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Blended tulsi-drumstick herbal tea: Quality and organoleptic properties

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Abstract
Background: Herbal tea is consumed as a refreshing drink for its health benefits and potential therapeutic properties. Herbs such as tulsi and moringa are rich in phenols and antioxidants, which offer several health benefits.
Methods: This investigation was carried out during 2019-20, the leaf samples were collected from the field at the college campus. Tulsi and moringa leaves were cleaned and dried by using tray drier, blended in different proportions with green tea. The blended herbal tea powder was assessed for moisture, water activity, TSS, phenols and antioxidants. Tea was prepared from these blends and organoleptic analysis was carried out.
Result: The moisture content, water activity, TSS, phenols and antioxidants ranged from 7.30±0.058 - 8.70±0.035%, 0.24±0.00- 0.34±0.00, 4.41±0.006^{g} - 8.52±0.006$^{a^{o}}$B, 60.84±0.00^{h} 125.08±0.0058^{a} mg GAE 100g^{-1}, 89.16±0.0126^{i} - 93.47±0.100^{a}%, respectively. All the herbal tea samples were in organoleptically acceptable range.

Keywords: Antioxidant activity, herbal tea, moringa beverage, tulsi-moringa leaf tea, tulsi beverage

Introduction

Herbal tea is a tea brewed from leaves, flowers, fruits, stems, *etc*, of plant species other than the leaves of *Camilla sinensis* L. (Zhao *et al*., 2013) [14]. They are generally consumed for their therapeutic and refreshing properties since it can help to induce relaxation. In addition to serving as a beverage, many are also consumed due to a perceived medicinal benefit. Indigenous herbs in spite of their enormous dietary and nutritional potential are in general highly under-exploited. It is therefore imperative to explore the potential of indigenous plant materials in the development of new herbal tea.

Drying herbs help prevent microbial growth and the low water activity and moisture hampers biochemical changes. Incidentally, drying is known to cause certain changes in the herb's appearance and aroma owing to the synthesis or loss of volatile compounds or through oxidation and esterification processes, which may increase the herb's quality. The antioxidant potential of Ocimum is mainly due to the presence of polyphenolic compounds, which are prone to chemical and enzymatic oxidation during processing, cooking, and storage (Jyotsha *et al*., 2018) [5]. Antioxidants are essential in the food industry as they offer whole lot of benefits resulting from their free radical neutralizing ability and positive effect on human health (Rabeta and Lai, 2013) [10].

Tulsi (*Ocimum tenuiflorum*) is one of the most important household medicinal plant in India. It is been regarded as sacred due to its medicinal importance and is generally advocated for common cold, cough, fever and many other ailments. Leaves of *Ocimum tenuiflorum* have been shown to possess hypo-glycaemic effects experimental animals (Buddhadev *et al*., 2014) [1]. Tulsi is packed with higher content of phenols, higher antioxidant activity and has many therapeutic properties. Tulsi is also aromatic and has a very pleasing flavour, which provides a better feeling of freshness and relaxation after being consumed. Tulsi has been used in traditional systems to make beverages like kashaya, which has been perceived to have many health benefits.

Moringa is a wonder crop of tropics and is a cornucopia of nutrients for humans. It is a dry land crop. Moringa leaves are not generally consumed though it is of high nutrition value, because of its not so likeable flavour and taste. It is also rich in flavonoids and has therapeutic and medicinal benefits.

Green tea is now one of the most sought after beverage in the world. Green tea is very high in phenols and antioxidants. It is mainly consumed because of its higher antioxidant activity and potential anti-cancerous properties. The main lacking factor of green tea is that it doesn't have a characteristic flavour and taste. So, to make green tea a taste sensation with added medicinal benefits and to explore the potential of Moringa and Tulsi as herbal tea this study was formulated.

