A3/B3	115	8.2	8.4	0.195	26

C.S- Control Sample; **A1** – Sample of herbal tea containing bael leaves powder and tulsi; **A2**– Sample of herbal tea containing bael leaves powder and cardamom; **A3** – Sample of herbal tea containing bael leaves powder and ginger; **B1** – Sample of herbal tea containing dried bael leaves and tulsi; **B2**– Sample of herbal tea containing dried bael leaves and cardamom; **B3** – Sample of herbal tea containing dried bael leaves and ginger.

INSTRUCTIONS- The calculations of proximate analysis have been done according to the table given in reference 41.

4. DISCUSSION AND CONCLUSION

The goal of the study was to prepare the herbal tea with bael leaf powder or dried bael leaves. According to Satchithanandam's research in 2008, between 9 mg and 420 mg of saponins can be comfortably consumed per person per day. Saponin has various therapeutic effects like antioxidant, antimicrobial, anticancer, etc in low amount. The saponin concentration of dried bael leaves was 142 mg/100g, but the saponin content of powdered bael leaves was 148 mg/100g. As a result, it can be stated that a person can safely consume 3-5 cups of bael leaves herbal tea per day prepared using 1-2g of bael leaf or its powder. In addition, unlike tea, there were no tannins in the result, which is good for iron absorption. The iron content of beal leaf herbal tea is quite high. The sensory evaluation of the different variations of bael leaf herbal tea revealed that all of them are easily acceptable by consumers. The bael tree is commonly found in many states of India, so the leaves could be easily procured and tea can be prepared at home using the ingredients of one's choice. Like bale fruit, bael leaves can also be used to make a variety of food products. However, there are no commercially marketed bael leaf products. It can be used in diabetic food products. The powdered bael leaves can be incorporated into other foods, such as cookies, to increase the health benefits of the food.

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