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Development of Nutra tea using Cluster fig (*Ficus racemosa)* and Arjuna (*Terminalia arjuna)* bark blends with black tea

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Abstract
The present study reports, the nutrient composition, total phenolic content and utilization potential of *Ficus racemosa* stem bark and *Terminalia arjuna* bark as an ingredient in tea, a popular non alcoholic beverage. The bark was found to be a good source of dietary fibre, minerals, and phenolic compounds. Further, the bark powder was used as an ingredient in the preparation of tea and the bark incorporated black tea (nutra tea) was found to contain significantly higher amounts of phenolic compounds compared to control tea. Sensory analysis of the nutra tea indicated no perceptible off-taste or off-aroma and the overall quality was similar to that of control and was acceptable in terms of all sensory attributes. The results suggest that the bark could be effectively used in the preparation of tea to derive its beneficial effects particularly attributable to those of phenolics.

Keywords: Ficus racemosa, Terminalia arjuna, black tea, Nutra tea

1. Introduction
Tea is one of the most popular beverages in many countries. It is the second most consumed drink in the world, but consumption habit varies between different countries. Incidence of different diseases varies widely across the world and many investigators relate these differences to diet including habitual tea drinking. It is consumed mostly as green tea and black tea where other forms such oolong; red or white teas are less popular. Green tea was extensively investigated on its health benefits but black tea is only now catching the serious attention of scientific community. Compounds contained in black tea such as theaflavins and thearubigens contribute to black tea dark color and distinctive flavor. Various bioactive compounds their bioactivity and relation to diseases, bioavailability with special attention to health benefits of black tea [1, 2, 3].

Ficus racemosa Linn is an evergreen, moderate to large sized spreading, lactiferous, deciduous tree, without much prominent aerial roots found throughout greater part of India in moist localities and is often cultivated in villages for its edible fruit. Different parts of F. racemosa are traditionally used as fodder, edible and ceremonial. All parts of this plant (leaves, fruits, bark, latex, and sap of the root) are medicinally important in the traditional system of medicine in India. The leaves powdered and mixed with honey is given in bilious infections. Fruits are a good remedy for visceral obstruction and also useful in regulating diarrhea and constipation. The astringent nature of the bark has been employed as a mouth wash in spongy gum and also internally in dysentery, menorrhagia and haemoptysis. The bark is antiseptic, antipyretic and vermicidal, and the decoction of bark is used in the treatment of various skin diseases, ulcers and diabetes. It is also used as a poultice in inflammatory swellings/boils and regarded to be effective in the treatment of piles, dysentry, asthma, gonorrhea, gleet, menorrhagia, leucorrhea, hemoptysis and urinary diseases [4, 5, 6, 7].

Ficus racemosa Stem-Bark consist phytochemicals like Tannin, wax, saponin gluanol acetate, β-sitosterol, leucocyanidin- 3 – O – β – D - glucopyrancoside, leucopelargonidin – 3 – O – β – D - glucopyranoside, leucopelargonidin – 3 – O – α – L - rhamnopyranoside, lupeol, ceryl behenate, lupeol acetate, α-amyrin acetate, leucoanthocyanidin, and leucoanthocyanin from trunk bark, lauanol acetate, lupeol, β-sitosterol and stigmasterol were isolated from stem bark [8].

Terminalia arjuna is a miracle herb which was used during ancient times to cure heart problems. In ancient Ayurvedic literature, Vagbhata and others have described the juice of Arjuna bark as a tonic and astringent. They have recommended it for the treatment of heart diseases. Arjuna is reported to be a beneficial herb in treating heart problems since 1200 B.C. Vagbhatta was the first to cite this in his book ‗Astang Hridayam' written some 1200 years ago. Modern research has discovered that *Terminalia arjuna* has antioxidant properties and may be clinically helpful in cardiovascular health. A deciduous tree found abundantly in the Indian subcontinent, *Terminalia arjuna* is a heart stimulant that can prove effective in the treatment of a number of heart conditions. Found commonly in the Himalayan region, the bark of the plant is used by traditional Indian medicine for a number of herbal preparations to treat cardiac disorders [9]. Terminalia arjuna stem bark consist phytochemicals like Triterpenoids: arjunolic acid, arjunic acid, arjunin, arjungenin, terminic acid,Glycosides: arjunetin, arjunoside II, arjunoside I,arjunaphthanoloside, terminoside A, β-Sitosterol, Flavonoids: arjunone, bicalein, arjunolone, luteolin, ethylgallate, gallic acid, kempferol, pelorgonidin, quercetin, oligomeric proanthocyanidins), Tanins: terflavin C, castalagin, punicallin, casuarinin, punicalagin, terchebulin, casuariin, pyrocatechols [9, 10, 11, 12].