Materials and Methods

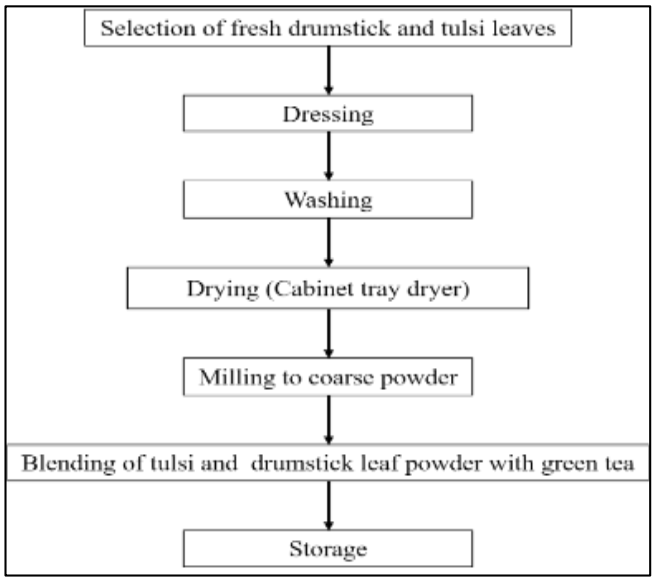
The present study was conducted in Post-Harvest Technology Laboratory, College of Horticulture, Venkataramannagudem, Dr. YSR Horticulture University, Tadepalligudem, Andhra Pradesh, India.

Source of materials

Fresh drumstick leaves of variety PKM-1 and tulsi variety Cim Ayu were harvested from field located in College of Horticulture, Venkataramannagudem. Mature and immature drumstick leaves along with petioles and rachis were harvested. Tulsi leaves both mature and immature were harvested.

Samples preparation

All the collected leaves of drumstick and tulsi were inspected thoroughly and foreign materials; dead, diseased, yellow and decayed leaves were removed. The leaves were washed thoroughly. The leaves were spread on clean trays and allowed to fan dry to remove excess surface moisture.



Flowchart of the preparation and blending of herbal tea

Dehydration and milling the leaves

The air-dried leaves were then placed in tray drier and dehydrated at 60 °C for 17 hours in case of drumstick leaves and at 65 °C for 18 hours in case of tulsi leaves till the constant moisture content 8-9% was reached. Dried leaves were powdered using electric miller to a coarse consistency.

Blending of the leaf powder samples

They were then blended in different ratios as given in the table along with 20% green tea (Korakundah organic green tea was purchased from local market). Initial observations were recorded and they were packed airtight leaving little to no airspace in different packaging materials like LDPE 200 gauge, aluminium pouch and PET bottles. The ratio of blending of different treatments is given in Table 1. The treatment blends are presented in Figure 1 where the differences in the colours among the treatments can be observed.

Table 1: Blending ratios of the leaf powders

Treatments	TLP (%)	MLP (%)	GT (%)
T_1	70	10	20
T_2	60	20	20
T_3	50	30	20
T_4	40	40	20
T_5	30	50	20
T_6	20	60	20
T_7	10	70	20
T_8	-	-	100

TLP- Tulsi leaf powder, MLP- Moringa Leaf powder, GT- Green tea

Moisture analysis

SHIMADZU digital Infrared moisture analyser (model MOC63u) was used for determination of Moisture content of the samples, 200 mg sample of the herbal tea powder was used for the determination of moisture at 170 °C and the moisture content displayed directly on percentage basis.

Water activity

The water activity of the dried powders and herbal tea powders was determined by using a digital water activity meter (Novasina Climmate). Water activity was read directly by the instrument by inserting the probe into the sample-containing bottle and the observations were recorded.

Total soluble solids

The total soluble solids (TSS) of herbal tea powder samples were determined with the help of digital hand refractometers. The refractometer was adjusted at 0 ºBrix with the help of distilled water. It was cleaned by absorbent cotton and dried. The powdered samples were diluted in the ratio of 1:4 with water. TSS was measured by placing a drop of the sample on the glass disc (Atago pocket refractometer, Japan range 0-85ºBrix) and the TSS value was read as ºBrix (Ranganna, 1995) [11].