2. Materials and Methods

2.1 Plant material

The *Terminalia arjuna* bark is collected from local place Sangamner, Ahmednagar, MH. And *Ficus racemosa* bark from Akole, Ahmednagar, MH. The fresh bark having a higher moisture content so it's required to dry. Sun drying of both barks for 5 days then ready to use for analysis. The foreign matter was discarded from it. The bark along with plant parts, would be well separated from it. The bark having a suitable moisture content for grinding is 6-8 %.

2.2 Identification of plant samples

The collected samples must be identified elsewhere. Reviewing the flora of the region to compile a list of the plants that are in interest and to separate them from the plants that are to be avoided. To aid the identification, taxonomic experts should identify the plant species with a permanent scientific record or in case of a voucher specimen, the plant with the reproductive organs must be submitted to the major institutions or herbaria of the source country.

2.3 Proximate composition

The moisture, protein, fat and ash contents were determined using the standard AOAC methods of analysis (AOAC, 1984; AOAC, 1986). Vitamin C was determined by indophenol dye method. Dietary fibre content was determined by the method of Aspet al., (1983)

2.4 Determination of Total Polyphenols (TP)

Total phenolic content was determined by the Folin–Ciocalteu method. Two hundred microliters of diluted sample were added to 1 mL of 1:10 diluted Folin–Ciocalteu reagent. After 4 min, 800 mL of saturated sodium carbonate solution (75 g/L) was added. After 2 h of incubation at room temperature, the absorbance at 765 nm was measured in triplicate. Gallic acid (0–500 mg/L) was used for calibration of standard curve. The results were expressed as milligram gallic acid equivalent (mg GAE)/g dry weight of plant material.

2.5 Product development

The formulation of Nutra tea is given in Table 1. Briefly, to 120 mL of boiling water, a mixture of coarsely powdered tea leaves (TATA Tea gold, Tata Consumer Products, India) and F. racemosa bark powder and *Terminalia arjuna* bark powder (100 mesh BS) was added, boiled over low flame (3 min), removed from fire and kept covered for 5 min. It was strained through muslin cloth fitted into a tea strainer. The samples were maintained at 60 - 65°C and served to the panelist for sensory evaluation.

Table 1: Composition of Nutra tea samples. (T0=Control tea) (T1 to T8, increasing order of bark powder)

Ingredients/T (%)	S0	S1	S2	S3	S4	S5	S6	S7	S8
Terminalia Arjuna	0	22	24	26	28	30	32	34	36
Ficus Racemosa	0	2	4	6	8	10	12	14	16
Tata Tea Gold	100	73	67	61	55	50	43	37	31
Sugar	50	50	50	50	50	50	50	50	50

2.6 Sensory analysis

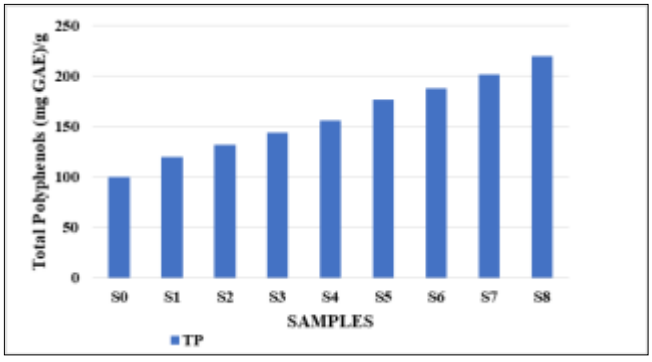
Samples were served hot (60 - 65°C) in containers coded with three digit random numbers, to the panelists. Plain water and bland biscuits were served as palate cleansers, along with the samples. Sensory analysis of tea samples was carried out in "Sensory Booths" under white fluorescent light, with the booth area maintained at a temperature of 20 ± 2°C and RH 50 ± 5%. Descriptors for the quality of tea were generated by 'Free choice profiling' and suitable ones were listed on the score card developed.

Sensory analysis of the nine samples of Nutra-tea was carried out by a trained panel of 10 members. "Quantitative Descriptive Analysis" (QDA) method was employed for this purpose, using a scale of 0 - 15 cm. This scale was anchored at 1.25 cm on either end as 'Low' and 'High' representing 'Recognition Threshold' and 'Saturation threshold' respectively. Panelist were asked to mark the perceived intensity of each attribute listed on the score card by drawing a vertical line on the scale and writing the code number. The scores for each attribute for a given sample were tabulated, representing the judgment of individual panelists. Finally, mean value was taken for each attribute of a sample, representing the panel's verdict about the sensory quality of the product. This is represented graphically as "Sensory Profile".