Antioxidants

The amount of 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity of the samples was assessed by using a method described by Eghdami and Sadeghi (2010) [2]. Sample of weighing 0.1 g or 0.1 ml of methanol (Blank) was combined with 3.9 ml of a 25 mg L^{-1} methanolic solution of DPPH. Methanol used as a blank. The mixture was mixed thoroughly for a minute. The samples were then kept for 30 minutes at 37 °C temperature in the dark and then the absorbance was read against blank at 517nm.

DPPH free radical scavenging activity (%) was calculated by using formula

$$\text{DPPH (\%)} = \frac{\text{A 517 nm of control- A 517 nm of sample}}{\text{A 517 nm of control}} \times 100$$

Phenols

Total phenol content in the sample was assessed as per the

Folin Ciocalteau Reagent (FCR) method (Sadasivam and Manickam, 2005) [12]. The herbal green tea powder of weight 0.5 g was taken and ground in 10 times volume of 80 per cent ethanol with the help of pestle and mortar. The solution was centrifuged at 10000 rpm for 20 minutes. Save the supernatant and re-extract the residue with five times volume of 80% ethanol, centrifuge and pool the supernatants. Supernatants was allowed to evaporate to dryness. To that, 5ml of distilled water was added and the residue was dissolved. A 0.5 ml aliquot of the filtrate was placed in a test tube with 2.5 ml distilled water, 0.5 ml FCR reagent, and 2 ml 20 percent sodium carbonate and heated for 1 minute in a water bath. The contents of the test tube were then cooled, completely mixed, and the absorbance was measured using a spectrophotometer at 650 nm. With the use of a standard graph and gallic acid, the total phenol content was estimated and represented in milligram gallic acid equivalents per gram.

Organoleptic analysis

The amount of powdered herbal tea powder was standardized as having 1 teaspoon of herbal tea powder by trial and error having highest acceptability and was served with honey and lemon juice.

Sensory evaluation of different blends of herbal tea was carried out by a panel of semi-trained judges consisting of teaching staff and students of College of horticulture Venkataramannagudem. The samples were three letters coded and the sensory characters *viz*., colour, aroma, taste, mouthfeel, astringency and overall acceptability were evaluated on a 9-point hedonic scale as described by Ranganna (1995) [11].

Statistical analysis

The data was analysed by using completely randomised block design as given by Panse and Sukathme (1985) [8] and means were taken for comparison and interpretation of results. The experiment consisted of 8 treatments and was replicated thrice.

Results and Discussion

Moisture and water activity

Moisture content and water activity are most important parameters for dehydrated products for both their quality and safety. Cabinet tray dehydrated blends of herbal tea powder showed a significant variation, the highest moisture content was recorded in (T_1) 8.70±0.035 per cent followed by (T3) 8.47±0.150 per cent and the lowest moisture content was recorded by (T8) 7.30±0.058 per cent, however this variation was a result of moisture contents of the individual ingredients. The moisture content of the herbal tea blends decreased with the increase in drumstick leaf powder content in blends, similar results were found by Shiriki *et al.*, (2015) [13] and Premi and Sharma (2017) [9] which may be due to lower initial moisture content of the drumstick powder. With the increase in tulsi powder content in the blends, the moisture content also increased similar results found by Jabez *et al.* (2015) [4] this may be due to the higher moisture content initially present in tulsi powder Premi and Sharma (2017) [9]. However, the relative moisture content of all the treatments was well within the range of safety.

Water activity of the herbal tea powders was in the safe category for all samples and the lowest water activity was recorded in T_8 (0.24). The water activity of the treatments increased gradually from T_8 to T_1 corresponding to the moisture content. This is expected because water activity is a function of moisture content of the food.

TSS

TSS of the treatments varied significantly the highest TSS (8.52±0.006) was observed in T_7 and the lowest TSS (5.06±0.006) was recorded in T_8. TSS of the blends increased with the increase in the moringa leaf powder content.

Phenols

Phenols are secondary metabolites extensively distributed in the medicinal plants, vegetables, fruits and a variety of beverages such as fruit juices, wine and tea (Pandey *et al*., 2009) [7]. They not only impart nutritional value but also plays a vital role in maintaining the health of individuals act as antioxidant, anti-inflammatory, antidiabetic, antiviral, etc. So, the analysis for polyphenols was conducted and reported in the table 1. It has been observed that polyphenols content varied significantly among the treatments and green tea (T_8) was found to be highest *i.e*., 125.08±0.0058 mg GAE g^{-1} followed by (T_1) 63.39±0.0058 mg GAE g^{-1} and the treatment (T_7) 60.84±0.00 mg GAE g^{-1} recorded lowest phenols content. This may be due to higher inherent polyphenol content of green tea. With the exception of T_8 treatment, all other treatments showed an increasing trend of phenols with the increase in tulsi powder content.

Antioxidants

Among the treatments the highest antioxidant activity was recorded in T_1 it was observed that the antioxidant activity increased significantly increased with the increase in tulsi leaf powder content from T_7 (93.47±0.100%) to T_1 (89.16±0.0126%) and it was also noted that though the polyphenol content of green tea was significantly higher, the antioxidant activity was comparatively lesser than with the combination of tulsi, drumstick and green tea. This may be due to synergistic effect of antioxidants present in tulsi and green tea in combination rather than alone (Gupta *et al*., 2014) [3]. The higher polyphenol content of green tea adds additional antioxidant activity to the herbal tea formulations, which have been proven time and again to have health benefits and also enhance the shelf life of the food by undesirable changes of oxidative reactions (Lorenzo and Munekata, 2016) [6].

Organoleptic evaluation

The results of the organoleptic evaluation is presented in table 2. Among the treatments the highest score (8.44) for color of the prepared tea was given to (T_8) consisting only green tea followed by T_1 (7.89) this may be because of the distinctive golden yellow color of that treatment and association of the green tea consumed by the panellists. The treatment T_7 recorded the lowest acceptability scores of 6.11 because of its muddy and dull color of the blend. This difference in the colour among herbal tea blends is presented and can be observed in Figure 2.

Table 2: Effect of different blends on physicochemical constituents of herbal tea

Treatments	Moisture (%)	Water activity(a_w)	TSS (ºBrix)	Phenols (mgGAE g^{-1})	Antioxidants (%)
T_1	8.70±0.035 ^{h}	0.34±0.00 ^{h}	4.41±0.006^g	63.39±0.0058^b	93.47±0.100^a
T_2	8.41±00.120 ^{g}	0.33±006 ^{g}	5.11±0.0006^{fa}	62.96±0.0058^c	92.72±0.033^b
T_3	8.47±0.150 ^{f}	0.32±0.06 ^{f}	5.77±0.006^e	62.54±0.00^d	92.06±0.478^c
T_4	8.44±0.005 ^{e}	0.32±000 ^{e}	6.47±0.006^d	62.13±0.001^e	91.47±0.415^d
T_5	8.42±0.035 ^{d}	0.32±0.06 ^{d}	7.16±0.01^c	61.69±0.00^f	90.58±0.0126^e
T_6	8.29±0.041^c	0.32±0.00 ^{c}	7.83±0.006^b	61.27±0.00^g	89.81±0.067^h
T_7	8.18±0.015 ^{b}	0.31±0.00 ^{b}	8.52±0.006^a	60.84±0.00^h	89.16±0.0126^i
T_8	7.30±0.058^a	0.24±0.00 ^{a}	5.06±0.006^{fb}	125.08±0.0058^a	90.19±0.005^f

Note: $p \leq 0.05$, Significant

Table 3: Effect of different blends of tulsi, drumstick leaf powder and green tea on organoleptic acceptability of herbal tea

Treatments	Color	Taste	Mouth feel	Aroma	Overall acceptability
T_1	7.89^a	7.32^c	7.22^c	8.61^a	7.78^b
T_2	7.56^a	8.32^b	7.33^c	8.06^b	8.48^a
T_3	7.44^b	8.66^a	7.44^c	7.94^b	8.89^a
T_4	7.11^b	7.21^c	7.11^c	7.50^c	8.00^b
T_5	7.00^b	6.77^d	7.22^c	7.39^c	7.33^c
T_6	6.67^b	6.54^e	7.89^b	6.94^d	7.09^c
T_7	6.11^b	6.66^e	8.33^a	6.61^e	6.53^d
T_8	8.44^a	6.99^d	7.33^c	6.11^f	7.53^c