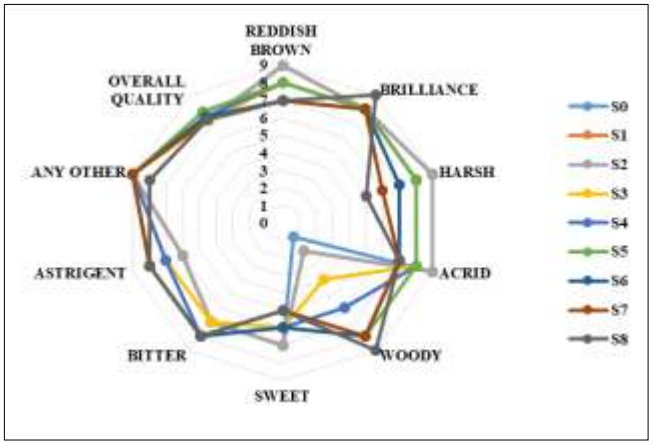
3. Results and discussion

Table 2: Proximate Composition (dry basis)

Nutrients	*Ficus racemosa* (%)	*Terminalia arjuna* (%)
Moisture	7.4	7.1
Protein	4.1	3.9
Fat	2.3	3.1
Total ash	13.6	14.5
Starch	6.5	6.9
Total dietary fibre	19.6	21.6



Graph 1: Total Polyphenols



Graph 2: Sensory Analysis

3.1 Proximate analysis

The proximate composition of the *F. racemosa* bark and *Terminalia arjuna* is presented in (Table 1) On dry basis, *F. racemosa bark* the moisture content it was relatively low (7.6%). Although the bark contained lower total dietary fibre (19.6 %) it was comparably higher than that of Arjuna bark, which contained 21.6% of crude fibre. The total starch content was low (6.5% and 6.9%), The protein content was 4.1 % which is comparatively higher than that of *Ficus racemosa* bark. The lipid content was found to be 2.3% in *Ficus racemosa* and 3.1% in *Terminalia arjuna.*

3.2 Total polyphenol content

The concentration of TP was estimated in the tea decoction and expressed in gallic acid equivalents (Graph 1). Nutra tea was found to contain significantly higher amounts of phenolic compounds than the control tea (both with sugar and with aspartame) indicating its usefulness in counteracting free radical induced oxidative damage within the body as phenolics are reported to scavenge free radicals, thus protecting the cells from oxidative damage.

3.3 Sensory analysis

Results of sensory analysis are presented in Graph 2. The results indicated that S1 to S5 were slightly darker in color compared to S6 to S8. The trend of ratings for brilliance, harsh, acrid and woody notes was similar in all the nine samples. Bitterness and astringency were rated slightly higher in these last three samples but this did not affect their overall quality, which was above 8.5. There was no perceptible off-taste or off-aroma in the experimental samples S1 to S5, with well overall quality. This indicated that the sample S5 containing the *F. racemosa* bark and *T. arjuna* bark powder extract were acceptable. The present investigation has revealed that the *F. racemosa* bark and Arjuna bark is an excellent source of particularly traces elements and total phenolics as well. The results demonstrate that *F. racemosa* bark and Arjuna bark could be effectively used in the preparation of tea without influencing sensory attributes as reflected by the sensory studies. Nutra tea could serve as a source of natural phenolics thus providing health benefits. Nevertheless, more work needs to be carried out in order to bring out the commercial usage of *F. racemosa* bark and Arjuna bark as an ingredient in tea.

4. Conclusion

The present investigation has revealed that the *F. racemosa* bark and Terminalia Arjuna bark is an excellent source of traces elements and total phenolics as well. The results demonstrate that *F. racemosa* bark and Terminalia Arjuna bark could be effectively used in the preparation of tea without influencing sensory attributes as reflected by the sensory studies. Nutra tea could serve as a source of natural phenolics thus providing health benefits. Nevertheless, more work needs to be carried out in order to bring out the commercial usage of *F. racemosa* bark and *Terminalia Arjuna* bark as an ingredient in tea. The results revealed that the. The appropriate composition of *Terminalia Arjuna* (30%) Ficus Racemosa (10%) incorporated nutra tea had the highest overall quality characteristics when compared to the other treatments combinations.

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