Among the treatments, the treatment T_3 recorded the highest score (8.66) followed by T_2 (8.32) and T_6 recorded the lowest score (6.54) for taste of the herbal tea. For mouth feel treatment (T_7) recorded the highest score (8.33) followed by T_6 (7.89) and the lowest score was recorded by T_4 (7.11). The best score for aroma was recorded for treatment T_1 (8.61) followed by T_2 (8.06) and treatment T_8 the lowest score (6.11).

Overall acceptability of all the treatments are in the acceptable range, the panellists disliked no treatments. The overall acceptability score ranged from 6.53 to 8.89. The treatment T_3 reported the highest score (8.89) followed by T_2 (8.48) and the treatment T_7 reported lowest score (6.53).

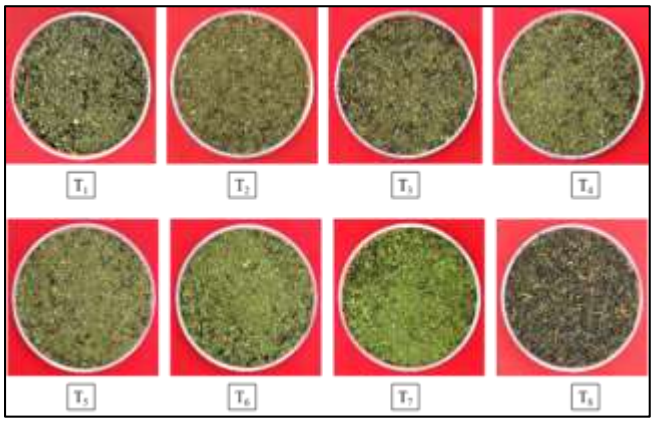


Fig 1: Different Blends of herbal tea powder

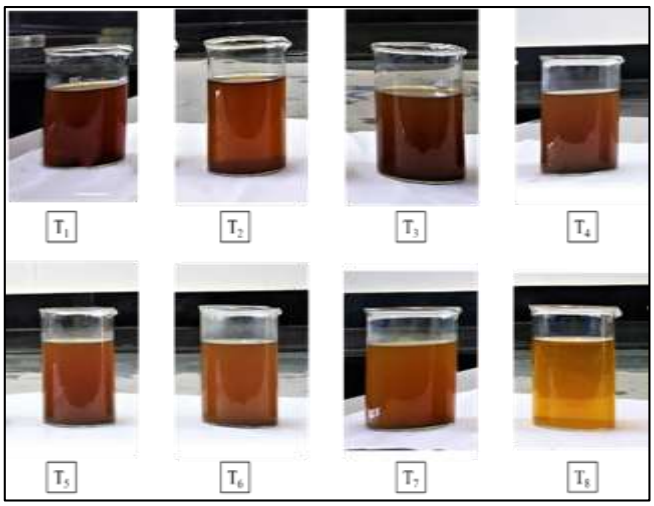


Fig 2: Herbal tea prepared from different blends

Summary

The blending of tulsi and moringa leaf powder with green tea had a positive impact on the nutrient composition and acceptability. The blends showed an improved nutrient composition as compared to green tea alone. The herbal tea blends were also highly acceptable as compared to green tea. Among the blends, green tea (T_8) recorded lowest moisture content and water activity, T_7 recorded highest TSS, T_1 recorded highest antioxidant activity and T_8 recorded highest total phenols. It was recorded that organoleptic acceptability of herbal tea was higher than the green tea, the highest scores for various organoleptic parameters are as follows, T_8 recorded the highest score for color, T_3 for taste, T_7 for mouthfeel, T_1 for aroma and T_3 for overall acceptability.

Conclusion

The herbal tea prepared from blends of drumstick leaves, tulsi leaves and green tea is not only packed with nutrients but also provided a unique taste with medicinal and antioxidant properties. The treatment T_3 was the best in terms of overall organoleptic quality.

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